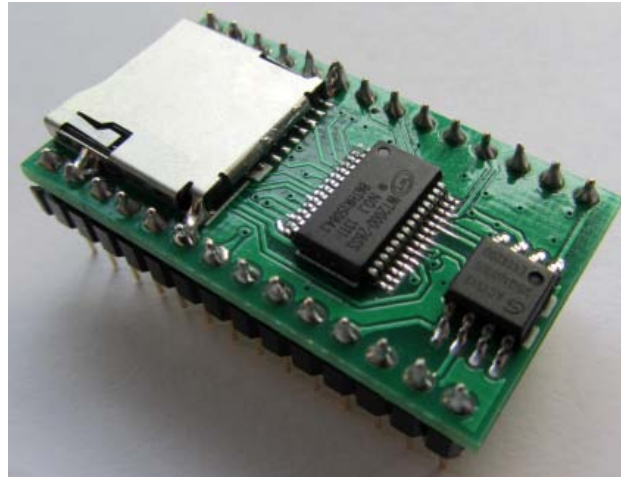# WT2000M03 MP3 Module

Overview

WT2000M03 is MP3 module, with folder classify, specified file name play and specified index sequence play. According file name to record in specified file or according index sequence to record and play. Support SPI-Flash, TF card and U disk.

Features

Support WAV, WMA and MP3 audio format
Use SPI-FLASH, TF card and U disk as storage, maximum support 32G TF card and U disk
Support combine play in the same storage
Support inter-cut in different storage
Adopt FAT and FAT32 file system
PC through USB interface to change audio in TF card
Through TF card or U disk to download audio file into SPI-FLASH, support change audio file offline
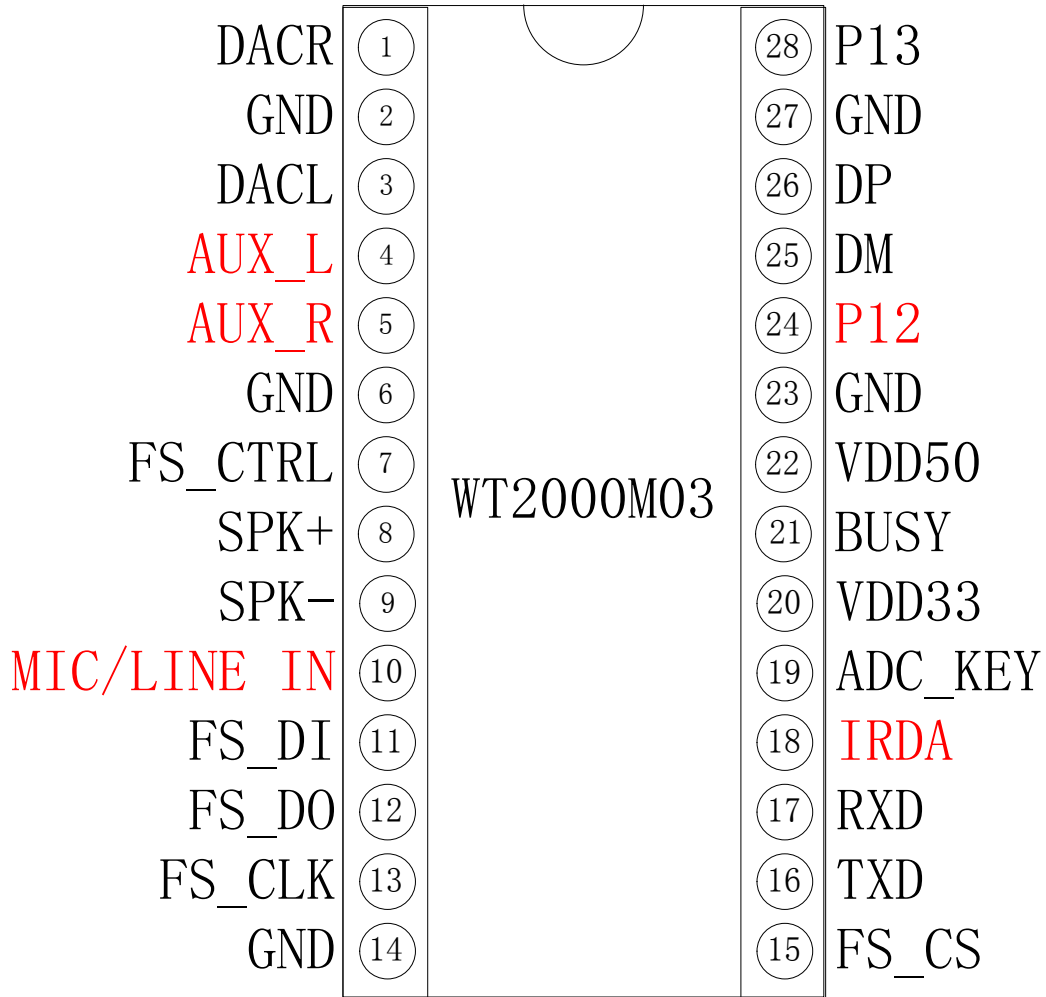Support USB sound card
Use UART ASYNC with standard interface protocol
Inner 1W amplified, direct drive 8 ohm/1W horn, 32 level volume can be adjusted
DC 5V power supply

Technology Specification

Name	Function
Audio Format	Support 8K-48K sample rate, 8-320Kbps bit rate Support 8K-44.1K sample rate WAV audio file (U disk support 22KHz sample rate at most) Support 8K-44.1K sample rate WMA audio file(FLASH not support the audio file format)
Storage Volume	Support 4Mbit-128Mbit SPI-FLASH Max support 32GB TF card Max support 32GB U disk
USB Interface	Full speed 2.0
Power Supply	DC3.3~5V
Rated Current	20~250mA（related with load）
IO Port Level	3.3V TTL Level
Size	21.3mm*37.2mm
Working Temperature	-40~85 degree
Humidity	5%~95%

Pin Image

```
         ┌──────┐
DACR    ①│      │㉘ P13
GND     ②│      │㉗ GND
DACL    ③│      │㉖ DP
AUX_L   ④│      │㉕ DM
AUX_R   ⑤│      │㉔ P12
GND     ⑥│      │㉓ GND
FS_CTRL ⑦│WT2000M03│㉒ VDD50
SPK+    ⑧│      │㉑ BUSY
SPK−    ⑨│      │⑳ VDD33
MIC/LINE IN ⑩│  │⑲ ADC_KEY
FS_DI   ⑪│      │⑱ IRDA
FS_DO   ⑫│      │⑰ RXD
FS_CLK  ⑬│      │⑯ TXD
GND     ⑭│      │⑮ FS_CS
         └──────┘
```

Illustration

Pin No.	Pin Name	Type	Function Description
1	DACR	IO	DAC right channel output
2	GND	PWP	connect with TF card slot GND
3	DACL	IO	DAC left channel output
4	AUX_L	IO	AUX record audio signal left channel input port(unused)
5	AUX_R	IO	AUX record audio signal left channel input port(unused)
6	GND	O	Connect with TF card slot
7	FS_CTRL	I	FLASH control pin(it need to control pin when FLASH download)
8	SP+	AO	Horn Terminal
9	SP-	AO	Horn Terminal
10	LINE IN/MIC	AI	Microphone Terminal (unused)
11	FS_DI	I	SPI of SPI-FLASH interface data input end
12	FS_DO	O	SPI of SPI-FLASH interface data output end
13	FS_CLK	I	SPI of SPI-FLASH interface clock signal output end
14	GND	PWP	Power Ground

15	FS_CS	I/O	SPI-FLASH chip selection end
16	TXD	O	UART ASYNC data output end
17	RXD	I	UART ASYNC data output end
18	IRDA	I	Red signal input end（unused）
19	ADC_KEY	I	ADC key connect port（unused）
20	VDD33	PWP	LDO 3.3V power output end
21	BUSY	I/O	Busy signal（not support）
22	VDD	PWP	Module power end
23	GND	PWP	GND connect with TF card slot
24	P12	IO	P12 port（unused）
25	DM	IO	USB data port DM
26	DP	IO	USB data port DP
27	GND	PWP	GND connect with TF card slot
28	P13	IO	P13 port

Note:

Second, sixth, twenty-third and twenty-seventh pin of GND connect with TF card. When used, only connect with fourteenth pin power.
Do not supply power to external device, only for low power consumption like pull-up resistor.

Key Control

Key Name	K1	K2	K3	K4
Function	Play/Pause	Next	Last	Stop

Key connect circuit please refer to behind corresponding circuit.

Serial Communication Control Command

Protocol Command Format

Inner standard UART ASYNC interface, with 3.3V TTL level interface. Through MAX3232 chip to convert into RS232 level.
Communication Data Format: start bit: 1, data bit: 8, parity bit: none, stop bit: 1. Use computer serial port debugging assistance, it need to correct setting serial parameter, setting as below:

Start Code	Length	Command Code	Parameter	Cumulative Sum and Verity	Over Code
0X7E	See below	See below	See below	See below	0XEF

Note: "Length" means, length (1 byte) + command code (several byte) + parameter (several byte) + 1 byte checksum length. "Cumulative sum verify" means length + command code + low byte cumulative sum of parameter.

Command List

Communication Control Command

Communication Query Command

Communication Control Command

CMD Detail Annotate	Function	Input Parameter
A0	Specified SPI FLASH root catalogue index play	File Index
A1	Specified SPI-FLASH folder file play	Folder, file index
A2	Specified SD card root catalogue index play	File index
A3	Specified SD card file name play	File name
A4	Specified file index play in SD card folder	File folder, file index
A5	Specified file name play in SD card folder	Folder name, file name
A6	Specified index play in U disk root catalogue	File index

A7	Specified U disk file name play	File name
A8	Specified file index play in U disk folder	Folder name, file index
A9	Specified file name play in U disk	Folder name, file name
AA	Play/pause command	N/C
AB	Stop command	N/C
AC	Next command	N/C
AD	Last command	N/C
AE	Volume control command	Volume level
AF	Specified play mode	Option mode
B0	Combination play command	File index
B1	Inner-cut command	Working drive, file index
B2	Specified EQ format	EQ format
B3	Copy from SD card to SPI FLASH command	N/C
B4	Copy from U disk to SPI FLASH command	N/C
B8	Store data to specified user area(Config data)	Address, data
B9	Enter sleep mode-low consumption	N/C
BA	End return code	If require feedback information
BB	Switchover current working drive	Working drive

Communication Query Command

CMD detail annotate	Function	Return Parameter
C1	Query current setting volume	C1 XX
C2	Look up current working status	C2 XX
C3	Read the quantity of music file in SPI Flash	C3 XXXX

C4	Read the total number of music file in specified folder of storage	C4 XXXX
C5	Look up the total number of file song in SD card	C5 XXXXX
C6	Read the total number of file song in specified folder of SD card	C6 XXXX
C7	Look up the total number of file song in U disk	C7 XXXX
C8	Look up the total number of file song in specified folder of U disk	C8 XXXX
C9	Read current playing file song	C9 XXXX
CA	Look up current connect status of external device	CA XX
CB	Look up specified identifying data of specified MP3	CA XX (8-BIT)
CC	Look up user cache data of specified address	CC xxxxxx

Write Operational Order

Write Operational order return format

Operation Code
XX

Note: after finish execute write order, return to operational code of the order corresponding byte

Return: 00 means OK execute command

01 means FAIL, command makes mistake, without execute

02 means EMP without the file

Root Catalogue Index Playing in Specified SPI FLASH (A0)

This command can play file in SPI FLASH. The file ordered by index.

Start Code	Length	Command	High-order of song	Low-order of song	Check code	End code
7E	05	A0	00	01	XX	EF

Note:

If specified song is not exist, it will not influence playing when specified playing.

File playing of Specified SPI-FLASH folder (A1)

This command use for classify music at folder when U disk and SD card copy to SPI-FLASH.

Start Code	Length	Command	Folder	High-order of song	Low-order of song	Check Code	End Code
7E	06	A1	01	00	02	XX	EF

In folder, 01 means No.1 file. 00 02 stand for the second song in chapter, this command specified play the second audio file of No.1folder.

File Index Play in Specified SD Card (A2)

This command can play specified file in SD card, influenced by file store sequence. File order according index order.

Start Code	Length	Command	High-order of song	Low-order of song	Check Code	End Code
7E	05	A2	00	01	XX	EF

Note:
If specified song is not exist, it will not influence playing when specified playing.

Specified Play File Name in SD Card (A3) (File name at most 8 character)

This command according file name to play in root catalogue of specified SD card

Start Code	Length	Command	File Name (high-low)				Check Code	End Code
7E	07	A3	54'T'	30('0')	30('0')	32('2')	XX	EF

54,30,30,32 respectively stand for T002 and ASCII code, only file name adopt ASCII code value, other data as hexadecimal values. The above command means playing "T002XXX.MP3". And the first four digit need to corresponding.

Fire Index Playing in Specified SD Card Folder (A4)

This command can play file index in specified root catalogue folder (folder name fixed 5 character)

Start Code	Length	Command	Folder Name (High-Low)					Folder Index(High-Low)		Check Code	End Code
7E	0A	A4	'M'	'U'	'S'	'I'	'C'	00	01	XX	EF

File name adopt ASCII code value, other data as hexadecimal values. The above command means playing the second audio file of "MUSIC" in specified root catalogue folder.

File Playing in Specified SD Card Folder (A5)

This command according file name to play in specified root catalogue (folder name fixed 5 character, the length of file name at most 8 character)

Start Code	Length	Command	Folder Name (High-Low)					File Name(High-Low)				Check Code	End Code
7E	0C	A5	'M'	'U'	'S'	'I'	'C'	54 'T'	30 '0'	30 '0'	32 '2'	XX	EF

Index Play in Specified U Disk Root Catalogue (A6)

This command can play specified file in U disk, but influenced by file order. The order is according index.

Start Code	Length	Command	The high order of audio	The low order of audio	Check Code	End Code
7E	05	A6	00	01	XX	EF

Note: If specified audio is not inexistence when play specified audio, it will not affect current playing.

Specified File Name Play in U Disk (A7)

This command can according file name to play audio in specified root catalogue of U disk.

Start Code	Length	Command	File Name (High-Low)				Check Code	End Code
7E	07	A7	54'T'	30('0')	30('0')	32('2')	XX	EF

54,30,30,32 respectively stand for T002 and ASCII code, only file name adopt ASCII code value, other data as hexadecimal values. The above command means playing "T002XXX.MP3". And the first four digit need to corresponding.

Specified File Index Playing in specified U Disk Folder (A8)

This command can play file index in specified root catalogue folder (folder name fixed 5 character)

Start Code	Length	Command	Folder Name (High-Low)					File Name(High-Low)		Check Code	End Code
7E	0A	A8	'M'	'U'	'S'	'I'	'C'	00	01	XX	EF

File name adopt ASCII code value, other data as hexadecimal values. The above command means playing the second audio file of "MUSIC" in specified root catalogue folder (Index No. 0001).

File Index Playing in Specified U Disk Folder (A9)

This command can play file according file name in specified U disk root catalogue

Start Code	Length	Command	Folder Name (High-Low)					File Name(High-Low)				Check Code	End Code
7E	0C	A9	'M'	'U'	'S'	'I'	'C'	54 'T'	30 '0'	30 '0'	32 '2'	XX	EF

54,30,30,32 respectively stand for T002 and ASCII code, only file name adopt ASCII code value, other data as hexadecimal values. The above command means playing "T002XXX.MP3". And the first four digit need to corresponding.

Pause Playback Command (AA)

Start Code	Length	Command	Check Code	End Code
7E	03	AA	AD	EF

In first time, sending this command, it will pause to play audio, resend data, it will continue to play audio from pause.

Stop Command (AB)

Start Code	Length	Command	Check Code	End Code
7E	03	AB	AE	EF

If send this command, it will stop to play current audio.

Next Command (AC)

Start Code	Length	Command	Check Code	End Code
7E	03	AC	AF	EF

This command can trigger play next audio, when play the last audio, send this command can play first audio.

Last Command (AD)

Start Code	Length	Command	Check Code	End Code
7E	03	AD	B0	EF

This command can trigger play previous audio, when play the first audio, send this command can play last audio.

Volume Control Command (AE)

The level of volume with 32, from 00 to 31, 00 as dormant, 31 level is the biggest volume.

Start Code	Length	Command	Volume Level	Check Code	End Code
7E	04	AE	1F	XX	EF

The example is 31 level volume, this command can modify real adjust volume.

Specified Play Mode (AF)

Start Code	Length	Command	Parameter	Check Code	End Code
7E	04	AF	00：single play(dormant)	B3	EF
			01：single cycle	B4	
			02：all audio cycle play	B5	
			03： random mode	B6	

Note: this command will recover dormant mode after power down if modify play mode without power down. When use this command, suggested operate to setting in MCU initialized module. It will execute in this way when electrify in every time.

Combination Play Command (B0)

This command can continue play certain file in specified current catalogue, this command only use for index play.

Start Code	Length	Command	Mark Word	Check Code	End Code
7E	04	B0	01	XX	EF

Start Code	Length	Command	The high order of audio	The low order of audio	Check Code	End Code
7E	05	B0	00	01	XX	EF

Start Code	Length	Command	Mark Word	Check Code	End Code
7E	04	B0	FF	XX	EF

Combination play means continue to send 10 or less music group code to WT2000, WT2000 according receive order code to play. The different from direct sending file name to control music is before not complete play music to send next code, it will not interrupt, after receive command, it will deal with FIFO. For example: When WT2000 continue receive the seven group of "7E 04 B0 01 B5 EF", "7E 05 B0 00 01 B8 EF", "7E 05 B0 00 02 B9 EF", "7E 05 B0 00 03 BA EF", "7E 05 B0 00 04 BB EF", "7E 05 B0 00 05 BC EF", "7E 04 B0 FF B3 EF", it will order play the first, second, third, fourth, fifth audio file in SD card. 7E 04 B0 01 B5 EF is start code, 7E 04 B0 FF B3 EF is end code.

Note:
1. Before combination, if want to play file in other store mode, start to send specified

store mode play command is available, audio play the first one of combination play command, and send behind audio command to realize combination play or direct switching mode.

2. Continue combination max support 10 groups. During playing, if has new play command, it will be interrupt and execute new command.

Note:

1. Judge overtime: for example: if only send the code of 7E 04 B0 01 XX EF, start reckon by time, if timekeeping over 3s with no response, need to delete relative information.

2. After sending 7E 04 B0 01 XX EF, if have receive command with 7E 06 B0 01 00 01 XX EF and other command, please delete recorded time and reckon by time again until over 10 groups, receive end code or waiting more than 3s. If receive start code and address code but end code, after overtime or over 10 command, it will direct start to play audio according command. In other words, after sending address code of combination play, it will start to play received data.

3. During execute combination play, send other command will lead interrupt combination play.

Mark Word:

00 stand for inter-cut specified index address in SPI-FLASH
01 stand for inter-cut specified index address in SD card
02 stand for inter-cut specified index address in U disk

Inter-cut Command (B1)

Start Code	Length	Command	Mark Word	The high order of audio	The low order of audio	Check Code	End Code
7E	06	B1	01	00	01	XX	EF

Note: When receive this command, it will pause current playing audio and execute this command specified audio, after complete playing, it will continue to play the pause audio (error within 1s is available)

First time inner-cut play and haven't finish, when send the second command, the order is not available. After finish the first inner-cut, the second one is available. It support between same devices or different devices inner-cut.

Mark Word:

00 stand for inter-cut specified index address in SPI-FLASH
01 stand for inter-cut specified index address in SD card
02 stand for inter-cut specified index address in U disk

Specified EQ Mode (B2)

Start Code	Length	Command	Parameter	Check Code	End Code

7E	04	B2	00：Normal (in default)	B6	EF
			01：Pop	B7	
			02：Rock	B8	
			03：Jazz	B9	
			04：Classic	BA	
			05：Base	BB	

Copy Content from SD Card to SPI-FLASH (B3)

Start Code	Length	Command	Check Code	End Code
7E	03	B3	B6	EF

Note: indicate light flicker when copy, after finish, indicate light will stop flicker.

MP3 file copy correct, config data copy correct, return: 00
MP3 file copy correct, config data copy abnormal, return: 01
MP3 file copy abnormal, config data copy correct, return: 02
MP3 file copy abnormal, config data copy abnormal, return: 03

Copy Content from U disk to SPI-FLASH Command (B4)

Start Code	Length	Command	Check Code	End Code
7E	03	B4	B7	EF

Note: indicate light flicker when copy, after finish, indicate light will stop flicker.

MP3 file copy correct, config data copy correct, return: 00
MP3 file copy correct, config data copy abnormal, return: 01
MP3 file copy abnormal, config data copy correct, return: 02
MP3 file copy abnormal, config data copy abnormal, return: 03

Specified User Area (Config data) Store in Data (B8)

Store data in specified address (0000H-0FFFH), max 4K address, at most max store in 200 characters every time.

Start Code	Length	Command	Start Address （0000H-0FFFH）	Data Area（At most 200B）	Check Code	End Code
7E	09	B8	00 00	F1 E2 D3 04	DA	EF

Check code: from start address, data will summation (hexadecimal), until the low byte date of the last data sum in data area. For example, the above command 0X00+0X00+0XF1+0XE2+0XD3+0X04 = 0X02DA, so the check code is 0XDA.
Above command means user through WT2000 to write 0XF   1, 0XE2, 0XD3, 0X04 into the address of 4000H, 4001H, 4002H, 4003H SPI-FLASH

Specified Weather Need to End Return Code (BA)

Start Code	Length	Command	Parameter	Check Code	End Code
7E	04	BA	00：no need of return information (in default)	BE	EF
			01：need return information	BF	

This command will decide after every audio finish playing weather need return information, which stand for current audio site. Return format: EF XX XX (return audio index site: two character data, if audio in folder, it will return the index site in folder)

Change for Current Work Drive (BB)

Start Code	Length	Command	Parameter	Check Code	End Code
7E	04	BB	00：SPI-FLASH(in default)	BF	EF
			01：SD Card	C0	
			02：U Disk	C1	

Read Operation Command

Check Current Setting Volume (C1)

Start Code	Length	Command	Check Code	End Code
7E	03	C1	C4	EF

Return Format

Operation Code	Return Value
0XC1	Volume Value（00-1F）

Read Current Working Status (C2)

Start Code	Length	Command	Check Code	End Code
7E	03	C2	C5	EF

Return Format

Operation Code	Return Value
0XC2	01: Play 02: Stop 03: Pause

Check the Total Number of Audio File in SPI-FLASH (C3)

Start Code	Length	Command	Check Code	End Code
7E	03	C3	C6	EF

Return Format

Operation Code	Return Value (2BYTE)
0XC3	The total number of file

Check the Total Number of File Number in SPI FLASH (C4)

Start Code	Length	Command	Folder	Check Code
7E	04	C4	1	XX

This command means the first folder store the total number of audio when read SPI-FLASH.

Return Format

Operation Code	Return Value (2BYTE)
0XC4	The total number of file

Check the Total Number of Audio in SD Card (C5)

Start Code	Length	Command	Check Code	End Code
7E	03	C5	C8	EF

Return Format

Operation Code	Return Value (2BYTE)
0XC5	The total number of file

Check the Total Number of Audio File of Specified Folder in SD

Card (C6)

Start Code	Length	Command	Folder Name (High-Low)					Check Code	End Code
7E	08	C6	'M'	'U'	'S'	'I'	'C'	XX	EF

The file folder name store in ASCII code, above command means read the total number of folder name as "MUSIC" file in root catalogue.

Return Format (C600 00 means no audio file or without the folder)

Operation Code	Return Value(2BYTE)

0XC6	The total number of file

Check the Total Number of Audio File in U Disk (C7)

Start Code	Length	Command	Check Code	End Code
7E	03	C7	CA	EF

Return Format

Operation Code	Return Value(2BYTE)
0XC7	The total number of file

Check the Total Number of Audio File in Specified Folder of U Disk (C8)

Start Code	Length	Command	File Folder (High-Low)					Check Code	End Code
7E	08	C8	'M'	'U'	'S'	'I'	'C'	XX	EF

The file folder name store in ASCII code, above command means read the total number of folder name as "MUSIC" file in root catalogue.

Return Format (C800 00 means no audio file or without the folder)

Operation Code	Return Value(2BYTE)
0XC8	The total number of file

Check the Audio of Current Playing (C9)

Start Code	Length	Command	Check Code	End Code
7E	03	C9	CC	EF

Return Format

Operation Code	Document Number High Type	Document Number Low Type
0XC9	XX	XX

Check Current External Device Connection Status (CA)

Start Code	Length	Command	Check Code	End Code
7E	03	CA	CD	EF

Return Format

Operation Code	Return Value
0XCA	XX

When SD card or U disk plug in or pull out, WT2000 will automatic return data to prompt. Return value of Low 4BIT stand for the status of PC connect with (BIT3), U disk (BIT2), SD card (BIT1) and SPI-FLASH (bit0).

0 stand for existence
1 stand for not exist
For example:
0x01: without PC connect (BIT3=0), without U disk (BIT2=0), without SD card (BIT1=0), with SPI-FLASH (BIT0=1)
0x07: without PC connect (BIT3=0), without U disk (BIT2=2), without SD card (BIT1=1), with SPI-FLASH (BIT0=1)

Read Specified MP3 Special Mark Data (only available for specified index) (CB)

Start Code	Length	Command	Working Mode	The high order of audio	The low order of audio	Checksum	End Code
7E	06	CB	01	00	01	XX	EF

There are 3 working mode: 00 as SPI-FLASH mode, 01 as SD card mode, 02 as U disk mode
Return Format

Operation Code	Return Value
0XCB	XX XXXXXXXXXXXXXX

Note: When send command of "7E 06 CB 01 00 01 D3 EF" WT2000 is going to read the first audio of specified mark data, the 8 character data stored from the 15H to 1CH address of MP3 file. Return code like "CB80 81 82 83 84 85 86 87" means the 15H address stored in "80H" of the first MP3 file. The 16H address in "81H" ......
Read data allow stop playing audio file.

Read Specified Address---"User Cache Data" (CC)

Read data in user area of SPI-FLASH, SD card or Config.mp3 file of U disk.

Start Code	Length	Command	Working Drive	Start Address 0000H~0FFFH	The length of	Checksum	End Code

					return data (at most 512)		
7E	08	CC	00	XX XX	XX XX	XX	EF

Return Format:

Return Code	Working Drive	Data Length	Data Content	Check Code
0XCC	00	XX XX	XX XXXXXX	**XX XX**

Note: XX XX as the length of specified return data. Serial command can specify return the number of byte, before read, need to switchover drive. If the length of data in Config.mp3 is less than the data of command required, the short of data will use "FF" to instead. For example, Config.mp3 file store "OFF ON", send read data "7E 08 CC 00 00 00 00 08 DB EF", it will return "CC 00 00 08 4F 46 46 00 4F 4E FF FF 03 7F". If send read data command of "7E 07 CC 00 00 02 00 02 D7 EF", it will return "CC 00 00 02 46 00 00 48"

In SPI-FLASH drive, read data of user cushion area (copy Config.mp3 data or user through AD command to write in data), address range as 0x0000-0x0FFF.

Direct read data of Config.mp3 file to return in SD card drive.

Direct read data of Config.mp3 file to return in U disk drive.

Note: congfig area max support 4KB (0000H-0FFFH)
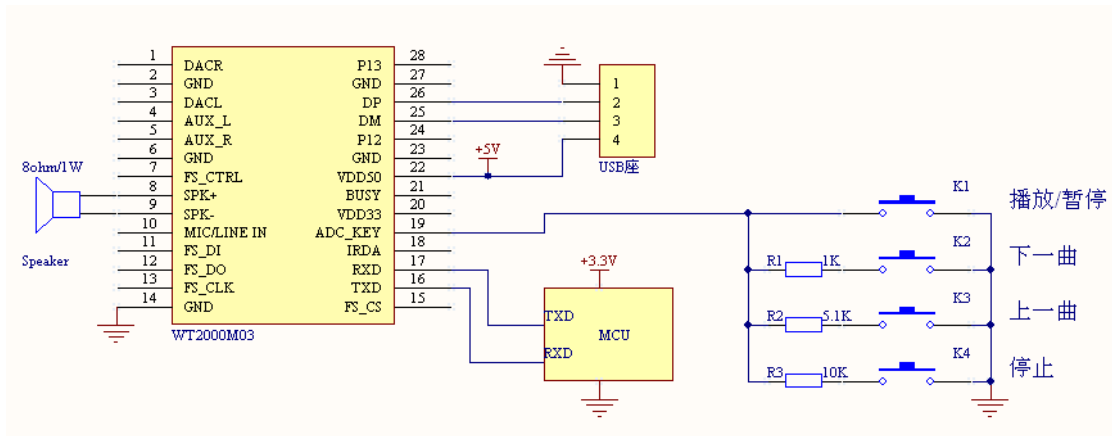
Announcement:

The time interval cannot lower than 300ms when send every serial command.

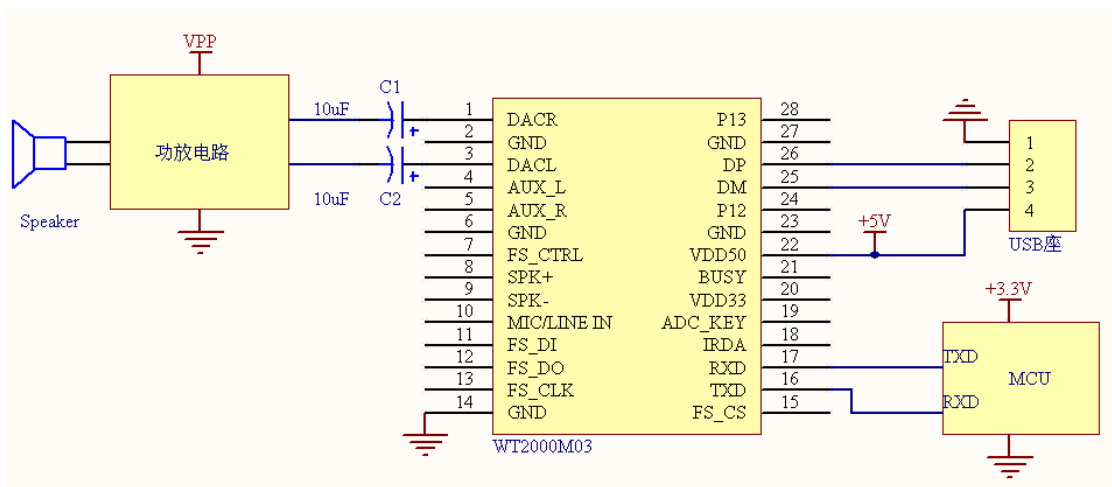Through checking return code to sure execute status after sending all control command.

In order to insure execute command in correct way.

Application Circuit Diagram

WT2000M03 direct drive horn application circuit diagram

WT2000M03 External Amplifier Application Circuit

Note:

1. IO port of WT2000M03 is 3.3V level, it can direct connect with 3.3V MCU. If connect with 5V MCU, it need to increase level to switchover circuit.
2. The data range of coupling capacity C1 and C2 is 0.1Uf-10uf.

Electrical Specification

Name	Function	Min Value	Typical Value	Max Value	Unit	Condition
VDD50	LDO input voltage	3.2	5.0	5.5	V	-
VDD33	LDO 3.3V output current	-	-	150	mA	Vout3.3>3.1V *note1
SNR	Signal to noise ratio	-	92	-	dB	-
THD+N	Total harmonic distortion	-	-70	-	dB	No load
PWRAB	DAC output power	-	-	16	mW	32ohm horn
VPP	DAC max output amplitude voltage	-	-	2.8	V	10K ohm load
Ps1	Stand-by	-	27.6	-	Ma	Relative about TF

	Consumption (with TF card)					card consumption
Prec	Record Consumption (with TF card)	-	28.1	-	Ma	Relative about TF card consumption
P	Playing consumption (no load)	-	28.7	-	Ma	Relative about TF card consumption
VPPLINE	External audio input value	-	-	2.8	V	

Version History

Version No.	Modify Date	Description
V1.0	2013-12-20	Original Version