



Shenzhen Cashway Technology Co., Ltd

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Micro SD card Serial Mp3 Module CY-T16 V1.0

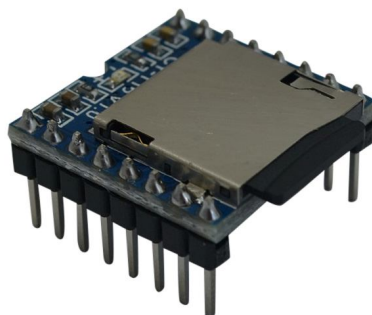
1. Brief Introduction

The CY-T16 is a small and low cost MP3 module with an amplifier output directly to the speaker. The module can be used as a stand alone module with attached battery, speaker and push buttons or used in combination with an Arduino UNO or any other with RX/TX capabilities.

The CY-T16 module perfectly integrates hard decoding module, which supports common audio formats such as MP3, WAV and WMA. Besides, it also supports TF card with FAT16, FAT32 file system. Through a simple serial port, you can play the designated music without any other tedious underlying operations.

2. Feature

- Supported sampling rates (kHz): 8/11.025/12/16/22.05/24/32/44.1/48
- 24 -bit DAC output, support for dynamic range 90dB , SNR support 85dB
- Fully supports FAT16 , FAT32 file system, maximum support 32G of the TF card, support 32GByte of micro SD card
- A variety of control modes, I/O control mode, serial mode, AD button control mode
- Advertising sound waiting function, the music can be suspended. when advertising is over in the music continue to play
- Audio data sorted by folder, supports up to 100 folders, every folder can hold up to 255 songs
- 30 level adjustable volume, 6 -level EQ adjustable



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.



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4. Electronic Specification

Item	Description
Supported sampling rates (kHz)	8/11.025/12/16/22.05/24/32/44.1/48
UART Port	Standard Serial; TTL Level; Baud rate adjustable(default baud rate is 9600)
Working Voltage	DC3.2~5.0V; Type :DC4.2V
Control	Button /RS232
Support memory card	Up to 32GB
Standby Current	<15mA
Operating Temperature	-40~+80
Humidity	5% ~95%

5. Pin Description

1	VCC	BUSY	16
2	RX	USB-	15
3	TX	USB+	14
4	DAC_R	ADKEY2	13
5	DAC_L	ADKEY1	12
6	SPK+	I/O2	11
7	GND	GND	10
8	SPK-	I/O1	9

No	Pin	Description	Note
1	VCC	DC3.2~5.0V;Type: DC4.2V	
2	RX	UART serial input	
3	TX	UART serial output	
4	DAC_R	Audio output R- channel	connect earphone / external amplifier
5	DAC_L	Audio output L- channel	connect earphone / external amplifier
6	SPK2	Speaker-	Connect speaker
7	GND	Ground	Power GND
8	SPK1	Speaker+	Connect speaker
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)



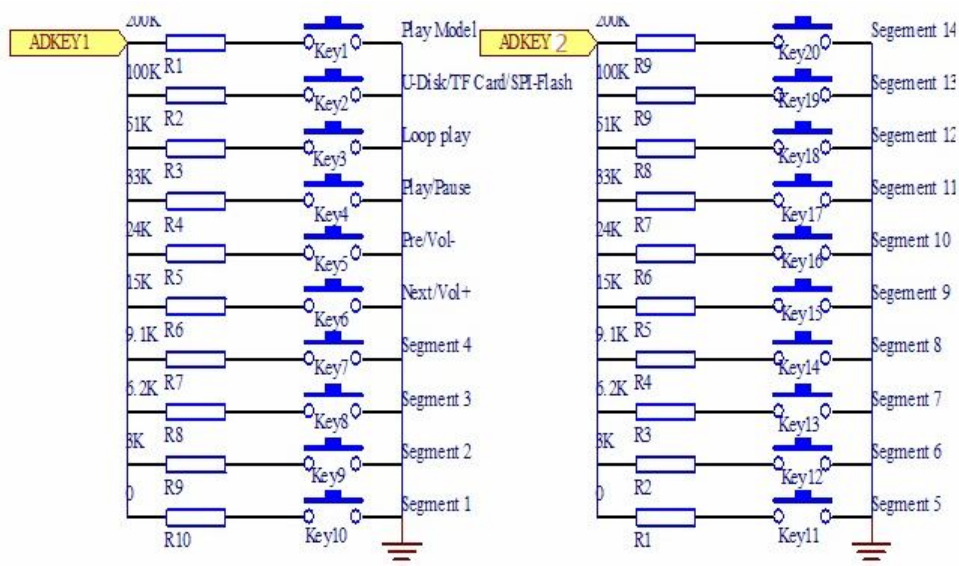
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12	ADKEY1	AD Port 1	Trigger play first segment
13	ADKEY2	AD Port 2	Trigger play fifth segment
14	USB+	USB+ DP	USB Port
15	USB-	USB- DM	USB Port
16	Busy	Indicator Pin	High level when play ;low level when stop

6. Control Model

6.1. AD Key Control



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	Short press play tracking 4	Long push always to repeat tracking 4
K8	3	Short press play tracking 3	Long push always to repeat tracking 3
K9	2	Short press play tracking 2	Long push always to repeat tracking 2
K10	1	Short press play tracking 1	Long push always to repeat tracking 1
K11	5	Short press play tracking 5	Long push always to repeat tracking 5
K12	6	Short press play tracking 6	Long push always to repeat tracking 6
K13	7	Short press play tracking 7	Long push always to repeat tracking 7
K14	8	Short press play tracking 8	Long push always to repeat tracking 8
K15	9	Short press play tracking 9	Long push always to repeat tracking 9



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K16	10	Short press play tracking 10	Long push always to repeat tracking 10
K17	11	Short press play tracking 11	Long push always to repeat tracking 11
K18	12	Short press play tracking 12	Long push always to repeat tracking 12
K19	13	Short press play tracking 13	Long push always to repeat tracking 13
K20	14	Short press play tracking 14	Long push always to repeat tracking 14

6.2. 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, the default baud rate is 9600

6.2.1. Serial Commands 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 bit 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	1 :need feedback,0: no need 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

6.2.2. Serial Commands

CMD	Function Description	Parameters(16 bit)
0x01	Play Next	
0x02	Play Previous	
0x03	Specify tracking play	0001~3000
0x04	Increase volume	
0x05	Decrease volume	
0x06	Specify volume	Volume level:0-30
0x07	Specify EQ(0/1/2/3/4/5)	0:Normal/1:Pop/2:Rock/3:Jazz/4:Classic/5:Base
0x08	Specify tracking repeat	0001~3000
0x09	Specify playback source(0/1/2/3/4)	0:U-disk/1:SD/2:AUX/3:SLEEP/4:FLASH
0x0A	Enter into standby – low power loss	
0x0B	NC	
0x0C	Reset module	



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0x0D	Playback	
0x0E	Pause	
0x0F	specify play 255 songs in each folder	01~10(need to set by user)
0x10	NC	
0x11	Repeat play all	{1:start repeat play}{0:stop play}
0x12	Specify mp3 folder tracking	0~9999
0x13	Spot play advertisement	0~9999
0x14	specify play 1000 songs in each folder	01~15 folders(need to set by user)
0x15	Stop play advertisement, play back ground music	
0x16	Stop play	
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 total files of U-Disk	
0x48	Query total files of TF Card	
0x49	NC	
0x4A	NC	
0x4B	Queries current track of U-Disk	
0x4C	Queries current track of TF Card	
0x4E	Query total files of folder	

6.2.3. Serial Commands Examples

Commands Description	Serial Commands [with checksum]	Serial Commands [without checksum]	Note
Specify playback device	7E FF 06 09 00 00 01 FE F1 EF	7E FF 06 09 00 00 01 EF	playback device is U-disk
	7E FF 06 09 00 00 02 FE F0 EF	7E FF 06 09 00 00 02 EF	playback device is SD card
Playback	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	
Stop play	7E FF 06 16 00 00 00 FE E5 EF	7E FF 06 16 00 00 00 EF	Stop mp3 software decoding
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	
Repeat play all	7E FF 06 11 00 00 01 FE E9 EF	7E FF 06 11 00 00 01 EF	Turn on repeat all
Single repeat play	7E FF 06 19 00 00 00 FE E2 EF	7E FF 06 19 00 00 01 EF	Turn on single repeat



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Turn off single repeat	7E FF 06 19 00 00 01 FE E1 EF	7E FF 06 1A 00 00 00 EF	
Random play	7E FF 06 18 00 00 00 FE E3 EF	7E FF 06 19 00 00 00 EF	
Specify volume	7E FF 06 06 00 00 1E FE D7 EF	7E FF 06 06 00 00 1E EF	Specify volume
Specify EQ(0/1/2/3/4/5)	7E FF 06 07 00 00 01 FE F3 EF	7E FF 06 07 00 00 01 EF	EQ is Pop
Specify tracking play	7E FF 06 03 00 00 01 FE F7 EF	7E FF 06 03 00 00 01 EF	Specify tracking 01 play
	7E FF 06 03 00 00 02 FE F6 EF	7E FF 06 03 00 00 02 EF	Specify tracking 02 play
	7E FF 06 03 00 00 0A FE EE EF	7E FF 06 03 00 00 0A EF	Specify tracking 10 play
Specify tracking repeat	7E FF 06 08 00 00 01 FE F2 EF	7E FF 06 08 00 00 01 EF	Specify tracking 0001 repeat
	7E FF 06 08 00 00 02 FE F1 EF	7E FF 06 08 00 00 02 EF	Specify tracking 0002 repeat
	7E FF 06 08 00 00 0A FE E9 EF	7E FF 06 08 00 00 0A EF	Specify tracking 0010 repeat
Specify "mp3" folder tracking play	7E FF 06 12 00 00 FF FD EA EF	7E FF 06 12 00 00 FF EF	Play folder "mp3" tracking 0255
	7E FF 06 12 00 07 CF FE 13 EF	7E FF 06 12 00 07 CF EF	Play folder "mp3" tracking 1999
	7E FF 06 12 00 0B B8 FE 26 EF	7E FF 06 12 00 0B B8 EF	Play folder "mp3" tracking 3000
specify play 255 songs in each folder	7E FF 06 0F 00 01 01 FE EA EF	7E FF 06 0F 00 01 01 EF	Play folder 01 tracking 001
	7E FF 06 0F 00 01 02 FE E9 EF	7E FF 06 0F 00 01 02 EF	Play folder 01 tracking 002
Support play 1000 songs in each folder	7E FF 06 14 00 10 FF FD D8 EF	7E FF 06 14 00 10 FF EF	Play folder 01 tracking 0255
	7E FF 06 14 00 17 CF FE 01 EF	7E FF 06 14 00 17 CF EF	Play folder 01 tracking 1999
	7E FF 06 14 00 C0 01 FE 26 EF	7E FF 06 14 00 C0 01 EF	Play folder 02 tracking 0001
	7E FF 06 14 00 C0 FF FD 28 EF	7E FF 06 14 00 C0 FF EF	Play folder 12 tracking 0255
Spot play advertisement	7E FF 06 13 00 00 01 FE E7 EF	7E FF 06 13 00 00 01 EF	Spot play folder "ADVERT" tracking "0001"
	7E FF 06 13 00 00 02 FE E6 EF	7E FF 06 13 00 00 02 EF	Spot play folder "ADVERT" tracking "0002"
	7E FF 06 13 00 00 FF FD E9 EF	7E FF 06 13 00 00 FF EF	Spot play folder "ADVERT" tracking "0255"
Stop play advertisement,	7E FF 06 15 00 00 00 FE E6 EF	7E FF 06 15 00 00 00 EF	Stop play advertisement, play back ground music
Enter into standby – low power loss	7E FF 06 0A 00 00 00 FE F1 EF	7E FF 06 0A 00 00 00 EF	
Reset module	7E FF 06 0C 00 00 00 FE EF EF	7E FF 06 0C 00 00 00 EF	
Specify folder repeat play	7E FF 06 17 00 00 01 FE E2 EF	7E FF 06 17 00 00 01 EF	Specify folder 01 repeat play
	7E FF 06 17 00 00 02 FE E3 EF	7E FF 06 17 00 00 02 EF	Specify folder 02 repeat play
DAC setup	7E FF 06 1A 00 00 00 FE E1 EF	7E FF 06 1A 00 00 01 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
Query the current status	7E FF 06 42 00 00 00 FE B9 EF	7E FF 06 42 00 00 00 EF	
Query the current volume	7E FF 06 43 00 00 00 FE B8 EF	7E FF 06 43 00 00 00 EF	
Query the current EQ	7E FF 06 44 00 00 00 FE B7 EF	7E FF 06 44 00 00 00 EF	



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Query total files of U-Disk	7E FF 06 47 00 00 00 FE B4 EF	7E FF 06 47 00 00 00 EF	
Query total files of TF Card	7E FF 06 48 00 00 00 FE B3 EF	7E FF 06 48 00 00 00 EF	
Queries current track of U-Disk	7E FF 06 4B 00 00 00 FE B0 EF	7E FF 06 4B 00 00 00 EF	
Queries current track of TF Card	7E FF 06 4C 00 00 00 FE AF EF	7E FF 06 4C 00 00 00 EF	
Query total files of folder	7E FF 06 4E 00 00 01 FE AC EF	7E FF 06 4E 00 00 01 EF	Query total files of folder 01
	7E FF 06 4E 00 00 0B FE A2 EF	7E FF 06 4E 00 00 0B EF	Query total files of folder 02

6.2.4 .Example of Serial Control Code

Code example: specify tracking playback

```
/******
```

- 实现功能：实现芯片上电分别指定播放第一曲和第二曲，基本的程序供用户测试
- 日期：2013-05-06
- 运行环境：STC 晶振：11.0592M 波特率：9600
- 备注：在普中科技的 51 开发板上调试 OK --- STC89C516RD+

1、该测试程序必须是模块或者芯片方案中有设备在线，譬如 U 盘、TF 卡、FLASH

```
*****/
```

```
#include "REG52.h"
```

```
#define COMM_BAUD_RATE 9600 //串口波特率
#define OSC_FREQ 11059200 //运行晶振：11.05926MHZ
static INT8U Send_buf[10] = {0};
```

```
void Delay_Ms(INT32U z)
{
    INT32U x=0 , y=0;
    for(x=110 ; x>0 ;x--)
        for(y=z; y>0;y-- );
}
```

```
/******
```

- 功能描述：串口 1 初始化
- 注：设置为 9600 波特率

```
*****/
```

```
void Serial_init(void)
{
    TMOD = 0x20; // 设置 T1 为波特率发生器
    SCON = 0x50; // 0101,0000 8 位数据位，无奇偶校验
    PCON = 0x00; //PCON=0;
    TH1=256-(OSC_FREQ/COMM_BAUD_RATE/32/12); //设置为 9600 波特率
    TL1=256-(OSC_FREQ/COMM_BAUD_RATE/32/12);
    TR1 = 1; //定时器 1 打开
    REN = 1; //串口 1 接收使能
    ES = 1; //串口 1 中断使能
}
```

```
void Uart_PutByte(INT8U ch)
{
```



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```
SBUF = ch;
while(!TI){;}
TI = 0;
}
```

```
/*-----*/
```

- 功能描述: 串口向外发送命令[包括控制和查询]
- 参数说明: CMD:表示控制指令, 请查阅指令表, 还包括查询的相关指令
feedback:是否需要应答[0:不需要应答, 1:需要应答]
data:传送的参数

```
-----*/
```

```
void SendCmd(INT8U len)
{
    INT8U i = 0 ;
    Uart_PutByte(0x7E); //起始
    for(i=0; i<len; i++)//数据
    {
        Uart_PutByte(Send_buf[i]) ;
    }
    Uart_PutByte(0xEF) ;//结束
}
```

```
/*-----*/
```

- 功能描述: 求和校验
- 和校验的思路如下:

发送的指令, 去掉起始和结束。将中间的 6 个字节进行累加, 最后取反码。接收端就将接收到的一帧数据, 去掉起始和结束。将中间的数据累加, 再加上接收到的校验字节。刚好为 0.这样就代表接收到的数据完全正确。

```
-----*/
```

```
void DoSum( INT8U *Str, INT8U len)
{
    INT16U xorsum = 0;
    INT8U i;
    for(i=0; i<len; i++)
    {
        xorsum = xorsum + Str[i];
    }
    xorsum = 0 -xorsum;
    *(Str+i) = (INT8U)(xorsum >>8);
    *(Str+i+1) = (INT8U)(xorsum & 0x00ff);
}
```

```
void Uart_SendCMD(INT8U CMD ,INT8U feedback , INT16U dat)
{
    Send_buf[0] = 0xff; //保留字节
    Send_buf[1] = 0x06; //长度
    Send_buf[2] = CMD; //控制指令
    Send_buf[3] = feedback;//是否需要反馈
    Send_buf[4] = (INT8U)(dat >> 8);//datah
    Send_buf[5] = (INT8U)(dat); //datal
    DoSum(&Send_buf[0],6); //校验
    SendCmd(8); //发送此帧数据
}
```




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```

void main()
{
  Serial_init() ;//串口寄存器的初始化设置
  Uart_SendCMD(0x03 , 0 , 0x01) ;//播放第一首
  Delay_Ms(1000) ;//延时大概 6S
  Uart_SendCMD(0x03 , 0 , 0x02) ;//播放第二首
  Delay_Ms(1000) ;//延时大概 6S
  Uart_SendCMD(0x03 , 0 , 0x04) ;//播放第四首
  while(1) ;
}
  
```

7. Application Circuit Example

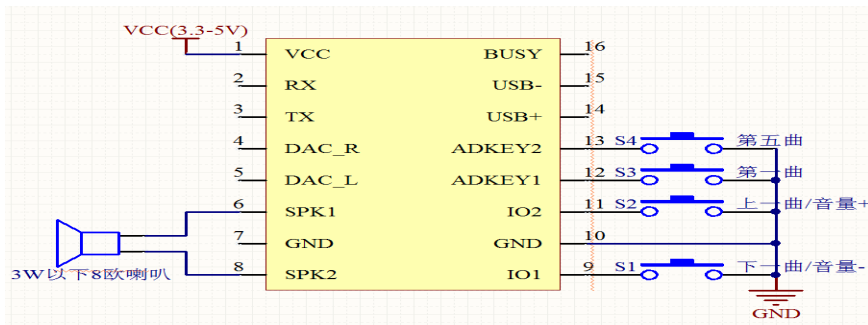


Figure 5-1: Connect speaker and key control

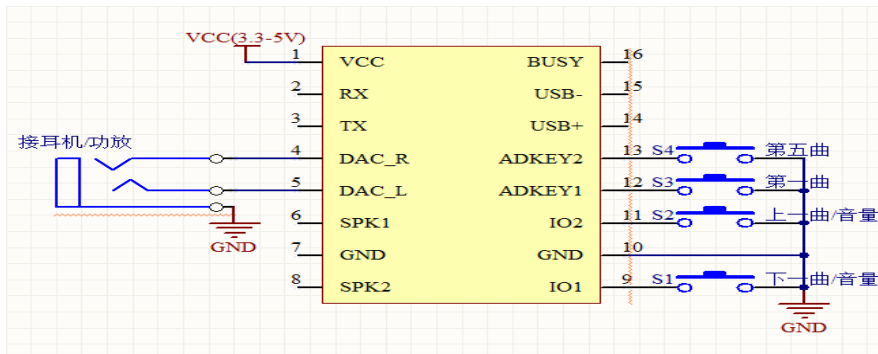


Figure 5-2: Connect earphone and key control

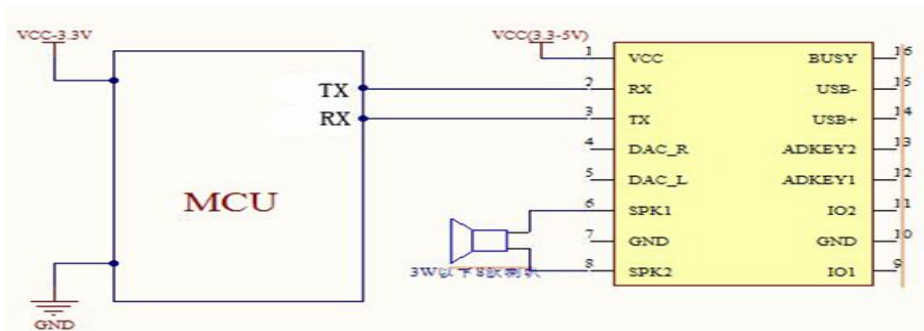


Figure 5-3: Connect 3.3V MCU and speaker



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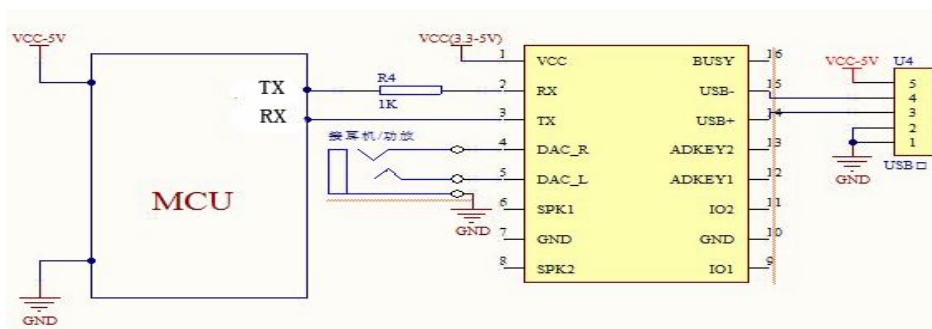


Figure 5-4: Connect 5V MCU and earphone

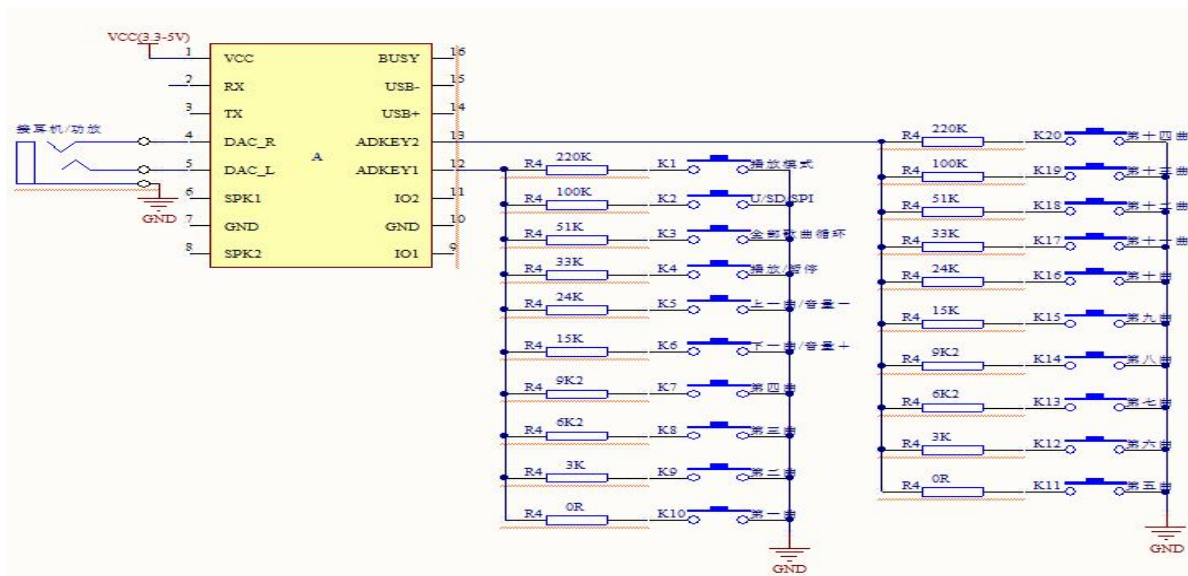
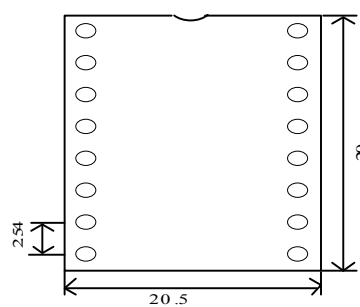


Figure 5-5: Connect AD key control and USB port

8、Size (unit: mm)



10. Version History

Version	Description	Date
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V1.1	Original	July 26th , 2013
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