

1. Summary

1.1 .Brief Instruction

DFPLayer Mini module is a serial MP3 module provides the perfect integrated MP3, WMV hardware decoding. While the software supports TF card driver, supports FAT16, FAT32 file system. Through simple serial commands to specify music playing, as well as how to play music and other functions, without the cumbersome underlying operating, easy to use, stable and reliable are the most important features of this module.

1.2 .Features

- Support Mp3 and WMV decoding
- Support sampling rate of 8KHz,11.025KHz,12KHz,16KHz,22.05KHz,24KHz,32KHz,44.1KHz,48KHz
- 24-bit DAC output, dynamic range support 90dB, SNR supports 85dB
- Supports FAT16, FAT32 file system, maximum support 32GB TF card
- A variety of control modes, serial mode, AD key control mode
- The broadcast language spots feature, you can pause the background music being played
- Built-in 3W amplifier
- The audio data is sorted by folder; supports up to 100 folders, each folder can be assigned to 1000 songs
- 30 levels volume adjustable, 10 levels EQ adjustable.

1.3 .Application

- Car navigation voice broadcast
- Road transport inspectors, toll stations voice prompts
- Railway station, bus safety inspection voice prompts
- Electricity, communications, financial business hall voice prompts
- Vehicle into and out of the channel verify that the voice prompts
- The public security border control channel voice prompts
- Multi-channel voice alarm or equipment operating guide voice
- The electric tourist car safe driving voice notices
- Electromechanical equipment failure alarm
- Fire alarm voice prompts
- The automatic broadcast equipment, regular broadcast.

2. Module Application Instruction

2.1. Specification Description

| Item | Description |
|-----------------------|---|
| MP3Format | 1、Support 11172-3 and ISO13813-3 layer3 audio decoding |
| | 2、Support sampling rate (KHZ):8/11.025/12/16/22.05/24/32/44.1/48 |
| | 3、Support Normal、Jazz、Classic、Pop、Rock etc |
| UART Port | Standard Serial; TTL Level; Baud rate adjustable(default baud rate is 9600) |
| Working Voltage | DC3.2~5.0V; Type :DC4.2V |
| Standby Current | 20mA |
| Operating Temperature | -40~+70 |
| Humidity | 5% ~95% |

Table 2.1 Specification Description

2.2 .Pin Description

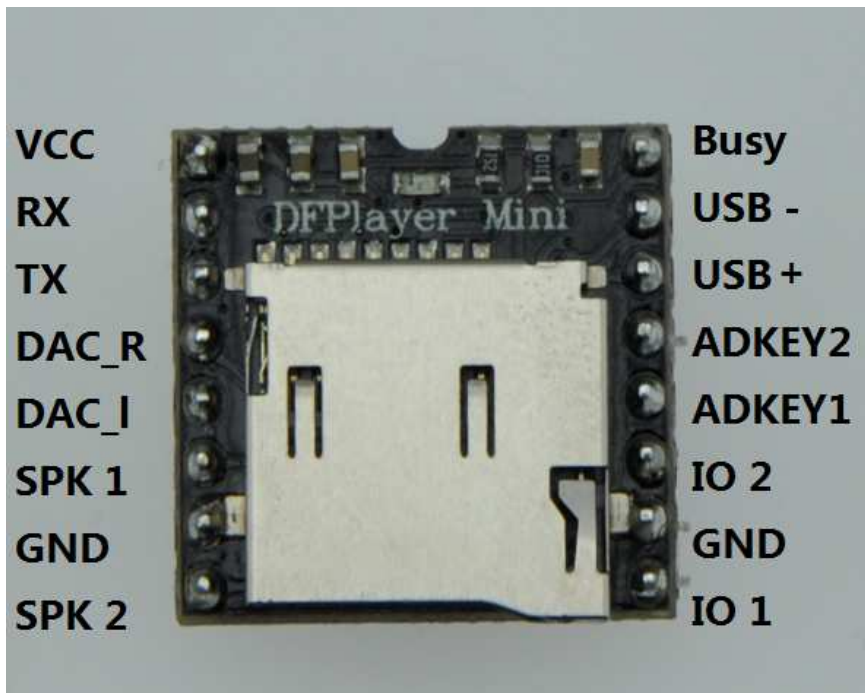


Figure 2.1

| No | Pin | Description | Note |
|----|--------|----------------------------|--|
| 1 | VCC | Input Voltage | DC3.2~5.0V;Type: DC4.2V |
| 2 | RX | UART serial input | |
| 3 | TX | UART serial output | |
| 4 | DAC_R | Audio output right channel | Drive earphone and amplifier |
| 5 | DAC_L | Audio output left channel | Drive earphone and amplifier |
| 6 | SPK2 | Speaker- | Drive speaker less than 3W |
| 7 | GND | Ground | Power GND |
| 8 | SPK1 | Speaker+ | Drive speaker less than 3W |
| 9 | IO1 | Trigger port 1 | Short press to play previous (long press to decrease volume) |
| 10 | GND | Ground | Power GND |
| 11 | IO2 | Trigger port 2 | Short press to play next (long press to increase volume) |
| 12 | ADKEY1 | AD Port 1 | Trigger play first segment |
| 13 | ADKEY2 | AD Port 2 | Trigger play fifth segment |
| 14 | USB+ | USB+ DP | USB Port |
| 15 | USB- | USB- DM | USB Port |
| 16 | BUSY | Playing Status | Low means playing \High means no |

Table 2.2 Pin Description

3. Serial Communication Protocol

Serial port as a common communication in the industrial control field, we conducted an industrial level of optimization, adding frame checksum, retransmission, error handling, and other measures to significantly strengthen the stability and reliability of communication, and can expansion more powerful RS485 for networking functions on this basis, serial communication baud rate can set as your own, the default baud rate is 9600

3.1. Serial Communication Format

Support for asynchronous serial communication mode via PC serial sending commands

Communication Standard:9600 bps

Data bits :1

Checkout :none

Flow Control :none

| Format: \$S VER Len CMD Feedback para1 para2 checksum \$O | | |
|---|---------------------------------|--|
| \$S | Start byte 0x7E | Each command feedback begin with \$, that is 0x7E |
| VER | Version | Version Information |
| Len | the number of bytes after “Len” | Checksums are not counted |
| CMD | Commands | Indicate the specific operations, such as play / pause, etc. |
| Feedback | Command feedback | If need for feedback, 1: feedback, 0: no feedback |
| para1 | Parameter 1 | Query high data byte |
| para2 | Parameter 2 | Query low data byte |
| checksum | Checksum | Accumulation and verification [not include start bit \$] |
| \$O | End bit | End bit 0xEF |

For example, if we specify play NORFLASH, you need to send: 7E FF 06 09 00 00 04 FF DD EF
Data length is 6, which are 6 bytes [FF 06 09 00 00 04]. Not counting the start, end, and verification.

3.2 .Serial Communication Commands

1).Directly send commands, no parameters returned

| CMD | Function Description | Parameters(16 bit) |
|------|---------------------------------|--|
| 0x01 | Next | |
| 0x02 | Previous | |
| 0x03 | Specify tracking(NUM) | 0-2999 |
| 0x04 | Increase volume | |
| 0x05 | Decrease volume | |
| 0x06 | Specify volume | 0-30 |
| 0x07 | Specify EQ(0/1/2/3/4/5) | Normal/Pop/Rock/Jazz/Classic/Base |
| 0x08 | Specify playback mode (0/1/2/3) | Repeat/folder repeat/single repeat/ random |

| | | |
|------|-------------------------------------|---|
| 0x09 | Specify playback source(0/1/2/3/4) | U/TF/AUX/SLEEP/FLASH |
| 0x0A | Enter into standby – low power loss | |
| 0x0B | Normal working | |
| 0x0C | Reset module | |
| 0x0D | Playback | |
| 0x0E | Pause | |
| 0x0F | Specify folder to playback | 1~10(need to set by user) |
| 0x10 | Volume adjust set | {DH=1:Open volume adjust } {DL: set volume gain 0~31} |
| 0x11 | Repeat play | {1:start repeat play} {0:stop play} |

2).Query the System Parameters

| Commands | Function Description | Parameters(16 bit) |
|----------|--|--|
| 0x3C | STAY | |
| 0x3D | STAY | |
| 0x3E | STAY | |
| 0x3F | Send initialization parameters | 0 - 0x0F(each bit represent one device of the low-four bits) |
| 0x40 | Returns an error, request retransmission | |
| 0x41 | Reply | |
| 0x42 | Query the current status | |
| 0x43 | Query the current volume | |
| 0x44 | Query the current EQ | |
| 0x45 | Query the current playback mode | |
| 0x46 | Query the current software version | |
| 0x47 | Query the total number of TF card files | |
| 0x48 | Query the total number of U-disk files | |
| 0x49 | Query the total number of flash files | |
| 0x4A | Keep on | |
| 0x4B | Queries the current track of TF card | |
| 0x4C | Queries the current track of U-Disk | |
| 0x4D | Queries the current track of Flash | |

3.3. Returned Data of Module

3.3.1. Returned Data of Module Power-on

1).The module power on, require a certain of the time initialization, this time is determined by U-disk, TF card, flash, etc. device 's file numbers, general situation in the 1.5 ~ 3Sec. If module initialization data has not been

sent out within the time, indicating that the module initialization error, please reset the module's power supply, and detect hardware connecting;

2).The module initialization data including online devices, such as sending 7E FF 06 3F 00 00 01 xx xx EF, DL = 0x01 describe only the U-disk online during power-on, Other data are seen as the table below:

| | | |
|--------------------------|-------------------------------|---------------------------------|
| U-Disk on-line | 7E FF 06 3F 00 00 01 xx xx EF | Each device are or relationship |
| TF Card on-line | 7E FF 06 3F 00 00 02 xx xx EF | |
| PC on-line | 7E FF 06 3F 00 00 04 xx xx EF | |
| FLASH on-line | 7E FF 06 3F 00 00 08 xx xx EF | |
| U-disk & TF Card on-line | 7E FF 06 3F 00 00 03 xx xx EF | |

3).MCU will not send corresponding control commands until module initialization sending commands or the module will not process the commands sent by MCU, and will also affect the normal initialization of the module.

3.3.2 .Returned Data of Track Finished Playing

| | |
|-----------------------------------|-------------------------------|
| U-Disk finish playback 1st track | 7E FF 06 3C 00 00 01 xx xx EF |
| U-Disk finish playback 2nd track | 7E FF 06 3C 00 00 02 xx xx EF |
| TF card finish playback 1st track | 7E FF 06 3D 00 00 01 xx xx EF |
| TF card finish playback 2nd track | 7E FF 06 3D 00 00 02 xx xx EF |
| Flash finish playback 1st track | 7E FF 06 3E 00 00 01 xx xx EF |
| Flash finish playback 2nd track | 7E FF 06 3E 00 00 02 xx xx EF |

1.The module will enter into pause status automatically after being specified playing, if customers need such application, they can specify track to play ,the module will enter into pause status after finishing playing ,and wait for the commands sent by MCU.

2 In addition, we opened a dedicated I/O as decoding and pausing status indication. See Pin 16, Busy

1).Output high level at playback status;

2).Output low level at pause status and module sleep;

3. For continuous playback applications, it can be achieved as below, if it finishes the first tracking of the TF card, it will return

7E FF 06 3D 00 00 01 xx xx EF
 3D ---- U-disk command
 00 01 ---- expressed finished playing tracks.

If the external MCU receives this command, please wait 100ms. And then sending the playback command [7E FF 06 0D 00 00 00 FF EE EF], because inside the module it will first initialize the next track information. In this case, the module can be played continuously.

4. If the currently finish playing the first song, the track pointer automatically point to second song, If you send a "play the next one" command, then the module will playback the third song. And, if the module finishes playing the last one, the player will automatically jump to the first pointer, and pause.

5. After specifying device, the module play pointer will point to device root directory of the first track, and enters the pause state, and wait MCU sending track playing command.

3.3.3 .Returned Data of Module Responds

| | |
|---|-------------------------------|
| FLASH finish play the 1 st track | 7E FF 06 3E 00 00 01 xx xx EF |
|---|-------------------------------|

1). in order to strengthen the stability of the data communication, we have increased response processing; ACKB byte is set whether need to reply to response. So that to ensure each communication get handshake signals, which will indicate the module has been successfully received data sent by the MCU and process immediately.

2).For general applications, customers can freely choose, without this response processing is also ok.

3.3.4 .Returned Data of Module Error

| | |
|-----------------------------------|-------------------------------|
| Module is busy | 7E FF 06 40 00 00 00 xx xx EF |
| A frame data are not all received | 7E FF 06 40 00 00 01 xx xx EF |
| Verification error | 7E FF 06 40 00 00 02 xx xx EF |

1). In order to strengthen the stability of the data communication, we added data error handling mechanism. Module will responds information after receiving error data format;

2). In the case of relatively harsh environment, it is strongly recommended that customers process this command. If the application environment in general, you no need handle it;

3).The module returns busy, basically when module power-on initialization will return, because the modules need to initialize the file system.

3.3.5. Push-in and Pull-out information of Device

| | |
|------------------|-------------------------------|
| Push in U-disk | 7E FF 06 3A 00 00 01 xx xx EF |
| Push in TF card | 7E FF 06 3A 00 00 02 xx xx EF |
| Pull out U-disk | 7E FF 06 3B 00 00 01 xx xx EF |
| Pull out TF card | 7E FF 06 3B 00 00 02 xx xx EF |

1).For the flexibility of the module, we particularly add command feedback of push-in and pull-out device. Let user know the working status of the module.

2).When push-in device, we default playback the first track of device root directory as audition, if users do not need this feature, you can wait 100ms after receiving the message of push –in serial device ,and then send pause command.

3.4 Serial Commands

3.4.1. Commands of Specify Track Play

Our instructions are given in support of the specified track is playing, the song selection ranges from 0 to 2999. Actually can support more, because it involves the reasons to the file system, support for the song too much, it will cause the system to operate slowly, and usually the application does not need to support so many files. If the customer has unconventional applications, please communicate with us in advance.

1).For example, select the first song played, serial transmission section: 7E FF 06 03 00 00 01 FF E6 EF
 7E --- START command
 FF --- Version Information
 06 --- Data length (not including parity)
 03 --- Representative No.
 00 --- If need to acknowledge [0x01: need answering, 0x00: do not need to return the response]
 00 --- Tracks high byte [DH]
 01 --- Tracks low byte [DL], represented here is the first song played
 FF --- Checksum high byte
 E6 --- Checksum low byte
 EF --- End Command

2).For selections, if choose the 100th song, first convert 100 to hexadecimal, the default is double-byte, it is 0x0064.

DH = 0x00; DL = 0x64

3).If you choose to play the 1000th, first convert 1000 to hexadecimal, the default is double-byte, it is 0x03E8
DH = 0x03; DL = 0xE8

4).And so on to the other operations, as in the embedded area in hexadecimal is the most convenient method of operating.

3.4.2 .Commands of Specify Volume

1). Our system power-on default volume is 30, if you want to set the volume, then directly send the corresponding commands.

2).For example, specify the volume to 15, serial port to send commands: 7E FF 06 06 00 00 0F FF D5 EF

3).DH = 0x00; DL = 0x0F, 15 is converted to hexadecimal 0x000F, can refer to the instructions of playing track section.

3.4.3 .Specify Device Play

1).The module default support four types of playback devices, the device must be on line, so it can specify playback. The software will automatically detect without user attention.

2).Refer the table as below to select the appropriate command to send

3).Module will automatically enter the Suspend state after the specified device, waiting for the user to specify a track playing. It will take about 200ms from specifying device to the module initialize file information. Please wait for 200ms and then send the specified track command.

| | | |
|-------------------------------------|-------------------------------|---------------------|
| Specify playback device -U-disk | 7E FF 06 09 00 00 01 xx xx EF | xx xx: Verification |
| Specify playback device -TF Card | 7E FF 06 09 00 00 02 xx xx EF | |
| Specify playback device -SLEEP | 7E FF 06 09 00 00 05 xx xx EF | |

3.4.4. Specify File to Play

| | |
|------------------------------|-------------------------------|
| Specify folder 01 of 001.mp3 | 7E FF 06 0F 00 01 01 xx xx EF |
| Specify folder 11 of 100.mp3 | 7E FF 06 0F 00 0B 64 xx xx EF |
| Specify folder 99 of 255.mp3 | 7E FF 06 0F 00 63 FF xx xx EF |

1).Specify the folder playback is developed extensions, default folders are named as "01", "11" in this way because our module does not support Chinese characters identify the name of the folder name, in order to stabilize the system switching speeds and songs under each folder default maximum support up to 255 songs, up to 99 folders classification, if customers have special requirements, they need to classify according to the English name, we also can be achieved, but name only is "GUSHI", "ERGE" and other English name.

2).For example, specify "01" folder 100.MP3 file, serial port to send commands : 7E FF 06 0F 00 01 64 xx xx EF

DH: represents the name of the folder, the default support for 99 documents become 01 - 99 named

DL: on behalf of the tracks, the default maximum of 255 songs that 0x01 ~ 0xFF

Please refer to the above set rules for setting tracks

3).to the standard of the module, you must specify both the folder and file name, to lock a file. Individually specified folder or specify the file name alone is also possible, but the document management will be worse.

4).The following diagram illustrates both the folders and file names are specified.

| | | | | |
|---|----|-----------------------|----------------|-----|
|  | 01 | folder name reference | 2014/4/9 15:03 | 文件夹 |
|  | 11 | | 2014/4/9 15:00 | 文件夹 |
|  | 31 | | 2014/4/9 15:00 | 文件夹 |
|  | 99 | | 2014/4/9 15:00 | 文件夹 |

Figure 3.1 folder name




| | | | | |
|---|---------|---------------------|----------------|--------|
|  | 001.mp3 | file name reference | 2014/4/9 15:02 | MP3 音频 |
|  | 002.mp3 | | 2014/4/9 15:03 | MP3 音频 |
|  | 255.mp3 | | 2014/4/9 15:03 | MP3 音频 |

Figure 3.2 file name

3.5. Key Ports

We use the AD module keys, instead of the traditional method of matrix keyboard connection, it is to take advantage of increasingly powerful MCU AD functionality, Our module default configuration 2 AD port, 20 key resistance distribution, if used in strong electromagnetic interference or strong inductive, capacitive load of the occasion, please refer to our "Notes."

1).Refer diagram

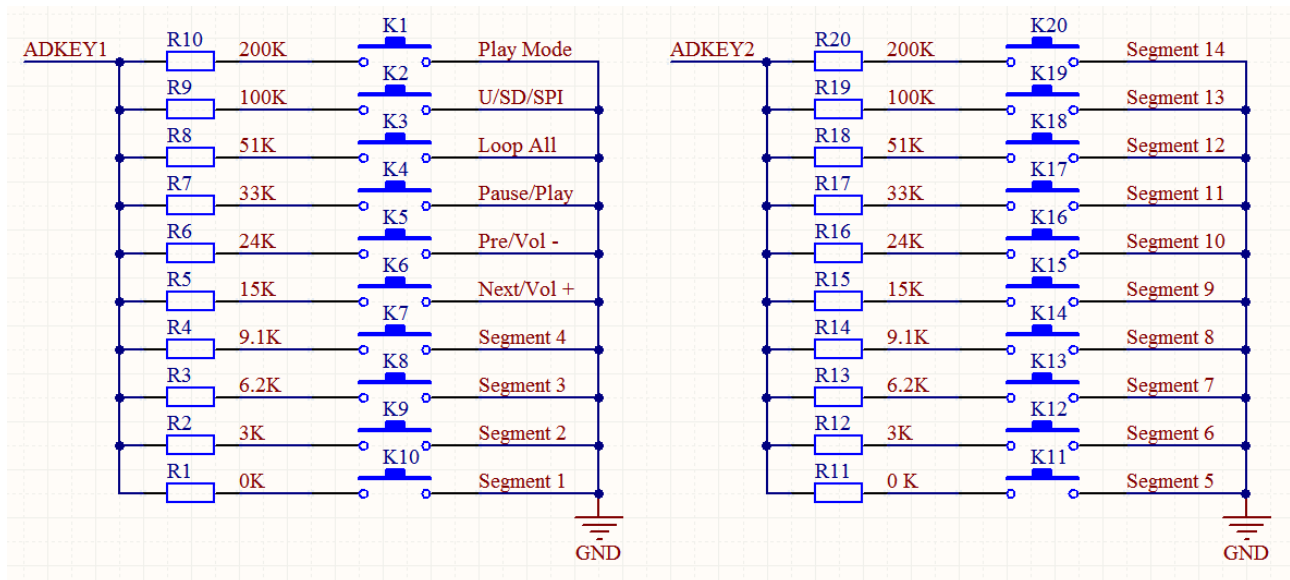


Figure 3.3 ad key refer

2)、20 function keys allocation table

| Key | Short Push | Long Push | Description |
|-----|--------------------------|------------------------|---------------------------------------|
| K1 | Play Mode | | Switch to interrupt / non interrupted |
| K2 | Playback device switches | | U/TF/SPI/Sleep |
| K3 | Operating Mode | | All cycle |
| K4 | Play/Pause | | |
| K5 | Previous | Vol+ | |
| K6 | Next | Vol- | |
| K7 | 4 | Repeat play tracking 4 | Long push always to repeat play |
| K8 | 3 | Repeat play tracking 3 | Long push always to repeat play |

| | | | |
|-----|----|-------------------------|---------------------------------|
| K9 | 2 | Repeat play tracking 2 | Long push always to repeat play |
| K10 | 1 | Repeat play tracking 1 | Long push always to repeat play |
| K11 | 5 | Repeat play tracking 5 | Long push always to repeat play |
| K12 | 6 | Repeat play tracking 6 | Long push always to repeat play |
| K13 | 7 | Repeat play tracking 7 | Long push always to repeat play |
| K14 | 8 | Repeat play tracking 8 | Long push always to repeat play |
| K15 | 9 | Repeat play tracking 9 | Long push always to repeat play |
| K16 | 10 | Repeat play tracking 10 | Long push always to repeat play |
| K17 | 11 | Repeat play tracking 11 | Long push always to repeat play |
| K18 | 12 | Repeat play tracking 12 | Long push always to repeat play |
| K19 | 13 | Repeat play tracking 13 | Long push always to repeat play |
| K20 | 14 | Repeat play tracking 14 | Long push always to repeat play |

4、Application Circuit

4.1 Serial Communication Connect

Module's serial port is 3.3V TTL level, so the default interface level is 3.3V. If the MCU system is 5V. It is recommended connect a 1K resistor in series.

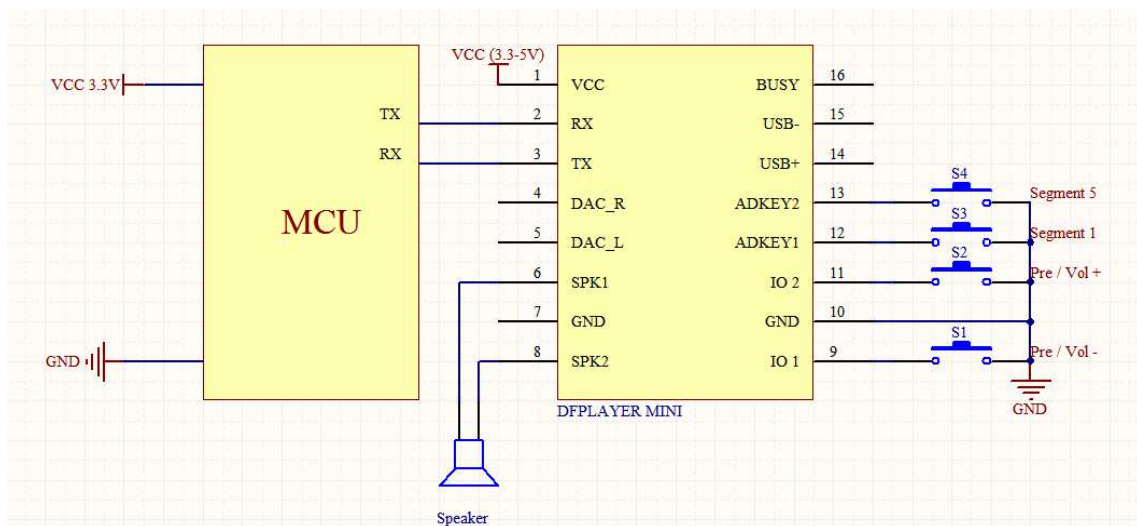


Figure 4.1 Serial Connect (3.3V)

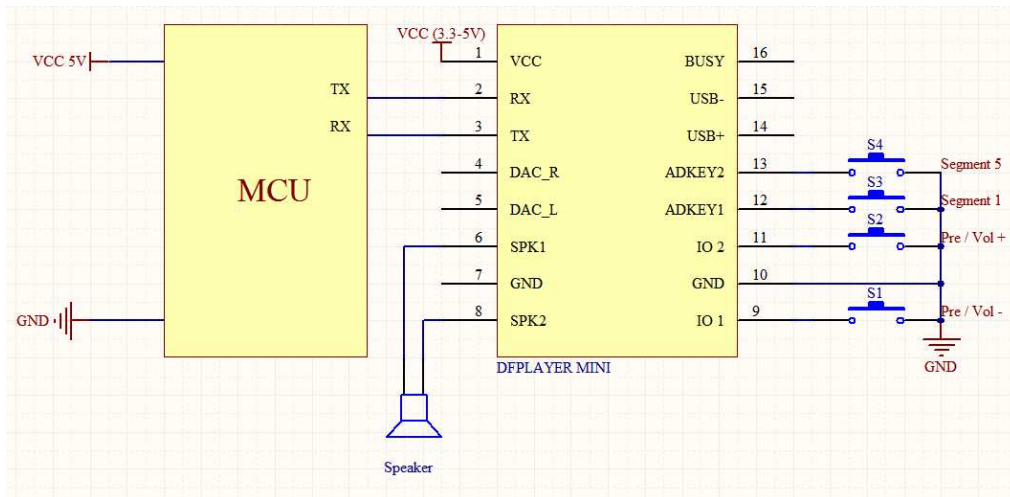


Figure 4.2 Serial Connect (5v)

4.2. Other Refer Diagram

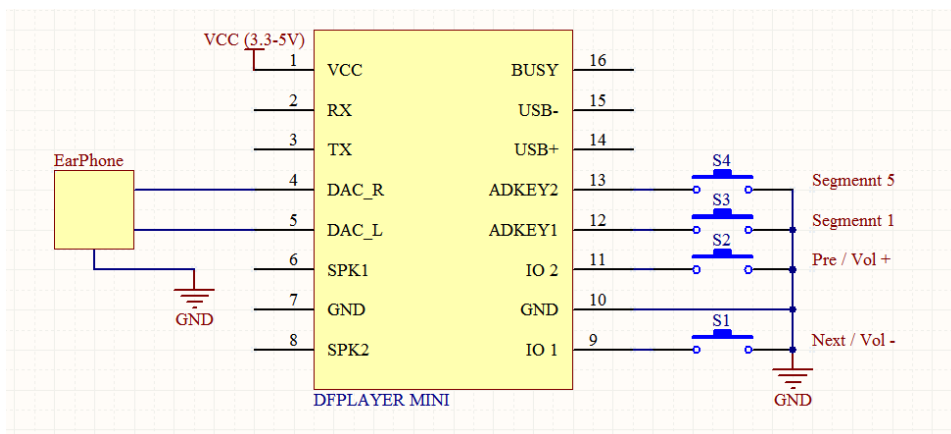


Figure 4.3 headset connect module

Between the headset and the module can string a 100R resistor, make a limiting

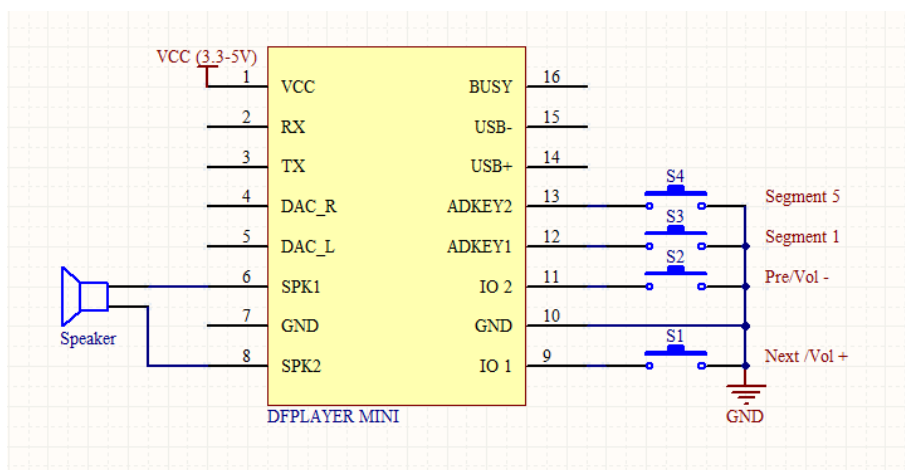


Figure 4.4 speaker connect module

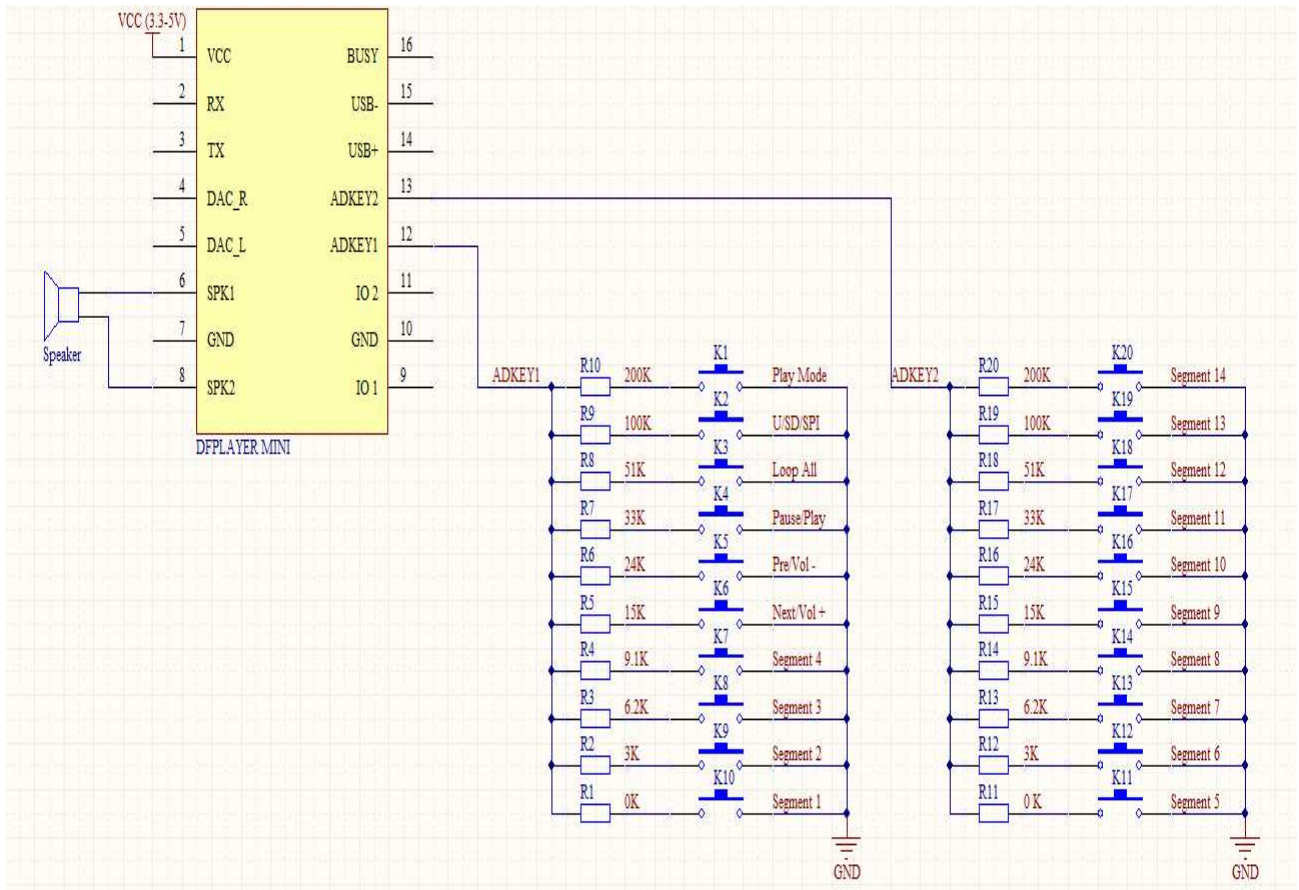


Figure 4.5 Ad key connect refer

5、MP3-TF-16P Size (unit: mm)

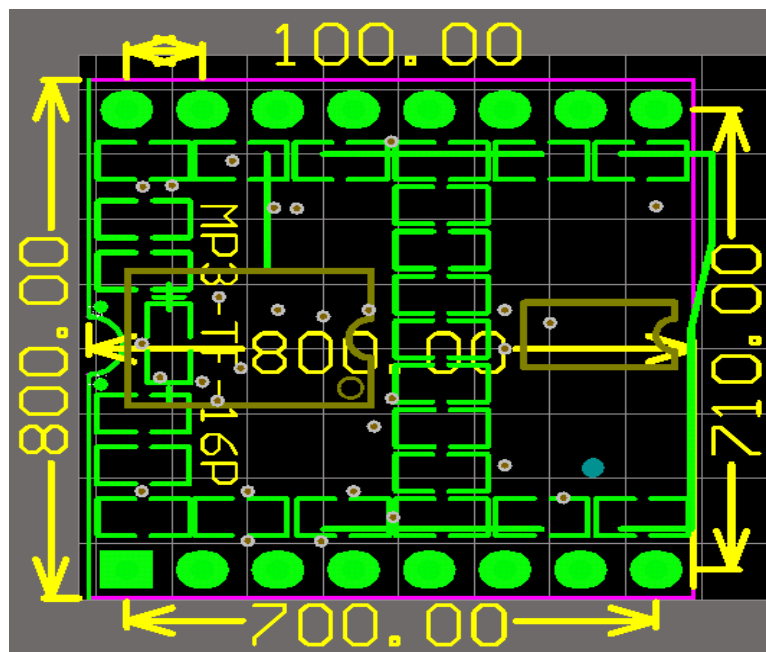


Figure 5.1 pcb size

6、Note*

| I/O Input Specification | | | | | | |
|--------------------------|---------------------------|----------|------|------------------|------|----------------|
| Item | Description | Min | Type | Max | Unit | Test Condition |
| VIL | Low-Level Input Voltage | -0.3 | - | $0.3 \times VDD$ | V | VDD=3.3V |
| VIH | High-Level Input Voltage | $0.7VDD$ | - | $VDD+0.3$ | V | VDD=3.3V |
| I/O Output Specification | | | | | | |
| Item | Description | Min | Type | 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 |

1. The module's external interfaces are 3.3V TTL level, so please note the level conversion during the hardware circuit design, also in strong interference environment, electromagnetic compatibility note some protective measures, GPIO using opt coupler isolation, increasing TVS etc.

2, ADKEY key values are in accordance with the general use of the environment, if the strong inductive or capacitive load environment, please note that the module power supply is recommended to use a separate isolated power supply, another matched beads and inductors for power filtering, we must ensure that the input power as much as possible the stability and clean. If you really can not be guaranteed, please contact us to reduce the number of keys to redefine wider voltage distribution.

3. For general Serial communication, please pay attention to level conversion. If strong interference environment, or long distance RS485 applications, then please note that signal isolation, in strict accordance with industry standard design communication circuits.