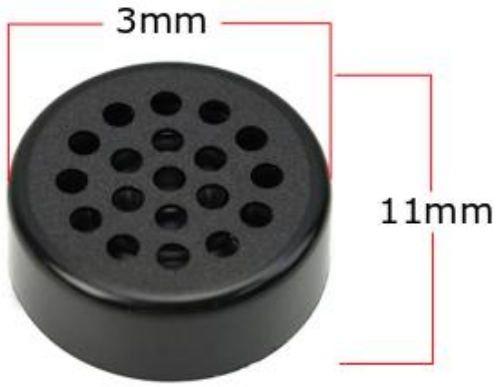
MP3 Voice prompter

1、Summary

The voice prompt module integrates an intelligent MP3 music playback chip with a speaker. Designed for ease of use, it can operate directly with a power supply, battery, and buttons, or be controlled via serial commands. Featuring seamless MP3, WAV, and WMA hardware decoding, this module boasts a 16MB memory capacity, enabling easy playback of specified tracks and sequences through simple serial commands. Its user-friendly design, wide applicability, good sound quality, and reliable performance make it superior to previous MP3 player and speaker solutions.

2、Product Specifications

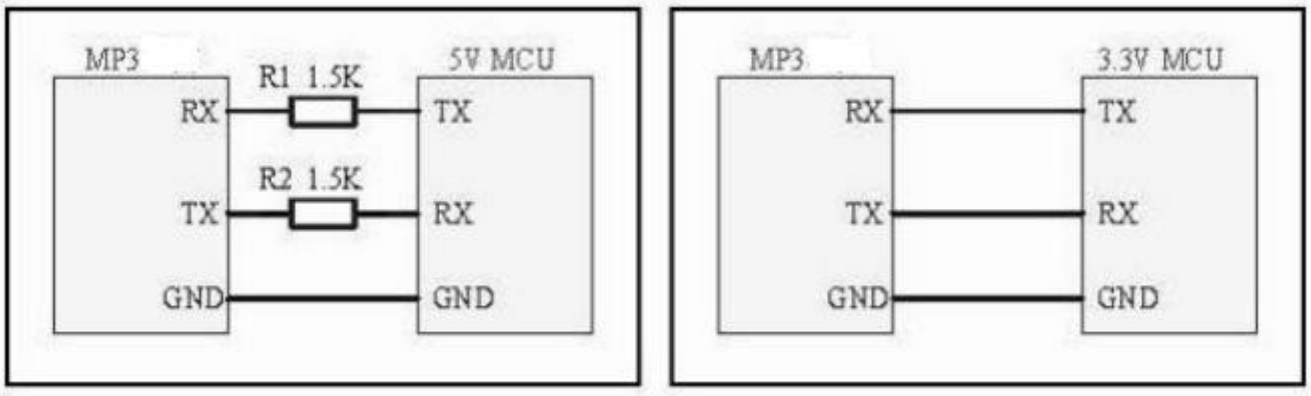
2.1 Product Dimensions:



2.2 Pin Description

Number		Pin	Description	Note
1		5V	Input Voltage	Input voltage should not exceed 5.2V
2		U+	USB+ DP	USB Port
3		U-	USB- DM	USB Port
4		GND	Ground	Power GND
5		TX	UART serial output	If connecting to a 5V TTL, a resistor should be connected in series.
6		RX	UART serial input	
7		Busy	Playing Status	Low means playing \high means no
8		P1	1-channel digital input interface.	Ground-triggered function: ● Short press: Next track ● Double press: Previous track ● Long press: Pause/Play

2.3 Wiring reference



The chip's serial port operates at a 3.3V TTL level, so the default interface voltage is 3.3V. If the system operates at 5V, it is recommended to add a 1.5K resistor in series at the interface connecting to the serial port.

2.4 Parameters

MP3 Voice prompter	
Power supply voltage	DC 5 V
Operating temperature	-20℃to+70℃
Output power	1W
Speaker impedance	4Ω
File format	Mp3/WAV
Dimensions	30mm*11mm
Trigger function	TTL level serial communication/1-channel switch
Trigger function for P1 interface	Short press:Next track Double press:Previous track Long press:Pause/Play
Storage capacity	16M

3、Serial Communication Protocol

In industrial control, power communication, smart metering, and other fields, serial communication is commonly used for data exchange. We have optimized the serial communication for industrial-grade applications by incorporating features such as frame validation, retransmission, and error handling to enhance stability and reliability. Additionally, it supports RS485 networking for further expansion of functionality.

Default parameters:Default volume: 30、Default baud rate: 9600

3.1 Serial Communication Format

Command type	CMD Command	Reference instruction	Instruction explanation
Control command	0x01	7E 01 00 02 00 00 EF	Next track
	0x02	7E 02 00 02 00 00 EF	Previous track
	0x03	7E 03 00 02 00 64 EF	Specify track (NUM) -- Play segment 100
	0x04	7E 04 00 02 00 00 EF	Increase volume
	0x05	7E 05 00 02 00 00 EF	Decrease volume
	0x06	7E 06 00 02 00 0A EF	Specify volume -- Value range [0-30] -- Specify as level 10
	0x08	7E 08 00 02 00 01 EF	Play specified track on repeat mode -- Repeat playback of segment 1
	0x0A	7E 0A 00 02 00 01 EF	Enter low power mode for the chip
	0x0B	7E 0B 00 02 00 03 EF	Specify baud rate -- 9600
	0x0C	7E 0C 00 02 00 00 EF	Reset the chip
	0x0D	7E 0D 00 02 00 00 EF	Paly
	0x0E	7E 0E 00 02 00 00 EF	Pause
	0x0F	7E 0F 00 02 01 01 EF	Play specified folder and file name -- Folder 01, File 001
	0x11	7E 11 00 02 00 01 EF	Specify current device for continuous loop playback
	0x16	7E 16 00 02 00 00 EF	Stop
	0x18	7E 18 00 02 00 01 EF	Specify current device for random playback of all
	0x19	7E 19 00 02 00 00 EF	Set the currently playing track to repeat mode
	0x21	7E 21 00 05 01 03 02	Play a combination of files from the root directory: 001, 003, 002, 005, 004
Query command	0x3F	7E 3F 00 02 00 00 EF	Query online devices
	0x42	7E 42 00 02 00 00 EF	Query current status
	0x43	7E 43 00 02 00 00 EF	Query current volume
	0x46	7E 46 00 02 00 00 EF	Query current version
	0x4A	7E 4A 00 02 00 00 EF	Query the total number of files in the built-in storage [excluding configuration files]
	0x4E	7E 4E 00 02 00 00 EF	Query the current file index in the built-in storage

3.2 Data returned by the chip.

The chip provides data feedback at crucial points to allow users to monitor the working status of the chip.

- Data indicating successful power-on initialization of the chip.
- Data indicating completion of playback for the current track by the chip.
- Data indicating successful reception of an ACK (acknowledgment) in response to an instruction by the chip.
- Data indicating an error in receiving a frame of data by the chip, including cases where the data is not received completely or there is a checksum error.
- When the chip is busy and data is received, the chip will return a busy command.

3.2.1 Data returned upon power-on of the chip: [3F]

Successful read of internal storage space in the chip -- Normal	7E 3F 00 02 00 08 EF
Failed read of internal storage space in the chip -- Abnormal	7E 3F 00 02 00 00 EF

1. Upon power-on, the chip requires a certain amount of time for initialization. The initialization time is determined by the number of files on the device, and in general, it takes around 700 milliseconds. If the initialization data of the chip is not sent out within this time, it indicates an initialization error. Please check the hardware.
2. The MCU (Microcontroller Unit) must wait for the chip initialization command to be sent before sending any corresponding control commands. Otherwise, the chip will not process the sent commands.

3.2.2 Data returned when the track playback is completed: [3D]

Playback of the 2nd track in the built-in memory completed.	7E 3D 00 02 00 02 EF
Playback of the 1st track in the built-in memory completed.	7E 3E 00 02 00 01 EF

1. By default, the chip automatically stops after playback and waits for user commands. The BUSY pin serves as an indicator of the playback and non-playback states. Please refer to the BUSY pin for more details.

2. Since all files in the device are identified in physical order, including specified folder and file name playback, the returned value after playback completion will still be based on the physical sequential numbering.

3.2.3 Data returned as an ACK (acknowledgment) from the module: [41]

7E 41 EF	The chip's proactive return indicates successful receipt of data

To enhance the stability of data communication, we will implement an acknowledgment mechanism. This approach ensures that there is a handshake signal for every communication. Receiving an acknowledgment indicates that the module has successfully received the data sent by the MCU and will process it promptly.

3.2.4 Data returned as an error from the module: [40]

Returned "Busy"	7E 40 00 02 00 01 EF	During file system initialization
Currently in sleep mode	7E 40 00 02 00 02 EF	Sleep mode only supports specific devices
Serial port reception error	7E 40 00 02 00 03 EF	Incomplete reception of one frame of serial data
Checksum error	7E 40 00 02 00 04 EF	Checksum error
Specified file out of range	7E 40 00 02 00 05 EF	Specified file exceeds the set range
Specified file not found	7E 40 00 02 00 06 EF	Specified file not found
Entering sleep mode	7E 40 00 02 00 0A EF	Entering SLEEP mode

1. To enhance the stability of data communication, an error handling mechanism has been implemented. The module provides feedback when it receives data that doesn't comply with the format or encounters any exceptions.

2. In harsh environments, it is strongly recommended that customers handle these commands. If the application environment is relatively normal, it may not be necessary to handle them.

3. The module returns "Busy" mainly during power-on initialization when the module needs to initialize the file system.

4. As long as you refer to the testing SDK program provided by us and port the serial operation section, you should not encounter checksum errors. We strongly recommend using the checksum method provided by us because no one can guarantee error-free data transmission.

4 Serial port command explanation

4.1 Control command

4.1.1 Designate song playback command [0x03]

The command supports specifying the song for playback, and the range of song selection is from 0 to 3000. If you have any unconventional applications, please communicate with us first. This command specifies the songs in the order of physical storage for TF card and USB disk. Similarly, for FLASH, it follows the physical order based on the copying sequence.

Data	Explanation: For example, to select the 2nd song for playback, the serial port

	command would be sent as follows: 7E 03 00 02 00 02 EF
0x7E	Start byte
0x03	Command byte
0x00	Length - High byte
0x02	Length - Low byte
0x00	High byte of the track [DH]
0x02	Low byte of the track [DL]
0xEF	End byte

2. When selecting a song, if you want to choose the 100th song, you need to convert 100 to hexadecimal. In this case, it will be 0x0064. The high byte (DH) will be 0x00 and the low byte (DL) will be 0x64.

4.1.2 Designate volume playback command [0x06]

Specify volume as level 30 - without memory	7E 06 00 02 00 1E EF
Specify volume as level 10 - with memory	7E 06 00 02 01 0A EF

1、system defaults to a volume level of 30 upon power-on. If you want to adjust the volume, simply send the corresponding command. The valid range for volume is 0 to 30.
2、 DH = 0x00; DL = 0x1E, converted to hexadecimal is 0x001E. This corresponds to volume level 30 without memory. This means that the chip will retain the maximum volume level of 30 even after power-on or reset.
1、DH = 0x01; DL = 0x0A, converted to hexadecimal is 0x011A. This corresponds to volume level 10 with memory.Note that when DH is set to 1, the chip will automatically enter the volume memory mode. After setting the volume to level 10, the chip will retain this volume level even after reset or power-on. If you do not want to use the volume memory feature, you can change DH to 0 before sending the command.

4.1.3 Single track loop playback command [0x08]

Loop playback of the first track	7E 08 00 02 00 01 EF
Loop playback of the second track	7E 08 00 02 00 02 EF

1. In order to meet the requirements for single track looping playback, we have made an improvement to the control command 0x08. When operating with TF cards, U disk, or FLASH, the specified order follows the physical order of file storage. Please note this point.

2. During the loop playback, normal operations such as play/pause, previous track, next track, and volume adjustment can be performed, and the status remains in loop playback. The loop playback state can be turned off by specifying a single track to trigger playback or stop.

4.1.4 Specify baud rate, reset command, and low power settings [0x0B] [0x0C] [0x0A]

Set the baud rate 1200	7E 0B 00 02 00 00 EF	Set the baud rate 38400	7E 0B 00 02 00 05 EF
Set the baud rate 2400	7E 0B 00 02 00 01 EF	Set the baud rate 57600	7E 0B 00 02 00 06 EF
Set the baud rate 4800	7E 0B 00 02 00 02 EF	Set the baud rate 115200	7E 0B 00 02 00 07 EF
Set the baud rate 9600	7E 0B 00 02 00 03 EF	Set the baud rate 230400	7E 0B 00 02 00 08 EF
Set the baud rate 19200	7E 0B 00 02 00 04 EF	Set the baud rate 460800	7E 0B 00 02 00 09 EF
Reset	7E 0C 00 02 00 00 EF		
Enter low power mode	7E 0A 00 02 00 01 EF		

1. Once the baud rate is set, the chip will remember it. The next time the device is powered on, the baud rate will be set to the value you have configured. Querying the current baud rate is not supported.
2. After setting the baud rate, please wait for 1 second before sending the reset command [0x0C], or you can power off and on the device.

7E 0A 00 02 00 01 EF The command for low power mode
1. After powering on the chip, it enters the normal working mode where all peripherals are in their normal state. The standby current consumption is maintained at 6mA, but the actual power consumption may vary for different devices. If low power consumption is required, please consider the following two methods: 2. Method 1: Use an external MOSFET to control the chip's power supply. When the chip is not needed, actively disconnect its power supply. When it is needed, supply power again. The chip can receive commands normally from power-off to power-on, which takes about 700ms. 3. Method 2: Send the command 7E 0A 00 02 00 01 EF. The chip will enter standby mode with a power consumption of around 30uA. To wake up the chip, you can send any command through the serial port and wait for 30ms. The chip will exit low power mode. ==> The chip is awakened by a falling edge. Any serial command can wake up the chip, but the chip cannot recognize the command. In low power mode, first send any command to wake up the chip, wait for 30ms, and then send the desired command. ==> After the chip is awakened, it must receive a correct serial data frame within 5 seconds, otherwise it will automatically enter low power mode again to prevent accidental wake-up.

4.1.5 Specify folder and file name for playback [0x0F]

Folder 01, file name 001xxx.mp3	7E 0F 00 02 01 01 EF

Folder 11, file name 100xxx.mp3	7E 0F 00 02 0B 64 EF
Folder 99, file name 255xxx.mp3	7E 0F 00 02 63 FF EF

1. The default naming convention for folders is "01", "11", and so on. For system stability and fast song switching, each folder supports a maximum of 255 songs by default, and a maximum of 99 folders.

2. For example, to specify the file "100xxx.MP3" in folder "01", the command to be sent through the serial port is: 7E 0F 02 01 64 EF.

- DH: Represents the folder name, which supports naming from 01 to 99.

- DL: Represents the track number, with a maximum of 255 songs, ranging from 0x01 to 0xFF.

3. Both folder names and file names support MP3 and WAV formats. Additionally, you can use Chinese characters or other characters in the folder and file names. Please refer to the following rules for naming conventions:

3.1 Folder names can consist of individual digits or a combination of digits and Chinese characters, but the total length should not exceed 12 bytes.Chinese characters occupy 2 bytes, while digits and letters occupy 1 byte each.

3.2 File names can also consist of individual digits, such as "001.MP3", or a combination of digits and Chinese characters, such as "001 回家.MP3".The maximum length supported for file names, similar to folder names, should not exceed 12 bytes.

4.1.6 Command for continuous loop playback [0x11]

Start continuous loop playback	7E 11 00 02 00 01 EF
Stop continuous loop playback	7E 11 00 02 00 00 EF

1. To meet the requirement of continuous loop playback of songs in the root directory, an additional control command 0x11 has been added.

2. During continuous loop playback, normal operations such as play/pause, previous track, next track, volume adjustment, etc., can be performed.

3. Once continuous loop playback starts, the module will continuously play the songs in the device according to the physical order of storage. After completing one full loop, it will continue to play again until it receives a command such as playback completion or pause.

4.1.7 Randomly play device files [0x18]

Play device files in random order	7E 18 00 02 00 00 EF

1、This command is for random playback of all voice files stored in the device. It plays the files in random order based on the physical sequence, without considering whether there are folders in the device.

4.1.8 Set the current track to loop playback [0x19]

Enable single track loop playback	7E 19 00 02 00 00 EF
Disable single track loop playback	7E 19 00 02 00 01 EF

1. This command needs to be sent during playback to enable loop playback of the current track. If the chip is in a paused or stopped state, it will not respond to this command.

2. To disable single track loop playback, simply send the command to disable it. This will stop the playback after the current track is finished.

4.1.9 Composite playback command [0x21]

Combination playback 001/003/002/005/004 5 files in the root directory	7E 21 00 05 01 03 02 05 04 EF
Combination playback 003/002/004 5 files in the root directory	7E 21 00 03 03 02 04 EF

1、Many applications require the use of TTS (Text-to-Speech) functionality, such as time announcements, temperature reports, and currency readings. If a module attempts to imitate basic TTS functionality, it may compromise the overall effectiveness, particularly in terms of speech delay between consecutive audio files. Directly playing each file one by one would result in unacceptable delays between speeches. Therefore, the combination playback feature has been introduced, which supports playing up to 30 specified audio files in the order they are sent via the serial port.
2、By sending the frame data 7E 31 00 05 01 03 02 05 04 EF, the following analysis can be made: CMD = 0x31 (refer to the command table) LEN = 0x05 (5 bytes) - 01 03 02 05 04 [Play according to the filenames in the root directory].The chip will play the following files in sequence: Root directory file 001, root directory file 003, root directory file 002, root directory file 004, and then stop. After each speech segment is played, serial port data will be returned [according to the physical numbering], thus achieving the functionality of combined playback across folders.Please note that all the parameters mentioned here are in hexadecimal format. For example, 64 represents the file "Root directory 100.mp3".
3、During the combined playback process, users are allowed to set the volume, but they cannot specify previous or next tracks. If users have higher requirements for combined playback, it is recommended for them to edit the audio source themselves by removing some silence at the beginning and end of each audio file. This can reduce the delay between speeches. Professional audio software such as "Adobe Audition CS5.5" or "GoldWave.exe" can be used for this purpose.
4、Additionally, to stop the combined playback process, you can directly send a stop

command.
5、For combined playback, the files must be stored in the root directory, and they must be renamed as "001xx.mp3" or other similar formats
6、If the specified files for combined playback are not found in the device, the combined playback will stop at the current position. It is important to ensure that the instructions sent can find the corresponding files. If an error occurs, the playback will stop at the position of the error. During the combined playback process, the change in the level of the "busy" pin can be used to detect the end of combined playback.

4.2 Detailed Explanation of Serial Port Query Commands

4.2.1 The Play command for playback status [0x42].

Send	Check playback status	7E 42 00 02 00 00 EF
Receive	Playing	7E 42 00 02 01 01 EF
	Paused	7E 42 00 02 02 02 EF
	Stopped	7E 42 00 02 04 00 EF

4.2.2 Query about the currently online devices [0x3F]

Chip returns 7E 3F 00 02 00 01 EF	Indicates that the current device is a USB flash drive
Chip returns 7E 3F 00 02 00 02 EF	Indicates that the current device is an SD card

1、During the operation of the chip, it continuously detects the online status of devices and can also be queried using the command 0x3F.

2、As an example, if the chip returns the data 7E 3F 02 00 0A EF:

(1) DL=0x0A = 0000 1010 represents the TF card and the built-in SPI flash are online.

(2) If DL=0x1F = 0000 1111, it indicates that the USB flash drive, TF card, external SPI flash, and built-in SPI flash are all online.

4.2.3 **Query about the current software version of the chip [0x46]**

Query about the current version of the chip	7E 46 00 02 06 30 EF

5 Common Issues

1.The voice playback has abnormal tone and becomes intermittent when the volume is increased.

The possible cause of this issue could be low power supply voltage or insufficient output power of the power supply.

2.After replacing my own voice files, they cannot be played.

The voice files should be in MP3 format with a bitrate not higher than 192kbps. They must also be in the supported sampling rate by the product. MP3 files in unsupported sampling rates may not be playable.

3.The played voice does not correspond to the sent command.

3.1 The product plays the voice files in the order of their replacement time, not based on the file name.

3.2 It is possible that the original voice files were not completely deleted and there are hidden files. You can format the memory first and then copy the voice files one by one in the desired order.

4. No response when connecting to the computer.

Please check if the cable used supports data transfer functionality.

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