WTR-S4 MODULE

1.PRODUCT FEATURES

◎Apply 8 bit DSP core recording chip WTR010 ,16 bit ADC input,16bit DAC output.
◎Support external SPI-FLASH(4M/Bit to 16M/Bit)
◎One key one voice mode(record & play by this same key) and three line serial mode.

◎Support Line and MIC record.
◎Self-set Sampling rate from 6KHz,8KHz,12KHz 16KHz.
◎Input valtage from DC2.7V to 3.5V
◎Below 150uA consumption in saving power mode.
◎Can use in phone recording, industrial control ,consumable products, toys and so on.

2.FUNCTION DESCRIPTIONS

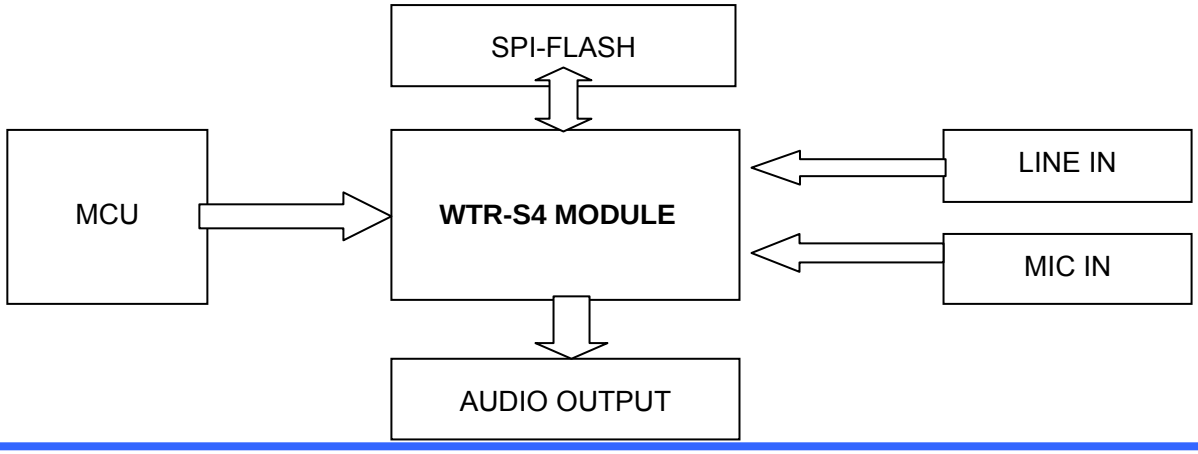
Realize the recording function by our WTR chip and external SPI FLASH. With good quality sound and long time recording and low cost. Currently, the longest recording duration is 2730 seconds for this module.
WTR-S4 module with key mode, One key one voice mode(record&play by this same key),and three line serial mode. The mode can not be change after fixed at first time programming. But the recording can be erased. You should tell us which mode you need.

3.RELATIONSHIP OF FLASH MEMORY CAPACITY AND RECORDING DURATION

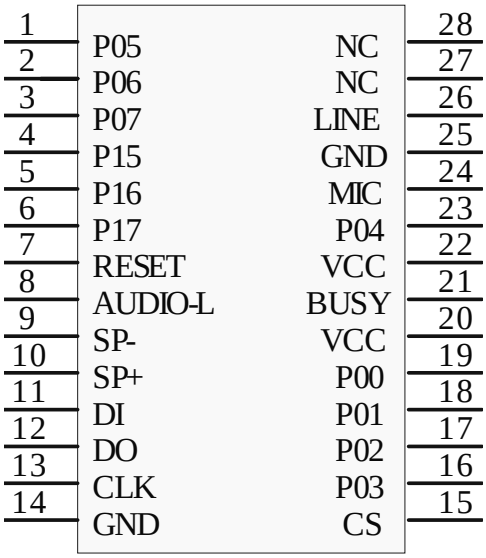
C / D / S	4M	8M	16M	32M	64M
6K	170	341	682	1365	2730
8K	128	256	512	1024	2048
12K	85	170	341	682	1365
16K	64	128	256	512	1024

S: SAMPLING RATE D: DURATION (seconds) C: CAPACITY

4.APPLICATION DIAGRAM



5.PACKAGE SKETCH MAP



28PIN MODULE

6.PIN DESCRIPTIONS

PINS	SYMBOL	BRIEF	FUNCTIONS
1	P05	KEY 6	Short press to erase the current group of voice, long press to erase all groups of voice
2	P06	Sampling rate setting	Combined P06 and P07 to set the sampling rate
3	P07	Sampling rate setting	Combined P06 and P07 to set the sampling rate
4	P15	Low voltage detecting	
5	P16	Mode choosing	In one key one voice mode(record & play by this same

			key),low level for recording, high level for playing.
6	P17	Charge	
7	RESET	Reset	Low level to reset
8	AUDIO-L	Audio output	When external amplifier, audio +
9	SP-	Audio output	When direct drive speaker, audio -
10	SP+	Audio output	When direct drive speaker, audio +
11	DI	I/O	Memory data in
12	DO	I/O	Memory data out
13	CLK	I/O	Memory clock
14	GND	GND	Power GND
15	CS	I/O	Memory CS
16	P03	Key 4/serial port data	“Previous”/serial port data in
17	P02	Key3/ serial port CLK	“Next” /serial CLK input
18	P01	Key 2 / serial port CS	‘Play/stop “/ serial port CS input
19	P00	Key 1	Record
20	VCC	Power +	Power input, positive, DC DC2.7V～3.5V
21	BUSY	Busy output	Discontinuous low level output in recording, durative low level output in playing.
22	VCC	Power +	Power input, positive, DC DC2.7V～3.5V
23	P04	Key 5	Four level volume adjustment
24	MIC	MIC record	MIC record positive input
25	GND	GND	MIC, Line record negative input
26	LINE	Line record	Line record positive input
27	NC	NC	NC
28	NC	NC	NC

7. SAMPLING RATE SETTINGS

Set sampling rate by P06 and P07, refer to following sheet.

P06	P07	SAMPLING RATE
LOW	LOW	6KHz
HIGH	LOW	8KHz
LOW	HIGH	12KHz
HIGH	HIGH	16KHz

8.PARAMETERS

Test conditions: DC3.3V , 25℃, 0.5W/8Ω speaker.

ITEM		MIN.	MAX.	TYPE	UNIT	CONDITION
WORKING VOLTAGE	RANGE	2.7	3.5	3.3	V	25℃
I/O LEVEL	HIGH	2.7	3.5	3.3	V	25℃
	LOW	0	0.5	0.1	V	25℃
RECORD CONSUMPTION	CURRENT	---	---	10	mA	VCC=DC3.3 V
PLAY CONSUMPTION	CURRENT	20	200	120	mA	VCC=DC3.3 V
STANDBY CONSUMPTION	CURRENT	---	---	120	uA	VCC=DC3.3 V

9.MODES

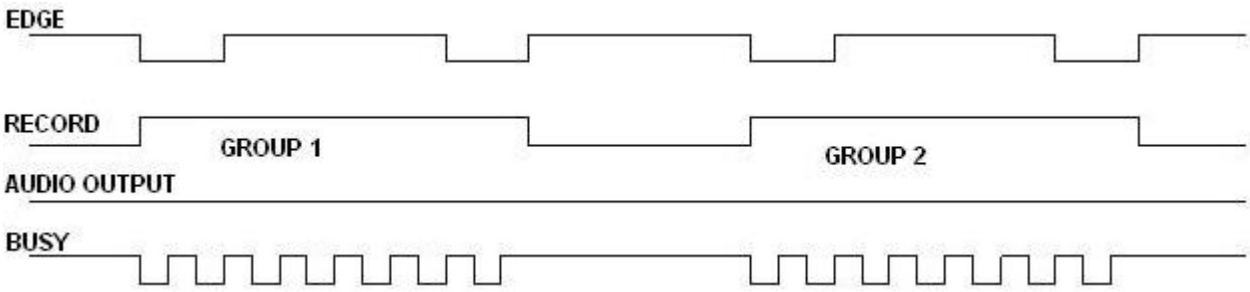
WTR-S4 with key mode, one key one voice mode(record & play by this same key) , three line serial mode.

9.1.KEY MODE

In this mode, I/O functions

I/O	P00	P01	P02	P03	P04	P05
FUNCTION	RECORD	PLAY/STOP	NEXT	PREVIOUS	VOLUME	ERASE

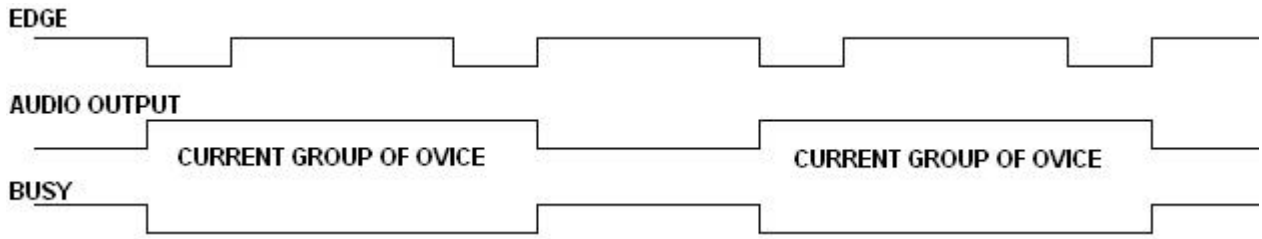
9.1.1.RECORD



Remark: First negative edge start to record first group of voice. Second negative edge stop recording. Third negative edge start to record second group of voice. Fourth negative edge stop recording. Record voice in this

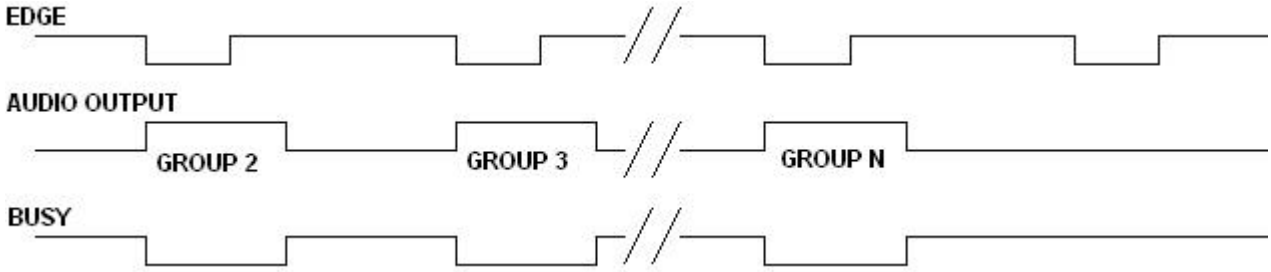
way, 256 group of voice . During recording , BUSY sending out discontinuous low level signal.

9.1.2. PLAY/STOP



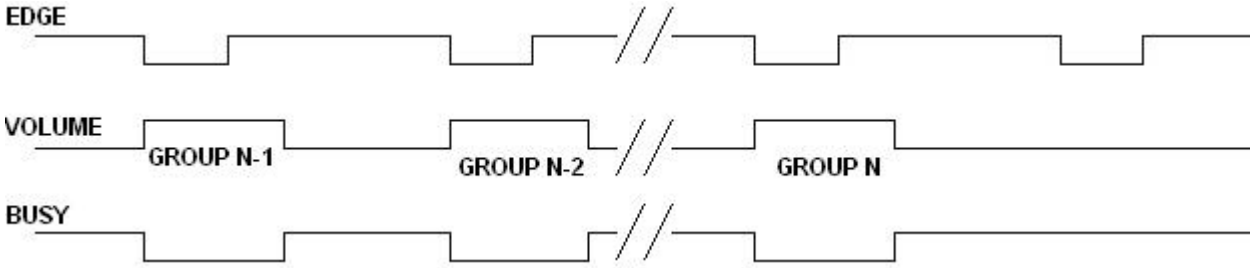
Remark:First negative edge start to play current group of voice, second negative edge stop playing, third negative edge replay , fourth negative edge to stop. Play in this way , During the palying , BUSY send out durative low level signal.

9.1.3. NEXT



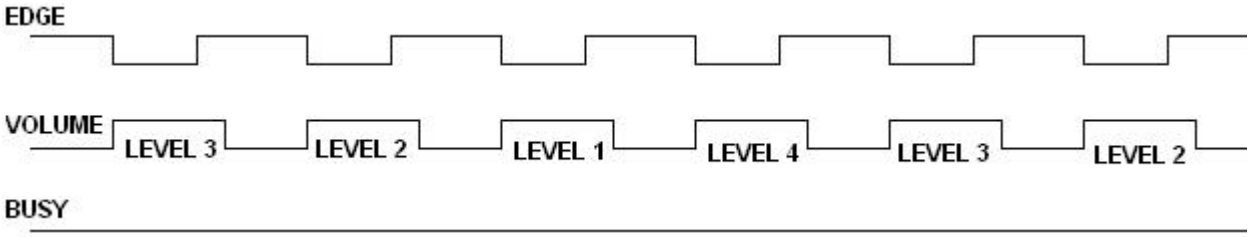
Remark: First negative edge trigger to play second group of voice, second negative edge trigger to play third group of voice. Play to last group in this way , then next trigger is invalid.

9.1.4.PREVIOUS



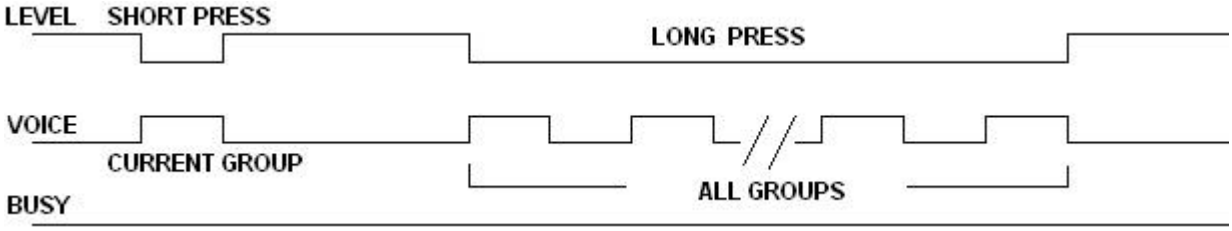
Remark: First negative edge trigger to play ” N-1” group of voice , second negative edge trigger to play “N-2” group of voice, play to first group of voice in this way , then next trigger is invalid.

9.1.5.VOLUME ADJUSTMENT



Remark: The default volume is maximum(level 4) when power on , first negative edge turn it to level 3, second negative edge turn to level 2, third negative edge turn to level 1(mute), fourth negative edge turn to level 4 again, loop in this way . During the volume adjustment, BUSY output keep high level. Volume can be adjusted in playing or stop status.

9.1.6.ERASE



Remark: Low level trigger. Short press to erase the current group of voice, Long press to erase all groups of voice in FLASH. During erasing BUSY output always high level.

9.2. ONE KEY ONE VOICE MODE(RECORD & PLAY BY THIS SAME KEY)

One key one voice mode(record &paly by this same key), Choose record or play status by P16, P16 high level(play),P16 low level (record).

When into record status, before recording start, BUSY must be Low level for 3 seconds, and make I/O P00～P05 correspond current address. And record start. P16 high level can make record stop.

P16 / STATUS / P14	P16 HIGH LEVEL（durative）	P16 LOW LEVEL（durative）
P14 HIGH LEVEL	PLAY	RECORDING
P14 LOW LEVEL （3 seconds）	PLAY	START RECORD

Record or play Addresses are decide by I/Os P00,P01,P02,P03,P04,P05, pull low I/O and choose relative address for record or play.

I/O	P00	P01	P02	P03	P04	P05
KEY	K1	K2	K3	K4	K5	K6
FUNCTION	RECORD/	RECORD/	RECORD/	RECORD/	RECORD/	RECORD/

	PLAY ADDRESS	PLAY ADDRESS	PLAY ADDRESS	PLAY ADDRESS	PLAY ADDRESS	PLAY ADDRESS
VOICE	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6

9.3.THREE LINE SERIAL MODE

Three line serial mode with 3 I/Os , they are CS , DI , CLK. Timing according to SPI communication protocol. MCU control voice chip by three line serial interface. In this mode, all keys are invalid.

9.3.1.ASSIGNMENT OF I/Os

MODEL	I/O FUNCTIONS					
	P00	P01	P02	P03	P04	P05
WTR-S4	---	CS	CLK	DATA(IN)	---	---

9.3.2.FUNCTIONS AND CORRESPONDING CODE

FUNCTIONS	CODES	DESCRIPTIONS
CONVENTIONAL RECORDING	FAH+00H	SEQUENTIAL RECORDING,TIME IS NOT LIMITED. BUSY PULLED LOW
TIME RECORDING	FBH+XXH	XXH REPRESENT THE RECORDING DURATION, 255 SECONDS MAX. SUCH AS FBH+05H, MEANS AFTER RECEIVE THE CODE, START TO RECORD 5 SECONDS, THEN STOP.THIS FUNCTION IS FOR FIXED DURATION OF EACH GROUP. RECORD START AND BUSY PULLED LOW, RECORD FINISH, BUSY PULLED HIGH.
PLAY	FCH+XXH	XXH REPRESENT GROUP NUMBER, SUCH AS FCH+01H PLAY GROUP ONE. BUSY PULL LOW WHEN START PLAYING, PULL HIHG WHEN FINISH.
LOOP	F3H+XXH	LOOP PLAY. SUCH AS F3H+09H MEANS LOOP PLAY GROUP 9
ERASE(1 GROUP)	FDH+XXH	XXH REPRESENT THE GROUP WHICH ERASED. FDH+02H MEANS ERASE GROUP 2 . IT NEEDS 400us TO ERASE.
ERASE(ALL GROUP)	F5H+00H	ERASE ALL VOICE IN FLASH ,"be-be –be" SOUND MEANS ERASE SUCCESSFULLY. NEEDS 400us TO ERASE.
VOLUME	F2H+XXH	F2+03H MEANS MAXIMUM, F2H+00H MEANS MINIMUM .
STOP	F4H+00H	STOP TO RECORD OR PLAY.
PAUSE	F6+00H	PAUSE TO PLAY.

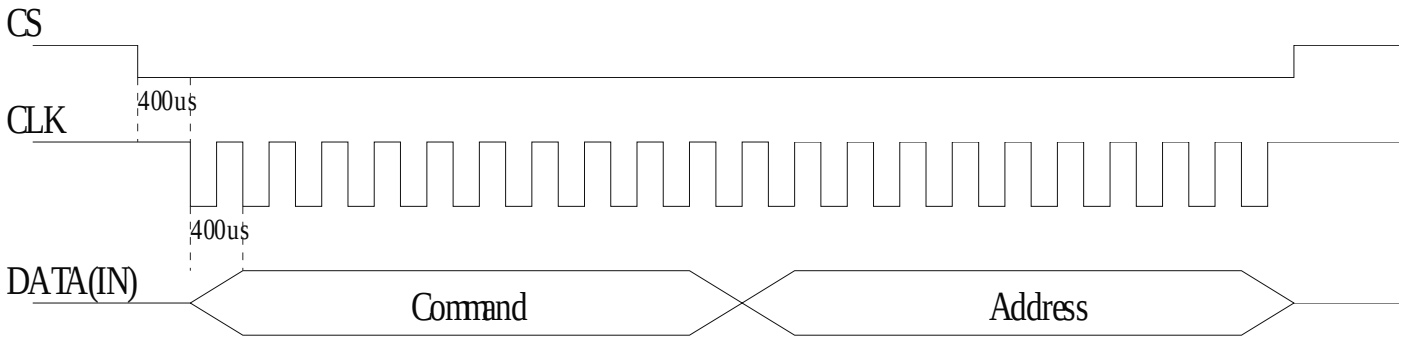
9.3.3 VOICE ADDRESSES

255 group is maximum, Hexadecimal code is FF. When the trigger addresses out of recorded address, trigger is invalid.

DATA（HEX）	FUNCTIONS
00H	PLAY GROUP 0
01H	PLAY GROUP 1
02H	PLAY GROUP 2
……	……
FDH	PLAY GROUP 253
FEH	PLAY GROUP 254
FFH	PLAY GROUP 255

9.3.4.THREE LINE SERIAL CONTROL TIMING

The three line serial control timing is base on standard SPI communication protocol , with CS, CLK, DI , without DO . Pull low CS 400us before sending,. Sending DI at CLK rising edge. CLK cycle longer than 800us and shorter than 5ms. Sending 16 bit one time, former 8 bit is the code , later 8bit is the address. Pull high CS when sent 16 bit out, instead to pull high when sent former 8 bit out. Following timing chart.



9.3.5.PROGRAM EXAMPLE

Three line serial C program exsample

Crystal oscillator 11.0592MHz . MCU：AVR-MEGA8

```
void spi_send(unchar ch)
{
 unchar i;
 PORTD |=BIT(spi_sda);
 PORTD |=BIT(spi_sck);
 for(i=0;i<8;i++)
 {
```

```
    if((ch&0x01))
    {
      PORTD |=BIT(spi_sda);
    }
    else
    {
      PORTD &=~BIT(spi_sda);
    }
    ch>>=1;
    PORTD &=~BIT(spi_sck);
    delay(552);
    PORTD |=BIT(spi_sck);
    delay(552);
  }
   PORTD |=BIT(spi_sda);
   PORTD |=BIT(spi_sck);
}

void main(void)
{
        ……
        PORTD &=~BIT(spi_cs);
        delay(600)
        spi_send(0xfc);
        spi_send(0x01);
        PORTD |=BIT(spi_cs);
        ……
}
```

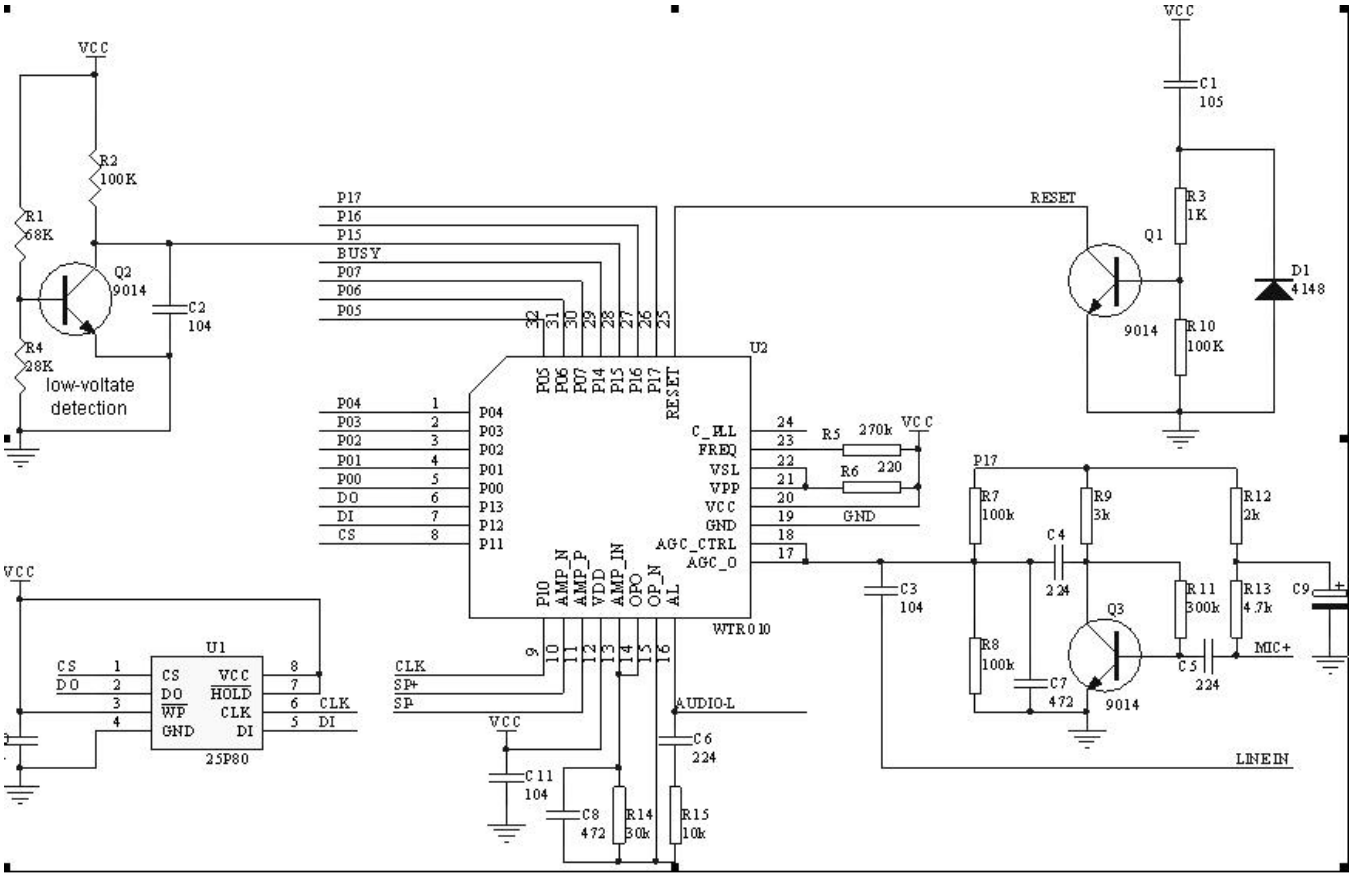
THREE LINE SERIAL ASSEMBLER EXAMPLE
ASM Crystal oscillator 4MHz MCU：AT89C2051

```
rec     bit    p1.6
play    bit    p1.7
cs      bit    p3.5
scl     bit    p3.7
sda     bit    p3.4

        org    0000h
        ajmp main
        org    0030h
main:   mov 2fh,#00h
key:    jnb rec,rec1
        jnb play,pla1
        ajmp key


rec1:    acall d10ms
         jb rec,key
         jnb rec,$
         clr cs
         acall d1ms
         mov a,#0f5h
         acall send2
```

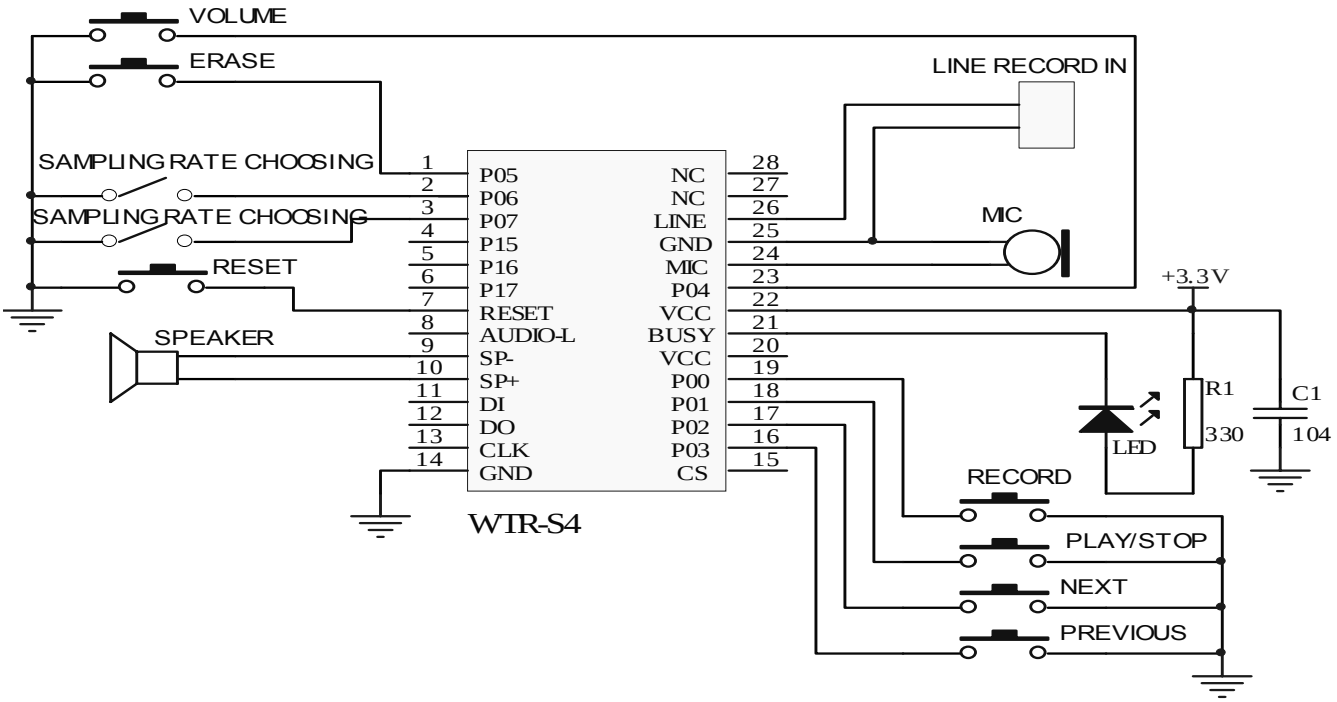
```
            mov a,#00h          ;
            acall send2
            setb    cs
            acall d1ms
            clr     cs
            acall d1ms
            mov a,#0fah
            acall send2
            mov a,#00h
            acall send2
            setb cs
            ajmp key
rec2:       clr cs
            acall d1ms
            mov a,#0f4h
            acall send2
            mov a,#00h
            acall send2
            setb cs
            ajmp key

pla1:       acall d10ms
            jb play,key
            jnb play,$
            cpl 2fh.1
            jnb 2fh.1,rec2
            clr cs
            acall d1ms
            mov a,#fch
            acall send2
            mov a,#00h
            acall send2
            setb cs
            ajmp key

send2:      mov     r1,#8
            setb scl
            setb sda
            clr     c
send2a:     rrc     a
            mov     sda,c
            clr   scl
            acall d1ms
            setb    scl
            acall d1ms
            djnz    r1,send2a
            ret
```

10.APPLICATION CIRCUIT

10.1.WTR-S4 RECORDING MODULE INNER CIRCUIT.

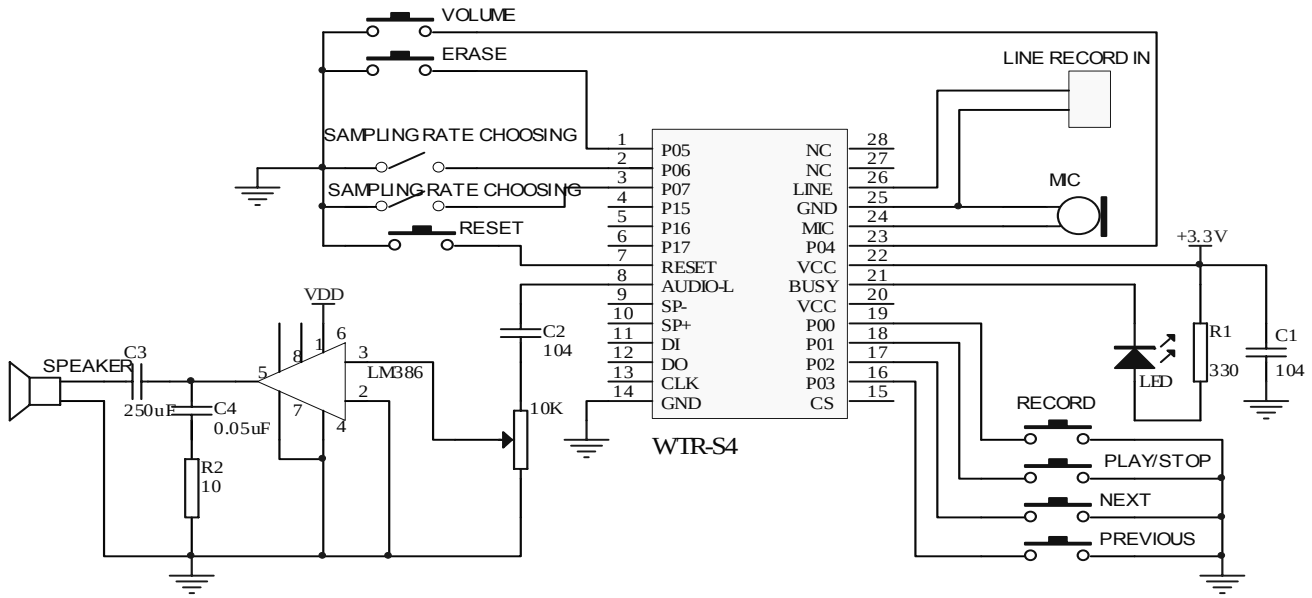


10.2. PWM OUTPUT APPLICATION CIRCUIT IN KEY MODE



Remark: Record can be taken by MIC or LINE or both at the same time. In this mode, pull low relative I/O to control module. such as P00 for RECORD, P01 for PLAY/STOP, P02 for NEXT, P03 for PREVIOUS, P04 for VOLUME, P06 for ERASE. PWM output direct drive speaker, SP+ and SP- are for speaker on module. BUSY is high level in standby , low level in palying or recording.

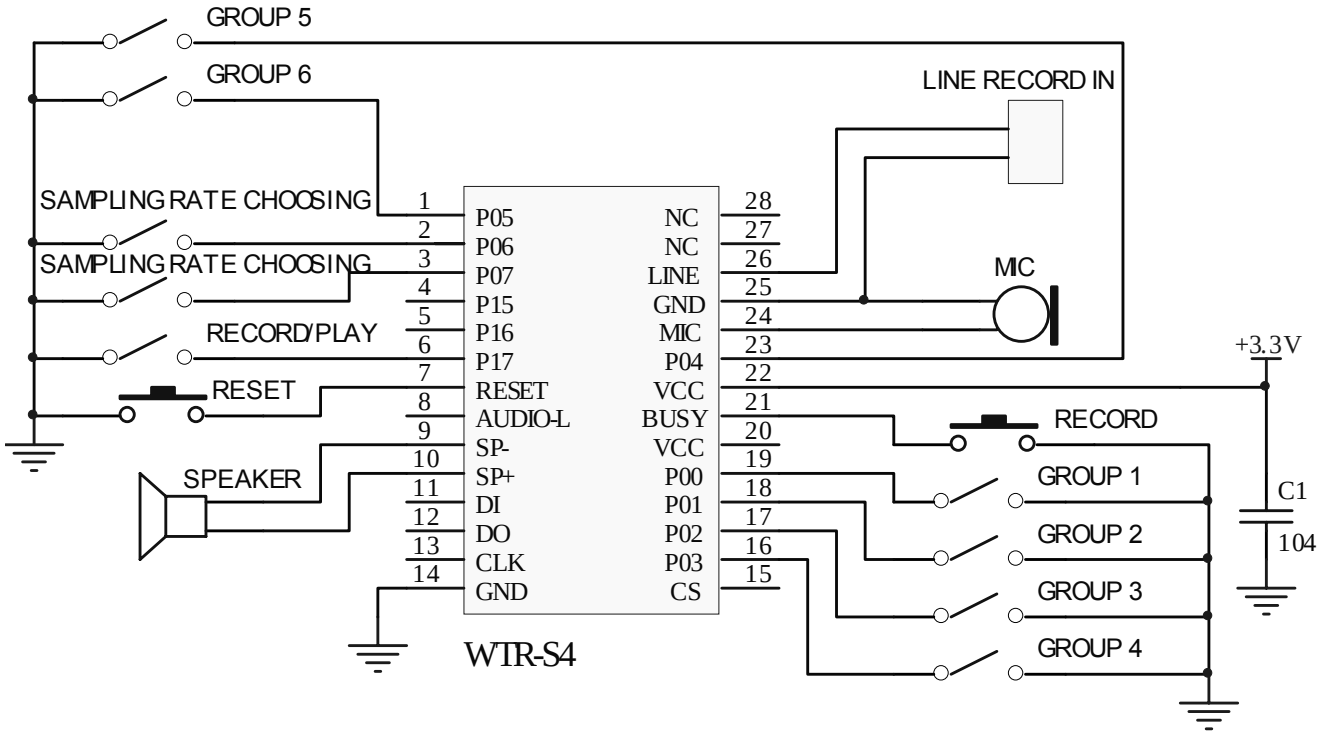
10.3. DAC OUTPUT APPLICATION CIRCUIT IN KEY MODE



Remark: Record can be taken by MIC or LINE or both at the same time. In this mode, pull low relative I/O to control module. such as P00 for RECORD, P01 for PLAY/STOP, P02 for NEXT, P03 for PREVIOUS, P04 for VOLUME, P06 for ERASE. In DAC output, AUDIO-L to amplifier, audio GND to module GND. BUSY is high level

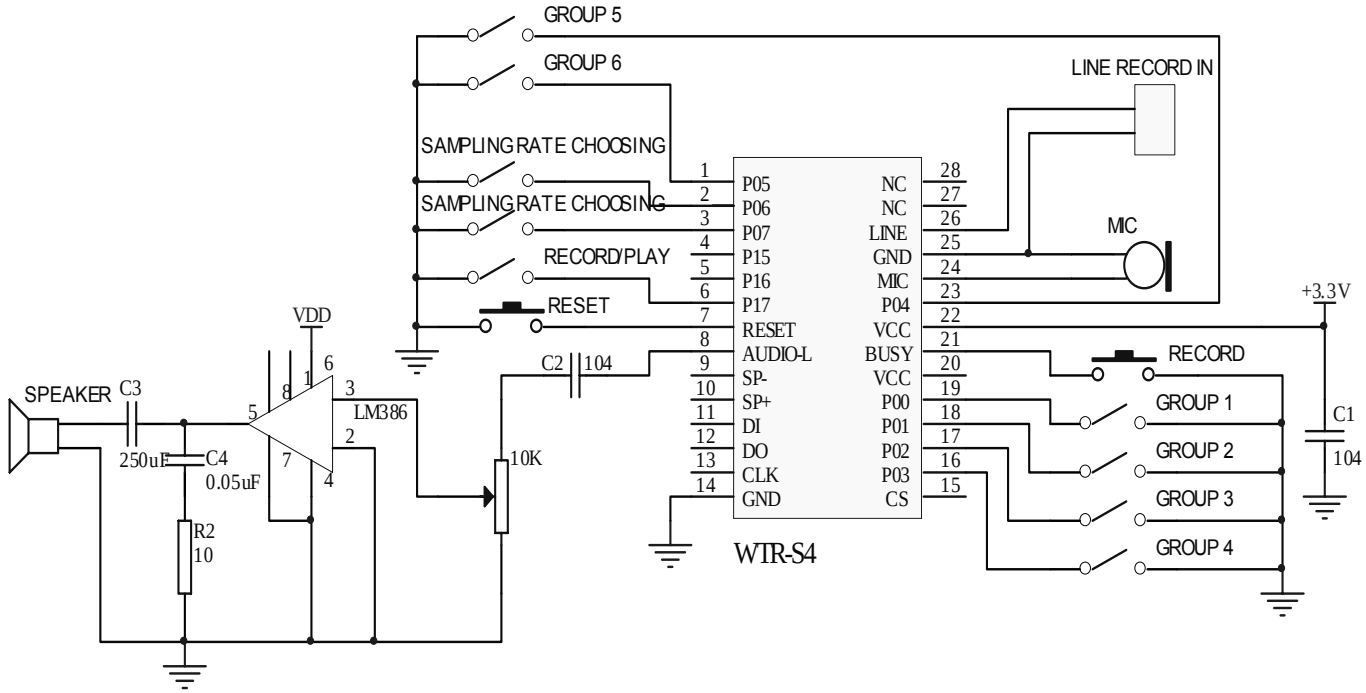
in standby , low level in palying or recording.

10.4. PWM OUTPUT APPLICATION CIRCUIT IN ONE KEY ONE VOICE(RECORD &PLAY BY THIS SAME KEY)



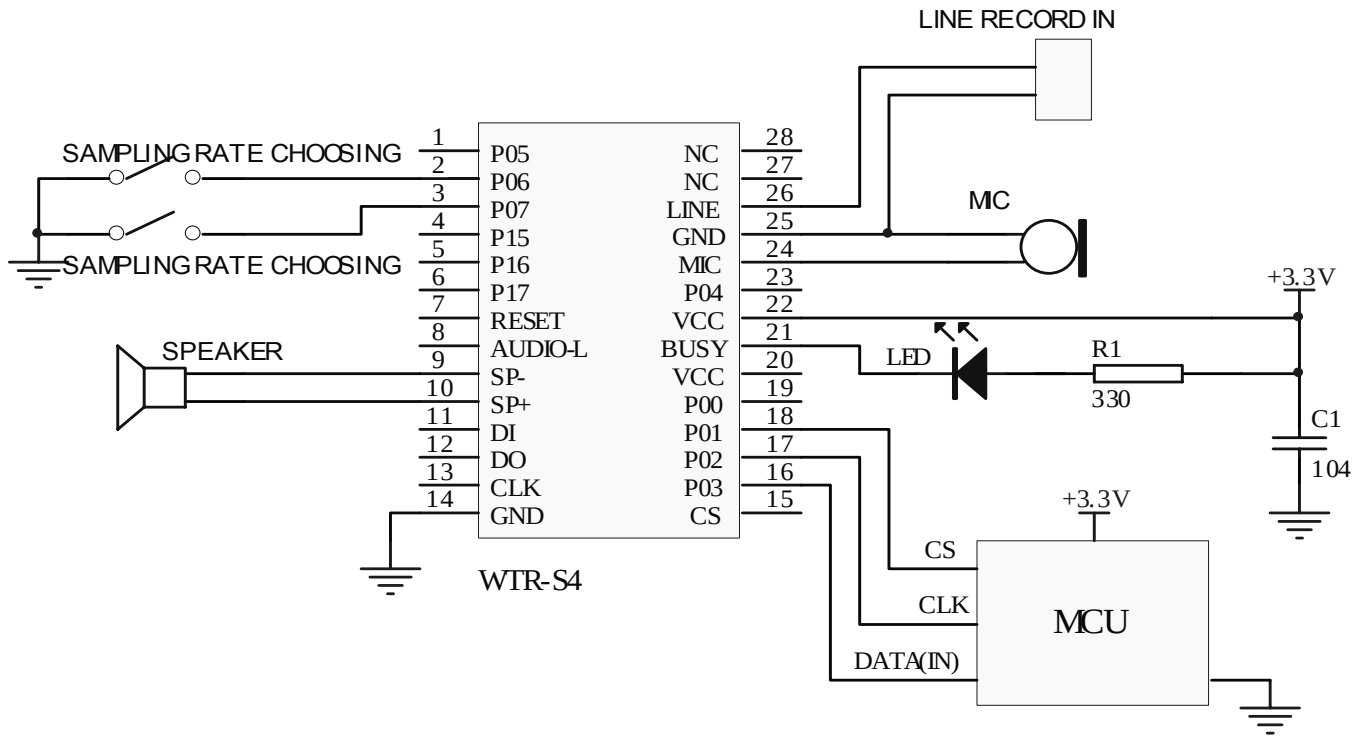
Remark: Record can be taken by MIC or LINE or both at the same time. Play status P17 must be high level, record status P17 must be low level. But change P17 to low level doesn't mean recording is started. We should pulll low one of P00～P05, and keep BUSY low level 3 seconds, record start now. after record started, BUSY high level or low level are invalid. P17 change to high level and record stop. SP+、SP- to speaker in PWM output.

10.5. DAC OUTPUT APPLICATION CIRCUIT IN ONE KEY ONE VOICE MODE(RECORD&PLAY BY THIS SAME KEY)



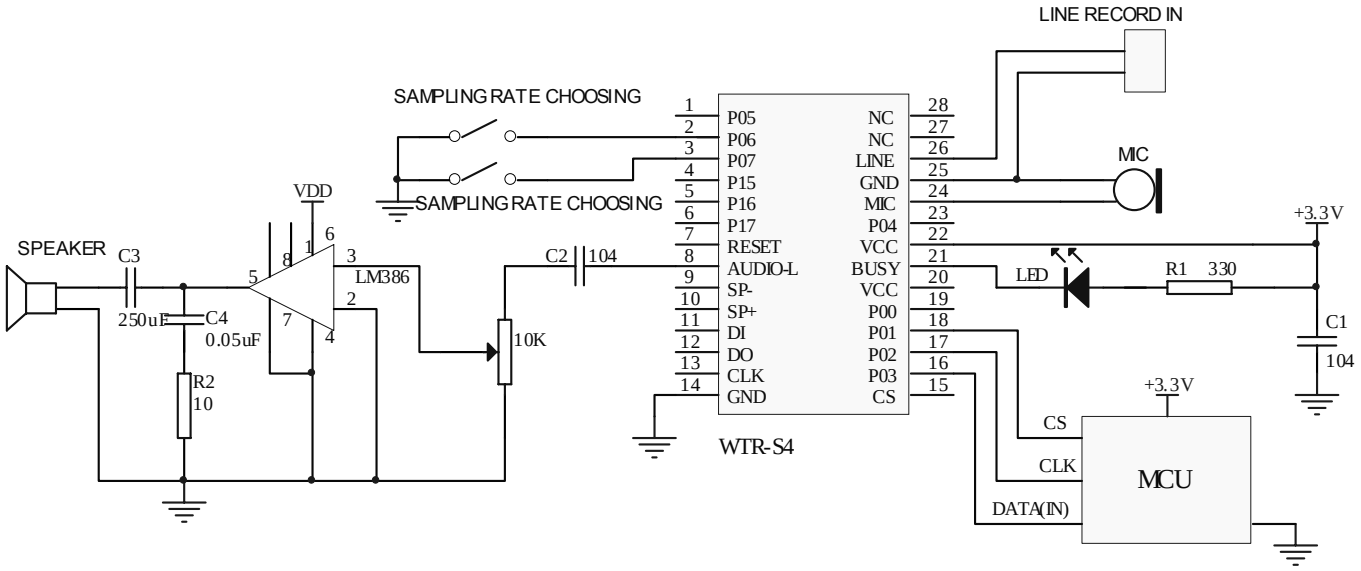
Remark: Record can be taken by MIC or LINE or both at the same time. Play status P17 must be high level, record status P17 must be low level. But change P17 to low level doesn't mean recording is started. We should pulll low one of P00～P05, and keep BUSY low level 3 seconds, record start now. after record started, BUSY high level or low level are invalid. P17 change to high level and record stop. In DAC output, AUDIO-L to amplifier, audio GND to module GND. driver speaker

10.6.PWM OUTPUT APPLICATION CIRCUTI IN THREE LINE SERIAL MODE



Remark: MCU control WTR-S4 to record or play by CS,CLK,DI , including conventional record and time record. Record can be taken by MIC or LINE or both at the same time. PWM output direct drive speaker, SP+ and SP- are for speaker on module.

10.7. DAC OUTPUT APPLICATION CIRCUIT IN THREE LINE SERIAL MODE



Remark: Remark: MCU control WTR-S4 to record or play by CS,CLK,DI , including conventional record and time record. Record can be taken by MIC or LINE or both at the same time . DAC output external amplifier , audio+ from “AUDIO-L” , audio- from module GND .

11. HISTORY VERSION

VERSION	DATE	DESCRIPTION
V1.0	2008-9-10	ORIGINAL