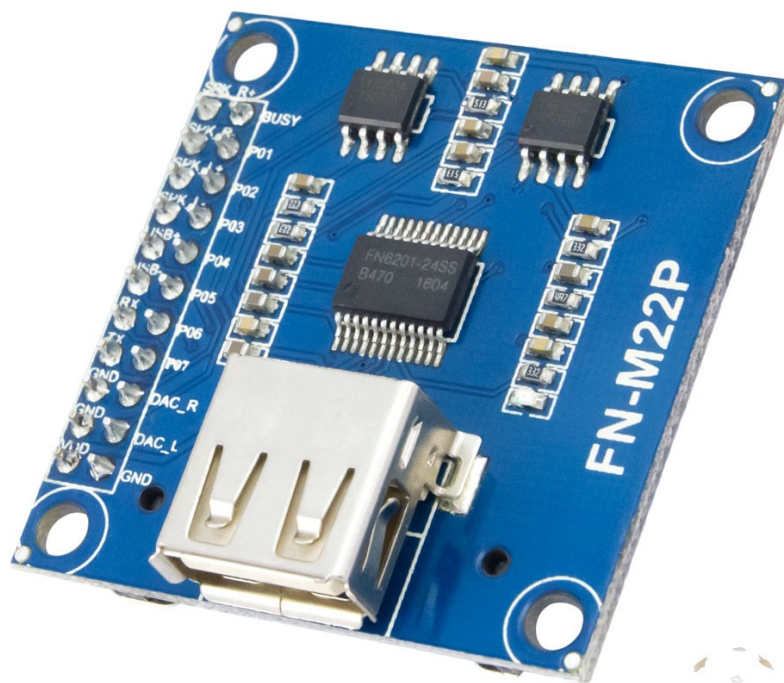


M22P Embedded MP3 Audio Module



Datasheet

V1.0

Content

1. Overview

- 1.1. Brief Introduction
- 1.2. Features
- 1.3. Technical Parameters
- 1.4. Naming Rules of Audio Files(Tracks) and Folders

2. Pin Configuration Summary

3. Key Control and Parallel Control Modes

- 3.1. Settings of Key Function
- 3.2. Key Control Mode
- 3.3. Parallel Control Mode

4. Serial Control Mode

- 4.1. Command Format
- 4.2. Checksum
- 4.3. Serial Communication Commands
- 4.4. Returned Data from Module
- 4.5. Detailed Annotation of Control Command
- 4.6. Detailed Annotation of Query Commands

5. Application Circuits References

- 5.1. Key Control
- 5.2. Serial Control

6. Other Notices

- 6.1. GPIO Features
- 6.2. Indicator Status
- 6.3. Delay of Serial Programming

1.1. Brief Introduction

M22P is a high quality audio playback module, which integrates MP3 and WAV decoder together perfectly. The module also supports

- parallel port control mode
- UART serial port control
- key control mode

The module supports SD card or USB flash drive as storage device, which can be chosen by users freely. It can be controlled easily via MCU commands or external push buttons. Easy to operate and high performance.

1.2. Features

- 1). Integrated high quality audio decoder, supports MP3 and WAV audio formats.
- 2). 8/11.025/12/16/22.05/24/32/44.1/48(KHz) sampling rates supported
- 3). 24 bit DAC output and supports dynamic range 90dB and SNR 85dB.
- 4). Supports multiple key control modes, parallel control mode and UART serial port control mode.
- 5). Possible to update audio files in the SD card via USB connecting with PC.
- 6). Supports playback of 63 audio files through binary encoding in parallel mode.
- 7). Supports maximum 3000 audio files in the root directory of the storage device in serial mode.
- 8). Supports maximum 99 folders and each folder stores maximum 255 audio files in serial mode.
- 9). Supports combination playback (plays a group of audio files one by one without pause) in serial mode.
- 10). Supports advertisement inter-cut function during playing a sound in serial mode.
- 11). Built-in double 3 watts amplifiers that can drive two 3 watts speakers directly.
- 12). Adjustable 30 levels sound volume.
- 13). Power input range: DC3.3-5V(5V is typical)
- 14). Module size: 40x40mm

Parameter	Description
MP3 audio format	Supports 11172-3 and ISO13813-3 layer3 audio decoding
	Supports sampling rate (KHZ): 8/11.025/12/16/22.05/24/32/44.1/48
	Supports Normal, Jazz, Classic, Pop, Rock, etc.
USB port	Standard USB 2.0
UART port	Standard serial port and TTL level;
Input voltage	3.3V-5V (5V is typical, and it's better to serially connect a diode)
Rated current	10mA (quiescent)
Low consumption current	<200uA
Working temp.	-40~+80°C
Humidity	5% ~ 95%

1.3. Technical Parameters

1.4. Naming Rules of Audio Files(Tracks) and Folders

1). Audio files directly stored in the root directory of the storage device(SD card or USB flash drive) need to be renamed as 0001.mp3/0001.wav, 0002.mp3/0002.wav, 0003.mp3/0003.wav,3000.mp3/3000.wav.

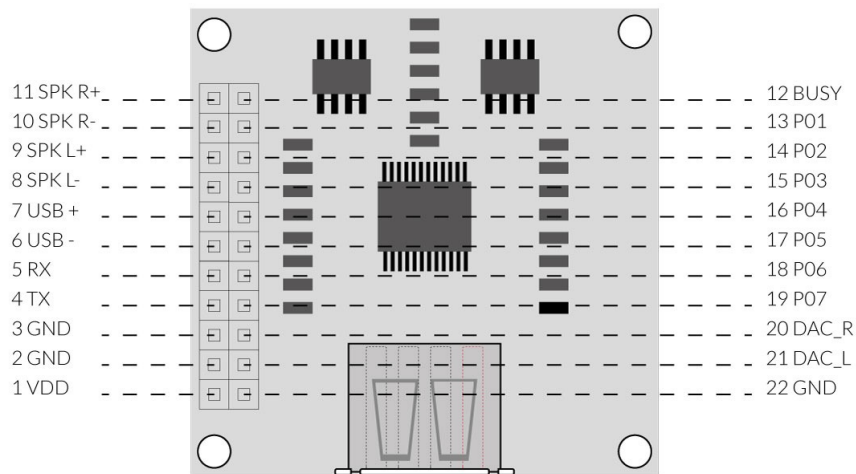
Here it works according to physical sequence when you copy the files from computer to SD card or USB flash drive.

For example, when the module receives a command to play the track 0001.mp3, it will play the 1st track you copied from computer, probably 0001.mp3 or not (maybe it would play 0007.mp3 if it was the first one you copied from computer). In order to avoid this problem, when you make the copy, rename the audio files firstly on computer and put all the renamed files in a one folder, then press "Ctrl+A" on the key board to select all, and press "Ctrl+C" to copy, and go back to the SD card or the USB flash drive, and press "Ctrl+V" to past all the files into the SD card or USB flash drive. Or users just directly give up this way and just move the audio files to folders and choose to control and play them in a folder as below.

2). Folders must be renamed as 01, 02, 03.....99, and the audio files must be renamed as 001.mp3/001.wav, 002.mp3/002.wav, 003.mp3/003.wav,255.mp3/255.wav.

It is also possible to keep the original audio file name when you rename a file. For example, the original audio file name is "Yesterday Once More.mp3", you can rename it as "001Yesterday Once More.mp3".

2. Pin Configuration and Summary



No.	Pin	Description	Note
1	VDD	Power input	3.3V-5V(5V is suggested and not higher than 5.2V)
2	GN	Ground	Power ground
3	GN	Ground	Power ground
4	TX	UART serial output	Baud rate is 9600
5	RX	UART serial input	Baud rate is 9600
6	USB-	USB- DM	USB Port(connected with a USB flash drive or connected to PC)
7	USB+	USB+ DP	
8	SPKL-	Connect speaker – for left	Direct drive a 3 watts speaker
9	SPKL+	Connect speaker+ for left	
10	SPKR-	Connect speaker – for right	
11	SPKR+	Connect speaker+ for right	Direct drive a 3 watts speaker
12	BUSY	Busy indication	High level when playing and low level when standby
13	P01	I/O port	I/O port
14	P02	I/O port	I/O port
15	P03	I/O port	I/O port
16	P04	I/O port	I/O port
17	P05	I/O port	I/O port
18	P06	I/O port	I/O port
19	P07	SBT	Triggering port(SBT) used for parallel mode
20	DAC_	Audio output right channel	Drive external earphone or amplifier
21	DAC_L	Audio output left channel	Drive external earphone or amplifier
22	GND	Ground	Audio ground

Note: When you get this module, you can use a tweezers to short P01 and ground to test it simply

3. Key Control and Parallel Control Modes

3.1. Key Function Configuration

This module has 6 keys/buttons function assignment. It can be set different many functions through a configuration file named "read.cfg", which comes from a text file(.txt) originally. Users just need to fill in a digit/parameter to a corresponding function in a new built text file. Save it and rename it "read.cfg", then put it in the root directory of the USB flash drive or the SD card. See as below.

2). read.cfg File Parameters / Configuration File

Digit in file "read.cfg"	Corresponding Function Mode
0	Pulse interruptable one-on-one playback
1	Electric level holding one-on-one playback
2	Pulse uninterruptable one-on-one playback
3	Standard MP3 key mode playback
4	Plays 6 sound files one-one-on in folder 01
5	Plays a sound when the key is pressed and plays another sound when the key is released
6	Plays sound files in the root directory of the storage device based on parallel control
7	Plays specified sound files in folder 01 based on parallel control

Notes:

1. Only 1 configuration file in the root directory of the storage device is supported.
2. In UART serial control no configuration file is permitted.
3. Digits 0-5 are used for settings of key control mode while 6-7 for settings of parallel control mode. When the digit is any of 0-5, key control function is enabled and parallel control is disabled. Also if digit 6-7 is set parallel control is enabled and key control is disabled.

3.2. Key Control Mode

3.2.1 Pulse interrupt one-on-one playback

Key	Short press	Long press(keep pressing)	Release
S1	Plays 1 st sound		
S2	Plays 2 nd sound		
S3	Plays 3 rd sound		
S4	Plays 4 th sound		
S5	Plays 5 th sound		
S6	Plays 6 th sound		

Note: The digit is 0 in the configuration file for this function mode.

3.2.2 Electric level holding one-on-one playback

Key	Short press	Long press(keep pressing)	Release
S1		Plays and loops 1 st sound	Stop
S2		Plays and loops 2 nd sound	Stop
S3		Plays and loops 3 rd sound	Stop
S4		Plays and loops 4 th sound	Stop
S5		Plays and loops 5 th sound	Stop
S6		Plays and loops 6 th sound	Stop

Note: The digit is 1 in the configuration file for this function mode.

3.2.3 Pulse uninterrupt one-on-one playback

Key	Short press	Long press(keep pressing)	Release
S1	Plays 1 st sound		
S2	Plays 2 nd sound		
S3	Plays 3 rd sound		
S4	Plays 4 th sound		
S5	Plays 5 th sound		
S6	Plays 6 th sound		

Note: The digit is 2 in the configuration file for this function mode.

3.2.4 Standard MP3 key mode playback

Key	Short press	Long press(keep pressing)	Release
S1	Previous		
S2	Next		
S3	Play/Pause		
S4	Stop		
S5	Volume up		
S6	Volume down		

Notes:

- 1). The digit is 3 in the configuration file.
- 2). Based on this mode if IO1 is shorted to ground, the module will play automatically when it is powered on, and in the mean time the keys are still workable.

3.2.5 Plays 6 sound files one- by-one in folder 01

Key	Short press	Long press(keep pressing)	Release
S1	Plays file 001 in folder 01		
S2	Plays file 002 in folder 01		
S3	Plays file 003 in folder 01		
S4	Plays file 004 in folder 01		
S5	Plays file 005 in folder 01		
S6	Plays file 006 in folder 01		

Note: The digit is 4 in the configuration file for this function mode.

3.2.6 Plays a sound when the key is pressed and plays another sound when the key is released

Key	Short press	Long press(keep pressing)	Release
S1	Plays file 001 in folder 01		Plays file 001 in folder 02
S2	Plays file 002 in folder 01		Plays file 002 in folder 02
S3	Plays file 003 in folder 01		Plays file 003 in folder 02
S4	Plays file 004 in folder 01		Plays file 004 in folder 02
S5	Plays file 005 in folder 01		Plays file 005 in folder 02
S6	Plays file 006 in folder 01		Plays file 006 in folder 02

Note: The digit is 5 in the configuration file for this function mode.

3.3. Parallel Control Mode

3.3.1 Plays sound files in the root directory of the storage device

I/O ports for parallel control

I/O Port	P01	P02	P03	P04	P05	P06	P07
Function	A0	A1	A2	A3	A4	A5	SBT

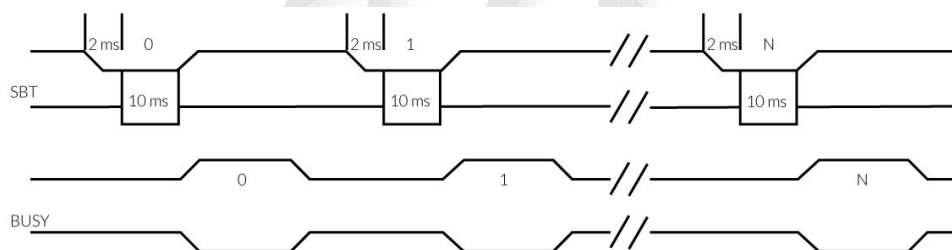
Note: SBT is the triggering port.

2). Corresponding triggering(as below)

Corresponding Sound	Address Pins(I/O ports)						Hexadecimal Value
	A0	A1	A2	A3	A4	A5	
Plays 1 st sound	0	1	1	1	1	1	0x01
Plays 2 nd sound	1	0	1	1	1	1	0x02
Plays 3 rd sound	0	0	1	1	1	1	0x03
Plays 4 th sound	1	1	0	1	1	1	0x04
.....	
Plays 20 th sound	1	1	0	1	0	1	0x14
Plays 21 st sound	0	1	0	1	0	1	0x15
.....	
Plays 63 rd sound	0	0	0	0	0	0	0x3F

Note: 0 represents low level while 1 represents high level

3). Timing sequence



- After sending address data, delay 2ms, and then send SBT to trigger.
- SBT needs to be kept for 10ms low level, then the triggering is valid.
- It's necessary to put down the relative pins when setting the address. For example, if the 3rd sound is needs to be played, please refer to the following.

I/O Port	P01	P02	P03	P04	P05	P06
Address	A0	A1	A2	A3	A4	A5
Electric Level	Low	Low	High	High	High	High

Note: The digit is 6 in the configuration file for this function mode.

3.3.2 Plays specified sound files in folder 01

1). I/O ports for parallel control

I/O Port	P01	P02	P03	P04	P05	P06	P07
Function	A0	A1	A2	A3	A4	A5	SBT

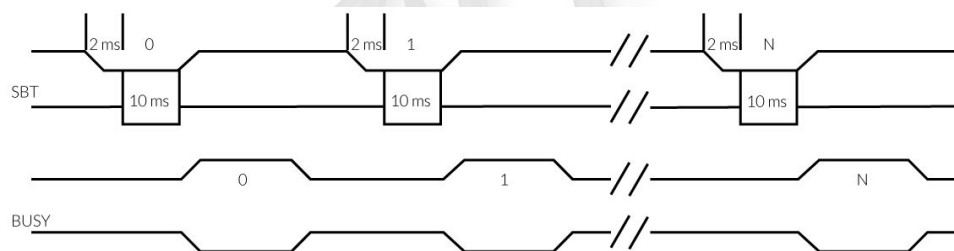
Note: SBT is the triggering port

2). Corresponding triggering(as list below)

Corresponding Sound	Address Pins(I/O ports)						Hexadecimal Value
	A0	A1	A2	A3	A4	A5	
Plays sound 001 in folder 01	0	1	1	1	1	1	0x01
Plays sound 002 in folder 01	1	0	1	1	1	1	0x02
Plays sound 003 in folder 01	0	0	1	1	1	1	0x03
Plays sound 004 in folder 01	1	1	0	1	1	1	0x04
.....	
Plays sound 020 in folder 01	1	1	0	1	0	1	0x14
Plays sound 021 in folder 01	0	1	0	1	0	1	0x15
.....	
Plays sound 063 in folder 01	0	0	0	0	0	0	0x3F

Note: 0 represents low level while 1 represents high level.

3). Timing sequence



- After sending address data, delay 2ms, and then send SBT to trigger.
- SBT needs to be kept for 10ms low level, then the triggering is valid.
- It's necessary to put down the relative pins when setting the address. For example, if the 3rd sound is needs to be played, please refer to the following.

I/O Port	P01	P02	P03	P04	P05	P06
Address	A0	A1	A2	A3	A4	A5
Electric Level	Low	Low	High	High	High	High

Note: The digit is 7 in the configuration file for this function mode.

4. Serial Control Mode

4.1. Serial Port Parameters

Supports asynchronous serial communication mode

UART Paramater:

- Baudrate:9600 bps
- Data bits :1
- Check bits :none
- Flow Control :none

Byte Table

\$S	Start byte 0x7E
Ver.	Version byte, 0xFF by default
Number	Number of bytes from version info to Check_LSB, typically 0x06 (checksum not counted)
Command	Command byte
Feedback	0x01: Need feedback--send confirmation back to MCU; 0x00: No need feedback
Param_MSB	Most significant byte of parameter
Param_LSB	Least significant byte of parameter
Check_MSB	Most significant byte of checksum
Check_LSB	Least significant byte of checksum
\$O	End byte 0xEF

For example, for specify playback of SD card, its required to send "7E FF 06 09 00 00 02 FF F0 EF". The number is 6 bytes, and these 6 bytes are "FF 06 09 00 00 02". Start byte, end byte and checksum are not included.

4.2. Checksum

Regarding to calculating checksum, set your 16 bit checksum value to 0. For each byte from the Version byte until the Param_LSB byte, subtract the byte from the checksum. Checksum is not required, the module can receive serial data with or without checksum. For MCU without crystal oscillator, we recommend to add checksum.

4.3. Serial Communication Commands

4.3.1 Control commands

Command	Function	Note
0x01	Play Next	
0x02	Play Previous	
0x03	Specify playback of a track	See 4.5.1 for details
0x04	Increase volume	
0x05	Decrease volume	
0x06	Specify volume	See 4.5.2 for details
0x07	N/A(reserved)	
0x08	Specify single repeat playback	See 4.5.3 for details
0x09	Specify playback of a device	See 4.5.4 for details
0x0A	Set sleep mode	See 4.5.5 for details
0x0B	Awake from sleep	
0x0C	Reset	
0x0D	Play	
0x0E	Pause	
0x0F	Specify playback of a track in a folder	See 4.5.6 for details
0x13	Inter cut an advertisement	See 4.5.7 for details
0x14	N/A(reserved)	
0x15	Stop playing inter-cut advertisement	
0x16	Stop	See 4.5.8 for details
0x17	Specify repeat playback of a folder	See 4.5.9 for details
0x18	Set random playback	See 4.5.10 for details
0x19	Set repeat playback of current track	See 4.5.11 for details
0x1A	Set DAC	See 4.5.12 for details
0x21	Combination playback(playback of a group)	See 4.5.13 for details
0x22	Specify playback of a track with a specific volume level	See 4.5.14 for details

4.3.2 Examples of sending control commands

Command Description	Serial Commands [with checksum]	Serial Commands [without checksum]	Note
Play Next	7E FF 06 01 00 00 00 FE FA EF	7E FF 06 01 00 00 00 EF	
Play Previous	7E FF 06 02 00 00 00 FE F9 EF	7E FF 06 02 00 00 00 EF	
Specify playback of a track (in the root directory)	7E FF 06 03 00 00 01 FE F7 EF	7E FF 06 03 00 00 01 EF	Specify playback of the 1 st track
	7E FF 06 03 00 00 02 FE F6 EF	7E FF 06 03 00 00 02 EF	Specify playback of the 2 nd track
	7E FF 06 03 00 00 0A FE EE EF	7E FF 06 03 00 00 0A EF	Specify playback of the 10th track
Increase volume	7E FF 06 04 00 00 00 FE F7 EF	7E FF 06 04 00 00 00 EF	
Decrease volume	7E FF 06 05 00 00 00 FE F6 EF	7E FF 06 05 00 00 00 EF	
Specify volume	7E FF 06 06 00 00 1E FE D7 EF	7E FF 06 06 00 00 1E EF	Specified volume is level 30
Specify single repeat playback (in the root directory)	7E FF 06 08 00 00 01 FE F2 EF	7E FF 06 08 00 00 01 EF	Repeatedly play the 1 st track
	7E FF 06 08 00 00 02 FE F1 EF	7E FF 06 08 00 00 02 EF	Repeatedly play the 2nd track
	7E FF 06 08 00 00 0A FE E9 EF	7E FF 06 08 00 00 0A EF	Repeatedly play the 10th track
Specify playback of a device	7E FF 06 09 00 00 01 FE F1 EF	7E FF 06 09 00 00 01 EF	Specified device is USB flash drive
	7E FF 06 09 00 00 02 FE F0 EF	7E FF 06 09 00 00 02 EF	Specified device is SD card
Set sleep mode	7E FF 06 0A 00 00 00 FE F1 EF	7E FF 06 0A 00 00 00 EF	
Awake from sleep	7E FF 06 0B 00 00 00 FE F0 EF	7E FF 06 0B 00 00 00 EF	
Reset	7E FF 06 0C 00 00 00 FE EF EF	7E FF 06 0C 00 00 00 EF	
Play	7E FF 06 0D 00 00 00 FE EE EF	7E FF 06 0D 00 00 00 EF	
Pause	7E FF 06 0E 00 00 00 FE ED EF	7E FF 06 0E 00 00 00 EF	
Specify playback of a track in a folder	7E FF 06 0F 00 01 01 FE EA EF	7E FF 06 0F 00 01 01 EF	Specify track "001" in the folder "01"
	7E FF 06 0F 00 01 02 FE E9 EF	7E FF 06 0F 00 01 02 EF	Specify track "002" in the folder "01"
Inter cut an advertisement	7E FF 06 13 00 00 01 FE E7 EF	7E FF 06 13 00 00 01 EF	Inter cut track "0001" in the folder "ADVERT"
	7E FF 06 13 00 00 02 FE E6 EF	7E FF 06 13 00 00 02 EF	Inter cut track "0002" in the folder "ADVERT"
	7E FF 06 13 00 00 FF FD E9 EF	7E FF 06 13 00 00 FF EF	Inter cut track "0255" in the folder "ADVERT"
Stop playing inter-cut advertisement	7E FF 06 15 00 00 00 FE E6 EF	7E FF 06 15 00 00 00 EF	Go back and continue to play the music interrupted
Stop	7E FF 06 16 00 00 00 FE E5 EF	7E FF 06 16 00 00 00 EF	Stop all playback tasks
Specify repeat playback of a folder	7E FF 06 17 00 02 00 FE E2 EF	7E FF 06 17 00 02 00 EF	Specify repeat playback of the folder "02"
	7E FF 06 17 00 01 00 FE E3 EF	7E FF 06 17 00 01 00 EF	Specify repeat playback of the folder "01"
Set random playback	7E FF 06 18 00 00 00 FE E3 EF	7E FF 06 18 00 00 00 EF	Random playback of the whole device
Set repeat playback of current track	7E FF 06 19 00 00 00 FE E2 EF	7E FF 06 19 00 00 00 EF	Turn on single repeat playback
	7E FF 06 19 00 00 01 FE E1 EF	7E FF 06 19 00 00 01 EF	Turn off single repeat playback
Set DAC	7E FF 06 1A 00 00 00 FE E1 EF	7E FF 06 1A 00 00 00 EF	Turn on DAC
	7E FF 06 1A 00 00 01 FE E0 EF	7E FF 06 1A 00 00 01 EF	Turn off DAC
Specify playback of a track with a specific volume level	7E FF 06 22 00 1E 01 FE BA EF	7E FF 06 22 00 1E 01 EF	Play 1 st track with volume level 30
	7E FF 06 22 00 0F 02 FE C8 EF	7E FF 06 22 00 0F 02 EF	Play 2 nd track with volume level 15

4.3.3 Query commands

Command	Function	Note
0x3F	Query current online storage device	See 4.6.1 for details
0x40	Module returns an error data with this command	
0x41	Module reports a feedback with this command	
0x42	Query current status	See 4.6.2 for details
0x43	Query current volume	
0x44	N/A(Reserved)	
0x45	N/A(Reserved)	
0x46	N/A(Reserved)	
0x47	Query total track numbers in USB flash drive	
0x48	Query total track numbers in SD Card	
0x4B	Query current track in USB flash drive	by physical sequence
0x4C	Query current track in SD Card	by physical sequence
0x4E	Query total track numbers in a folder	See 4.6.3 for details
0x4F	Query total folder numbers in the storage device	See 4.6.4 for details

4.3.4 Examples of sending query commands

Query Command Description	Serial Commands [with checksum]	Serial Commands [without checksum]	Note
current online storage device	7E FF 06 3F 00 00 00 FE BC EF	7E FF 06 3F 00 00 00 EF	
current status	7E FF 06 42 00 00 00 FE B9 EF	7E FF 06 42 00 00 00 EF	
current volume	7E FF 06 43 00 00 00 FE B8 EF	7E FF 06 43 00 00 00 EF	
total track numbers in USB flash drive	7E FF 06 47 00 00 00 FE B4 EF	7E FF 06 47 00 00 00 EF	Total file numbers of current device
total track numbers in SD card	7E FF 06 48 00 00 00 FE B3 EF	7E FF 06 48 00 00 00 EF	Total file numbers of current device
current track in USB flash drive	7E FF 06 4B 00 00 00 FE B0 EF	7E FF 06 4B 00 00 00 EF	Query the track being played
current track in SD card	7E FF 06 4C 00 00 00 FE AF EF	7E FF 06 4C 00 00 00 EF	Query the track being played
total track numbers in a folder	7E FF 06 4E 00 00 01 FE AC EF	7E FF 06 4E 00 01 00 EF	
Query total folder numbers in current storage device	7E FF 06 4F 00 00 00 FE AC EF	7E FF 06 4F 00 00 00 EF	SD card or USB flash drive

4.4. Returned Data from Module

4.4.1 Returned data after the module is powered on

After the module is powered on, it needs between 500ms to 1500ms (depending on actual track quantities in storage device) initialization time. Once initialization is done, the module returns a data to MCU. If it does not return a data after more than the initialization time, it means there is an error during initialization. In that case please check the hardware connections.

After initialization the module repeats the current effective storage device or online equipment.

For example, the module returns 7E FF 06 3F 00 00 03 xx xx EF.

0x3F represent the returned command from module,

0x03 represents USB flash drive and SD card are effective/online at the same time.

See details as follows:

Online Equipment	Returned Data
USB flash drive online	7E FF 06 3F 00 00 01 xx xx EF
SD card online	7E FF 06 3F 00 00 02 xx xx EF
PC online	7E FF 06 3F 00 00 04 xx xx EF
USB flash drive and SD card online	7E FF 06 3F 00 00 03 xx xx EF

The MCU is not able sending commands to the module until the initialization is finished. CommandsSend Otherwise cMCU commands during initialization

4.4.2 Returned data after a track is finished playing

Track Played	Returned Data
1 st track is finished playing in USB flash drive	7E FF 06 3C 00 00 01 xx xx EF
2 nd track is finished playing in USB flash drive	7E FF 06 3C 00 00 02 xx xx EF
1 st track is finished playing in SD card	7E FF 06 3D 00 00 01 xx xx EF
2 nd track is finished playing in SD card	7E FF 06 3D 00 00 02 xx xx EF

Example:

The returned data is 7E FF 06 3C 00 00 01 xx xx EF.

0x3C represents USB flash drive and

0x3D represents SD card

0x00 and 0x01 represents the 1st track 0x01

0xF4 represents the 500th track(0x01F4=500).

All files(tracks) in the storage device are read in physical sequence. The returned data still follow the physical sequence.

4.4.3 Returned data of feedback from module 0x41

Module returns ACK	7E FF 06 41 00 00 00 xx xx EF
--------------------	-------------------------------

In order to enhance stability between data communication, the function of a feedback from module is added. Once command is successfully send to the module, the module will repeat 0x41. It is not feedback function is not required but recommended

4.4.4 Returned data of errors

Returned Data of Errors	Description
7E FF 06 40 00 00 01 xx xx EF	Module busy(this info is returned when the initialization is not
7E FF 06 40 00 00 02 xx xx EF	Currently sleep mode(supports only specified device in sleep mode)
7E FF 06 40 00 00 03 xx xx EF	Serial receiving error(a frame has not been received completely)
7E FF 06 40 00 00 04 xx xx EF	Checksum incorrect
7E FF 06 40 00 00 05 xx xx EF	Specified track is out of current track scope
7E FF 06 40 00 00 06 xx xx EF	Specified track is not found
7E FF 06 40 00 00 07 xx xx EF	Inter-cut error(a inter-cut operation only can be done when a track is
7E FF 06 40 00 00 08 xx xx EF	SD card reading failed(SD card pulled out or damaged)
7E FF 06 40 00 00 0A xx xx EF	Entered into sleep mode

During starting the module, starts reading SD card, if SD card is not available it checks for USB flash drive.

4.4.5 Returned data after a storage device is plugged in or pull out

Status	Returned Data
USB flash drive is plugged in	7E FF 06 3A 00 00 01 xx xx EF
SD card is plugged in	7E FF 06 3A 00 00 02 xx xx EF
USB cable connected to PC is plugged in	7E FF 06 3A 00 00 04 xx xx EF
USB flash drive is pulled out	7E FF 06 3B 00 00 01 xx xx EF
SD card is pulled out	7E FF 06 3B 00 00 02 xx xx EF
USB cable connected to PC is pulled out	7E FF 06 3B 00 00 04 xx xx EF

0x3A represents a device is plugged in while

0x3B represents a device is pull out

0x01, 0x02, 0x04 represent USB flash drive, SD card and USB cable connected to PC respectively.

4.5. Detailed Annotation of Control Commands

4.5.1 Specify playback of a track(root directory of the storage device) 0x03

The available selective tracks is from 1st to 3000th in the root directory of the storage device.

For example, if set the first track to be played, send the command 7E FF 06 03 00 00 01 FF E7 EF

7E --- Start byte

FF --- Version Information

06 --- Number of bytes

03 --- Actual command(specify playback of a track)

00 --- 0x01: need feedback; 0x00: no need feedback

00 --- Most significant byte of the track(MSB of Parameter)

01 --- Least significant byte of the track(LSB of Parameter)

FF --- Most significant byte of checksum(MSB of checksum)

E7 --- Least significant byte of checksum(LSB of checksum)

EF --- 0xEF End byte

Regarding track selection, if the 100th song(track) is selected to be played
convert 100 to hexadecimal

It is double-byte by default, i.e. 0x0064.

MSB=0x00

LSB=0x64

4.5.2 Specify volume 0x06

Standard Volume

Default volume is to level 30, if you want to set the volume, then directly send the corresponding command.

Set volume example

For example, if specify the volume to level 15, by using command 7E FF 06 06 00 00 0F FF D5 EF.

15 is converted to hexadecimal 0x000F

MSB=0x00

LSB=0x0F

4.5.3 Specify single repeat playback (in the root directory of the storage device) 0x08

Repeatedly play 1 st track	7E FF 06 08 00 00 01 xx xx EF
Repeatedly play 2 nd track	7E FF 06 08 00 00 02 xx xx EF
Repeatedly play 3 rd track	7E FF 06 08 00 00 03 xx xx EF

During single repeat playback, you can still execute the operations Play/Pause, Previous, Next, Volume +/-, and so on, the status is also repeat playback. Users can specify single track playback or send the stop command to turn off single repeat playback status.

4.5.4 Specify playback of a device 0x09

Specify playback of USB flash drive	7E FF 06 09 00 00 01 FE F1 EF
Specify playback of SD card	7E FF 06 09 00 00 02 FE F0 EF

The module supports two types of playback devices

- USB flash drive
- SD card

The device must be on-line, so it can be specified playback. It automatically detects if a device is on-line or not.

It automatically enters into the standby status after specifying a device, MCU is waiting to specify a track to play. It takes around 200ms from specifying device until the module finishes initialization of file system.

After device selection a delay of 200ms is required before sending specified command to play a track.

4.5.5 standby, awake and reset 0xA - 0xC

standby mode	7E FF 06 0A 00 00 00 FE F1 EF
Awake from standby	7E FF 06 0B 00 00 00 FE F0 EF
Reset	7E FF 06 0C 00 00 00 FE EF EF

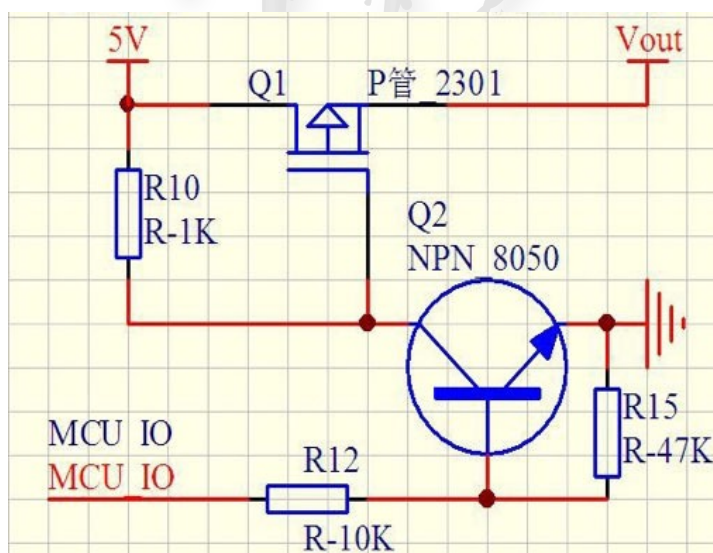
In standby mode following commands are possible to exit standby

Specify playback of the storage device, either USB flash drive or SD card, see 0x09

Pull out the storage device and re-plug it in.

Regarding the reset, it's a soft reset. The reset time is 5-8 seconds. The reset command could send in any state of module.

Note: When the module enters into the sleep mode, the standby power consumption is about 10mA. In case of very low power consumption, a MOS in combination with a transistor can be used to control power supply of the module. It is possible to cut off the power supply completely when standby is not necessary. Please refer to the schematic as below.



4.5.6 Specify playback of a track in a folder 0x0F

Specify playback of track 001 in the folder 01	7E FF 06 0F 00 01 01 xx xx EF
Specify playback of track 100 in the folder 11	7E FF 06 0F 00 0B 64 xx xx EF
Specify playback of track 255 in the folder 99	7E FF 06 0F 00 63 FF xx xx EF

Default folders are named as "01", "11", "99". The module supports up to 99 folders and 255 tracks in each folder.

For example, if specify to play "100.mp3" in folder "01", send the command 7E FF 06 0F 00 01 64 xx xx EF
MSB: represents the name of the folder, maximum supports 99 folders from 01 - 99.

Random playback of the whole storage device	7E FF 06 18 00 00 00 FE E3 EF
---------------------------------------------	-------------------------------

LSB: represents the track, maximum supports 255 tracks from 0x01 to 0xFF.

You must specify both the folder and the file name to target a track. This feature supports MP3 and WAV audio formats.

4.5.7 Inter cut an advertisement 0x13

Inter cut track "0001" in the folder "ADVERT"	7E FF 06 13 00 00 01 FE E7 EF
Inter cut track "0002" in the folder "ADVERT"	7E FF 06 13 00 00 02 FE E6 EF
Inter cut track "0255" in the folder "ADVERT"	7E FF 06 13 00 00 FF FD E9 EF
Inter cut track "1999" in the folder "ADVERT"	7E FF 06 13 00 07 CF FE 12 EF
Inter cut track "3000" in the folder "ADVERT"	7E FF 06 13 00 0B B8 FE 25 EF

This module supports inter-cut advertisements during playback of a track, so special needs for some applications are possible.

After sending the command 0x13, the system will save the IDV3 information of the track being played and pause. During track pause the module will play a specified inter-cut track(advertisement). When the inter-cut track is finished, the system will go back and continue to play the track that was interrupted. The setting method is based on a folder named "ADVERT" in the storage device. Advertise tracks(ads) should be placed in files as "0001.mp3/wav", 0002.mp3/wav.

If an inter-cut command during the module is at Pause status or Stop status, an error information will be returned.

In the course of an inter-cut, you can continue to inter cut other tracks(ads). If the last inter-cut track reach the end, the system will return to the IDV3 position.

4.5.8 Stop 0x15 - 0x16

Stop playing inter-cut advertisement	7E FF 06 15 00 00 00 FE E6 EF
Stop	7E FF 06 16 00 00 00 FE E5 EF

During playback there are two modes to stop.

During inter-cut advertisement playback, to go back and continue playing the track it was interrupted

During regular playback mode to stop all playback(stop decoding).

For example,

suppose the module is playing an inter-cut advertisement, and stop command 0x16 will send, it will stop all playback tasks.

4.5.9 Specify repeat playback of a folder 0x17

Specify repeat playback of the folder "02"	7E FF 06 17 00 00 02 FE E2 EF
Specify repeat playback of the folder "01"	7E FF 06 17 00 00 01 FE E3 EF

The folder names must be 01-99, (max. 99 folders supported). After sending the command, it repeats the tracks in the specific folder. The module will play all tracks until it receives a command to stop.

4.5.10 Set random playback 0x18

This command is used to randomly play all of the tracks in the storage device according to physical sequence.

Random playback of the whole storage device	7E FF 06 18 00 00 00 FE E3 EF
---------------------------------------------	-------------------------------

4.5.11 Set repeat playback of current track 0x19

Turn on single repeat playback	7E FF 06 19 00 00 00 FE E2 EF
Turn off single repeat playback	7E FF 06 19 00 00 01 FE E1 EF

During playback, send the turn-on command, and it will repeatedly play the current track. If the module is in Pause or Stop state, it will not respond to this command. If you need to turn off repeat playback, just send the turn-off command again.

4.5.12 Set DAC (Digital Analog Converting) 0x1A

Turn on DAC	7E FF 06 1A 00 00 00 FE E1 EF
Turn off DAC(high resistance)	7E FF 06 1A 00 00 01 FE E0 EF

On default DAC is enabled command 0x1A will disable DAC. For enable disabled DAC return command 0x1A.

4.5.13 Combination playback(playback of a group) 0x21

Combination playback supports up to 15 tracks for each combination playback. All of the sound files used for combination playback has to be in folders(folder 01-folder 99). The combination of tracks is placed in one data frame, described in example as follows:

Frame data as 7E FF 15 21 01 02 01 03 01 04 01 05 01 06 02 01 03 05 04 07 05 09 EF, see details as below.

Number of bytes: 0x15=21 bytes --- FF 15 21 01 02 01 03 01 04 01 05 01 06 02 01 03 05 04 07 05 09

Above example is based on 2 parameters for each track, folder number and the track number.

The module will play track 002 in folder 01, track 003 in folder 01, track 004 in folder 01, track 005 in folder 01, track 006 in folder 01, track 001 in folder 02, track 005 in folder 03, track 007 in folder 04, and track 009 in folder 05.

During combination playback, it is allowed to Play/Pause and set volume, but its not allowed to set Previous and Next. If need to stop, just direct send the stop command. It is not possible to play another group of combination during a combination playback is running. Users need to send the stop command to stop the current combination playback before start another group of combination playback. If a track specified to be played in combination is not in the folder, it will stop playing at this track position, so please make sure the track specified to play is available in the folder.

4.5.14 Specify playback of a track with a specific volume level 0x22

Play 1 st track at volume level 30	7E FF 06 22 00 1E 01 FE BA EF
Play 2 nd track at volume level 15	7E FF 06 22 00 0F 02 FE C8 EF

This function is added to play a track with a specific volume level within one command. The command is only available for the tracks in the root directory of the storage device.

For normal operations, users still need to send the volume command first and then specify playback of a track with the corresponding command like most of MP3 players.

4.6. Detailed Annotation of Query Commands

4.6.1 Query current online storage device 0x3F

Query current online storage device	7E FF 06 3F 00 00 00 FE BC EF
-------------------------------------	-------------------------------

During the module is playing, command 0x3F queries the status of the online storage devices.

For example,

If the module returns the data 7E FF 06 3F 00 00 0A xx xx EF,

LSB 0x0A(0000 1010) represents SD card online

LSB is 0x1F(0000 1111), it represents all of USB flash drive, SD card, and PC online(PC online, module is connecting with PC via a USB cable).

4.6.2 Query current state 0x42

Query current state	7E FF 06 42 00 00 00 FE B9 EF
---------------------	-------------------------------

There are 4 states

- playing
- paused playing
- stopped playing
- in sleep

that can be queried during the module is decoding.

Interpretation of returned state data

Returned Data	Status
7E FF 06 42 00 01 01 xx xx EF	USB flash drive is being played
7E FF 06 42 00 02 02 xx xx EF	SD card is paused playing
7E FF 06 42 00 01 00 xx xx EF	USB flash drive is stopped playing
7E FF 06 42 00 10 00 xx xx EF	Module in sleep

MSB and LSB Representations

MSB Representation		LSB Representation	
0x01	USB flash drive	0x00	Stopped
0x02	SD card	0x01	Playing
0x10	Module in sleep mode	0x02	Paused

4.6.3 Query amount of tracks in a folder 0x4E

Queries amount of tracks in folder 01	7E FF 06 4E 00 00 01 FE AC EF
Queries amount of tracks in folder 11	7E FF 06 4E 00 00 0B FE A2 EF

If the queried folder is empty, the module will report an error 7E FF 06 40 00 00 06 FE B5 EF.

4.6.4 Query total folder numbers in current storage device 0x4F

Query total folder numbers in current storage device	7E FF 06 4F 00 00 00 FE AC EF
------------------------------------------------------	-------------------------------

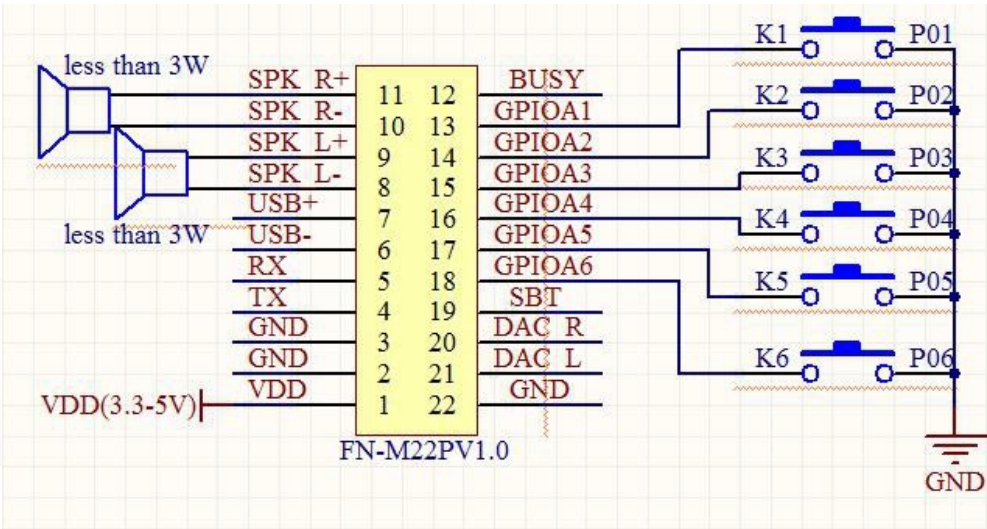
The command supports only the amount of folder in the root directory of the device. It is not possible query amount of folder in sub directories.



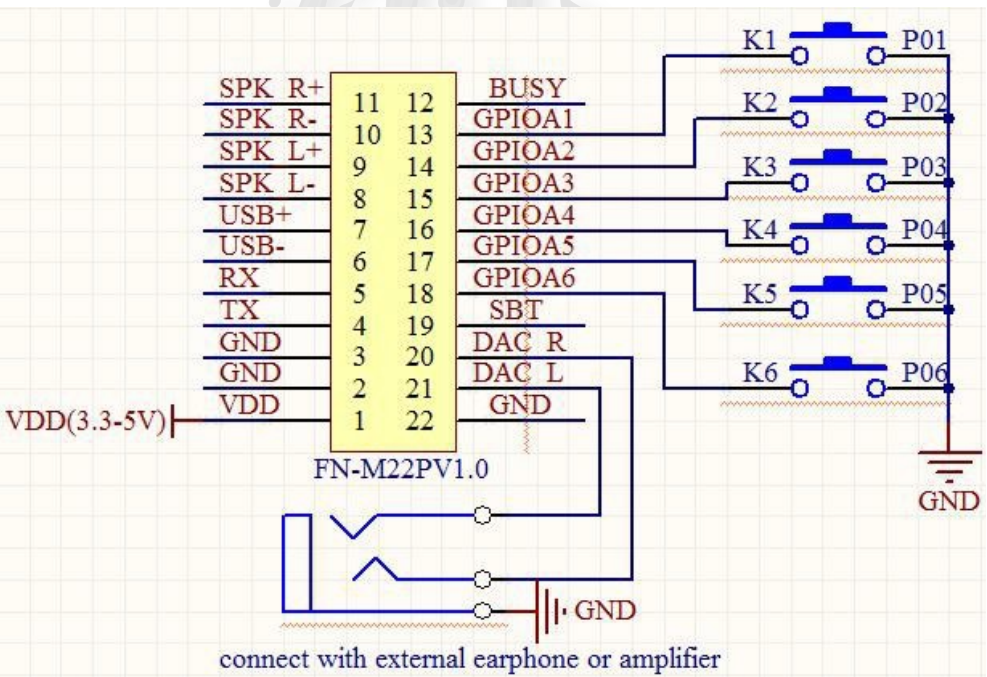
5. Application Circuits References

5.1. For Key Control

Connection with two 3 Watts speakers

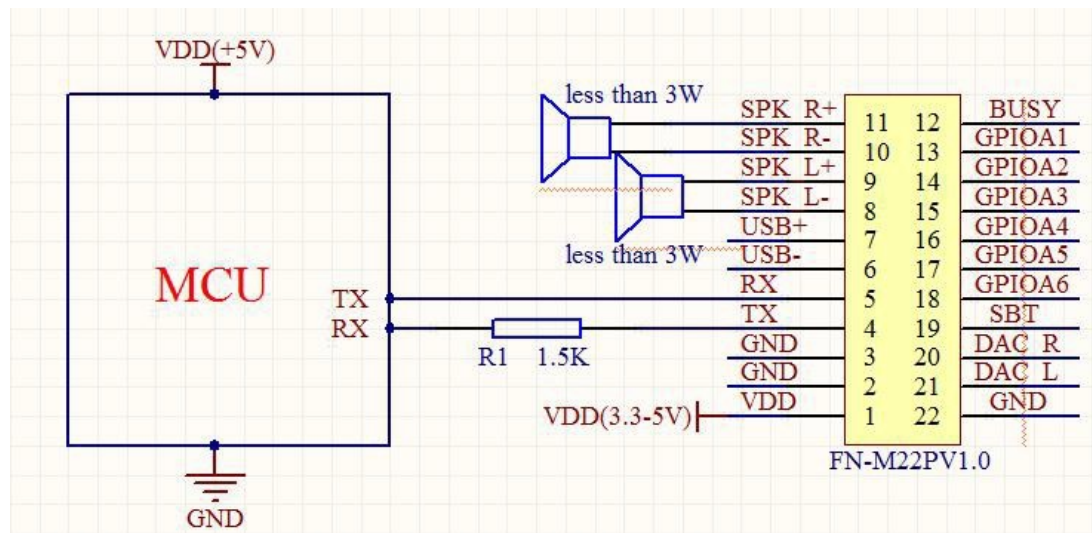


Connection with external earphone or amplifier

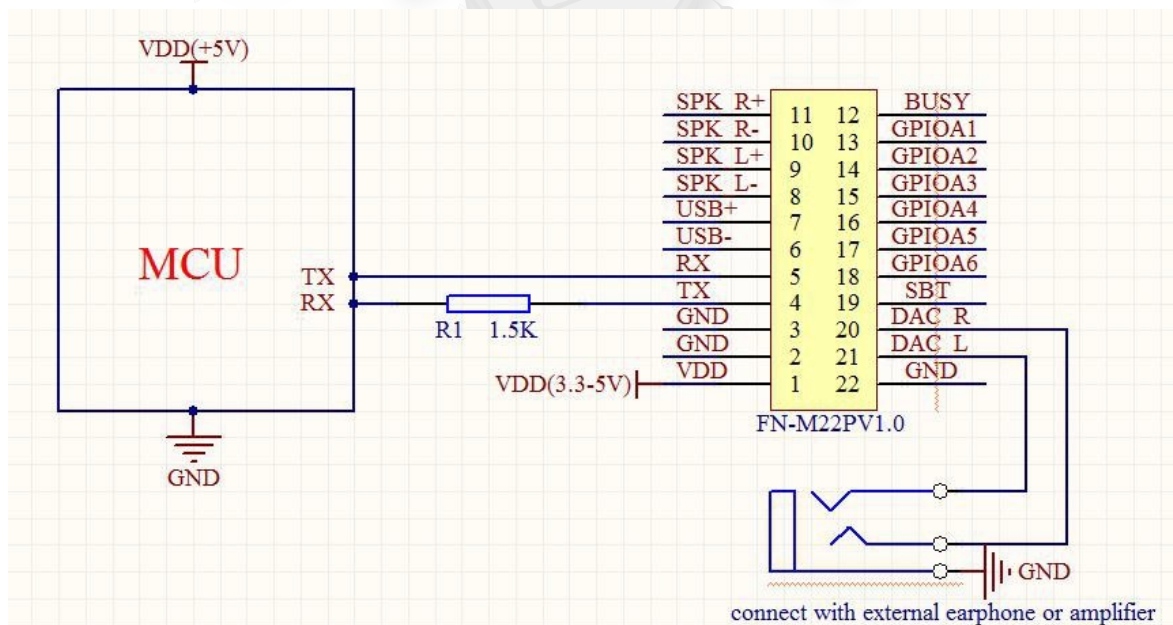


5.2. For Serial Control 5V MCU

5V MCU and connection with two 3 Watts speaker



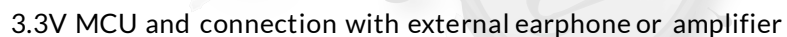
5V MCU and connection with external earphone or amplifier



Important Note:

The standard TTL Level of the module is based on 3.3V TTL level. By using 5V MCU at least a 1.5K resistor between MCU RX and module TX is required. We recommend using a 1.5K resistor also between MCU TX and module RX.

3.3V MCU and connection with two 3 Watts speaker



6. Other Notices

6.1. GPIO Features

IO Input Features						
Item	Description	Min	Typical	Max	Unit	Test Condition
VIL	Low-Level Input Voltage	-0.3	-	0.3*VDD	V	VDD=3.3V
VIH	High-Level Input Voltage	0.7VDD	-	VDD+0.3	V	VDD=3.3V
IO Output Features						
Item	Description	Min	Typical	Max	Unit	Test Condition
VOL	Low-Level Output Voltage	-	-	0.33	V	VDD=3.3V
VOH	High-Level Output Voltage	2.7	-	-	V	VDD=3.3V

6.2. Indicator LED Status

Module Work Status	Update sound from PC	Playing a sound	Pause	Sleep
Corresponding Indicator Status	fast flashing	slow flashing 500ms	Keeps ON	OFF

If the module does not detect available online SD card or USB flash drive, the indicator will turn off.

6.3. Delay of Serial Programming

After the module is powered on, it needs about 500ms to 1500ms (depending on the track quantities in the storage device) to initialize. After that, some data related to initialization returns to MCU.

After specifying playback of a device (SD card or USB flash), it needs 200ms delay before sending the command to execute the relative operation.

The module processes a serial data in 10ms frames, so when MCU continuously sends commands one by one,

20ms delay must be added before sending next command, otherwise the command will not be executed.

If specifying playback of a track in a folder, the delay must be longer than 40ms, for target track in specific folder. In general a delay of 40ms is required for loading tracks.