

# AVM3324C

# DATA SHEET

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### 一般規格:

AVM3324C 乃一單晶片 3 頻道的音色合成器。(1個語音頻道單獨放音；或 2個音樂頻道放音；或 2個音樂頻道 + 1個語音頻道聯合放音。) 此晶片有 4K 個指令格，且以 LOGPCM 編碼方式，合成長達 3秒之語音。藉由製造過程中更換光罩，將客戶需要之語音資料編寫入 ROM 中。

### 特性：

1. 單一工作電壓範圍為 2.4 ~ 6 伏特。
2. 聲音輸出組合如下：
  - A> 純語音：所有 D/A 的電流輸出全被語音使用。
  - B> 三個頻道隨意組合放音時：每個音樂頻道各佔四分之一 D/A 的電流輸出，語音頻道佔二分之一 D/A 的電流輸出。
3. 語音總長度可達 3.0 秒，且可被分割成 32 個語音段(voice\_section)。
4. 其中每一語音段的長度 (語音 + 靜音) 最多可達 5.4 秒 (在 6KHz 取樣頻率下)。
5. 一個具有 4096 個指令格的 ROM，可被分割為 32 個指令組。在合成過程中，音色、節奏、音調、播放速度、拍差、語音段、甚至 STS 輸出狀態，都可在指令組的任何位置編輯修改。音色是由指定的 8 x 8 波形 及 32 x 32 包封架構合成而成。總共有 4 個音色，可被彈性地指定到第一或第二音樂頻道。

音樂音調：--3 到 ++5 包括半音。共有 53 個音符。

語音音調：-6# 到 +4 包括半音。共有 20 個音符。

語音播放速度：5.35 到 16 KHz。共有 20 種播放速度。

語音播放速度：5.35 5.66 6.00 6.36 6.73 7.14 7.56 8.01 8.49 9.08 9.53 10.10 10.70 11.33 12.00 12.72 13.47 14.28 15.27 16.0  
語音播放音調：-6# 7 1 1# 2 2# 3 4 4# 5 5# 6 6# 7 +1 +1# +2 +2# +3 +4

音樂節奏：82 88 95 103 112 123 137 154 176 205 246 拍/分鐘。

共有 11 種不同的節奏。

拍差：1/8 1/4 3/8 1/2 5/8 3/4 1 1-1/4 1-1/2 2 2-1/2 3 3-1/2 4 0 拍。

共有 15 種不同的拍差。

6. 三種觸發方式的光罩選擇：矩陣觸發、單獨觸發、並列式 CPU 驅動。

矩陣觸發輸入：

◎ 4×4 矩陣輸入：M1 -- M16 (MODE=0 --> sub\_table 1-16)  
(MODE=1 --> sub\_table 17-32)

◎ 優先順序: Mn+1>Mn+2>Mn+3>Mn+4 (n=0>4>8>12)

◎ 防止誤動作 (DEBOUNCE) 時間：

長時間：4.2 ms 到 12.5 ms

短時間：150 us 到 430 us

註：若在停止狀態時觸發依據播放速度 7.64KHz，若在播放過程中觸發依據播放速度 (5.3KHz 到16KHz)。

單獨觸發輸入：

◎ 8 單獨輸入：A1 -- A8 (MODE=0 --> sub\_table 1-8)  
(MODE=1 --> sub\_table 9-16)

◎ 優先順序: A1 > A2 > A3 > A4 > A5 > A6 > A7 > A8

◎ 防止誤動作 (DEBOUNCE) 時間：

長時間：4.2 ms 到 12 ms

短時間：20 us 到 59 us

註：若在停止狀態時觸發依據播放速度 7.64 KHz，若在播放過程中觸發依播放速度 (5.3 KHz 到 16 KHz)

註：不論是矩陣或單獨觸發所有的輸入腳 (M1-M16；A1-A8) 皆可規劃成下列選項：

<input type="checkbox"/> 邊緣觸發 / <input type="checkbox"/> 位準觸發	(Edge/Level)
<input type="checkbox"/> 保持 / <input type="checkbox"/> 非保持	(Hold/Unhold)
<input type="checkbox"/> 後段蓋前段 / <input type="checkbox"/> 非後段蓋前段	(Retrigger/Irritigger).

並列式 CPU 觸發：在此模式下，可任意進入指令組 1-32。欲以並列式 CPU 觸發，必須選擇以下設定：單獨觸發輸出，一般觸發，可重置，短誤動作時間；  
邊緣觸發，非保持，後段蓋前段

※在並列式 CPU 模式下，ROW1-4 & COL1 以二進位制代表指令組 1-32 的位址。COL4 以低位準觸發。

※在並列式 CPU 介面控制下，STS1、STS2、STS3 三者中必須有一者選擇 BUSY LOW 或 BUSY HIGH 的功能選項。

7. 輸入觸發 (A8 或 M16) 可由光罩選擇設定為一般觸發(Normal)、順序觸發(Sequential)：

一般觸發 (Normal)：A8 或 M16 的驅動如第 6 項所述。

順序觸發功能 (Sequential)：此時的 A8、M16 被當作順序觸發輸入腳。

A) 一經觸發將由第一指令組 (subtable\_1) 至設定之指令組 (subtabl\_n) (n：1--32)。每次觸發播放一指令組，按順序循環播放。

B) A16 或 M32 開始動作後，若其它輸入 (A1-A7/M1-M15) 觸發時，可經光罩選擇定義為『可重置或不可重置』。

◎可重置 (Reset)：若其它輸入觸發，順序觸發的循環將被重回指令組 1。

◎不可重置 (Unreset)：順序觸發功能的循環不受其它鍵觸發的影響。

### 8. 三個狀態輸出接腳 (STS1、STS2、MODE/STS3) 具有下列光罩選擇：

#### STS1輸出的選擇

- a) 停止播放時送出高位準脈衝
- b) 停止播放時送出低位準脈衝
- c) 播放時送出高位準訊號
- d) 第1, 2音樂頻道音符最初1/4拍或1/8拍閃爍
- e) 可程式化
- 0> 熄滅
- 1> LED 6HZ或跑馬燈
- 2> LED 3HZ或跑馬燈
- 3> 聲音動態 2/4位準訊號
- 4> 第1音樂頻道音符最初1/4拍或1/8拍閃爍
- 5> 第2音樂頻道音符最初1/4拍或1/8拍閃爍
- 6> 播放時送出低位準訊號

#### STS2輸出的選擇

- a) 停止播放時送出高位準脈衝
- b) 停止播放時送出低位準脈衝
- c) 播放時送出高位準訊號
- d) 播放時送出低位準訊號
- e) 可程式化
- 0> 熄滅
- 1> LED 6HZ或跑馬燈
- 2> LED 3HZ或跑馬燈
- 3> 聲音動態 2/4位準訊號
- 4> 第1音樂頻道音符最初1/4拍或1/8拍閃爍
- 5> 第2音樂頻道音符最初1/4拍或1/8拍閃爍
- 6> 第1, 2音樂頻道音符最初1/4拍或1/8拍閃爍

#### STS3輸出的選擇

- a) 停止播放時送出高位準脈衝
- b) 停止播放時送出低位準脈衝
- c) 播放時送出高位準訊號
- d) 播放時送出低位準訊號
- e) LED 6HZ或跑馬燈
- f) LED 3HZ
- g) 聲音動態 2/4位準訊號
- h) 第1音樂頻道音符最初1/4拍或1/8拍閃爍
- i) 第2音樂頻道音符最初1/4拍或1/8拍閃爍
- j) 第1, 2音樂頻道音符最初1/4拍或1/8拍閃爍

※ 如 STS1 和 STS2 選擇相同 LED 6Hz 或 LED 3Hz 之模式時它們將交互閃爍，STS3 將跟著 STS1 閃爍。

※ Dynamic 的意思是 LED 會隨著聲音的振幅大小閃爍。

※ 每個指令組中，STS1、STS2、STS3 可被編輯為致能或非致能。

※ STS3 須在選擇 MODE/STS3 的功能下才能作用。

※ 停止播放脈衝的寬度為：15ms--45ms (播放速度為 6KHz 時寬度為 40ms)

※ STS1 和 STS2 的第 "e" 項意思是可由編輯程式來控制輸出狀態，在合成過程中也可以更改。

備註：LED 3Hz 和 6Hz 會依據播放速度 (5.3KHz 到 16KHz) 而有所不同。實際播放完畢輸出脈衝的寬度根據最後的播放速度而定。

9. 具有播放完畢輸出脈衝內部回授至輸入腳的光罩選項。STS1、STS2、STS3 只能回授至輸入腳 (ROW1-4、COL1-4) 中的其中之一。

## GENERAL DESCRIPTION :

The AVM3324C is single-chip 3 channel timbre generator that can synthesize (2 ch melody and/or 1 ch. voice). It is designed by instruction-based synthesizing method. Total has 4k instruction steps. Total voice is up to 3 seconds using APLUS qualified coding algorithm(LOGPCM). Customer speech data will be edited and programmed into ROM by changing one mask during the device fabrication.

## FEATURES :

**1. Single power supply can operate from 2.4V through 6V.**

**2. With following audio output combination.**

A> voice only: all D/A are occupied by voice(VOICE MODE).

B> All 3 channel could play out with arbitrary combination; each melody channel occupy 1/4 of D/A, voice channel occupy 1/2 of D/A (SYMPHONY MODE)

**3. The total voice duration is about 3 seconds could be partitioned up to 32 voice sections.**

**4. Voice+mute length could be up to 5.4 seconds (6KHz sampling rate)for each voice section.**

**5. One 4096 instruction steps table, could be partitioned up to 32 subtables.**

With programmable instructions, Timbre, Tempo, pitch, playback speed, rhythm, voice section, even STS output status can be programmable changed anywhere during synthesizing.

Timbre is synthesized from assigned 8\*8 waveform and 32\*32 envelope structure. Total has 4 timbres, could be assigned to ch1&2 flexibly.

Melody pitch: --3to ++5 & rest node, include half node. Total has 53 tones.

Voice melody playback pitch : -6# to +4,include half node. Total has 20 tones .

Voice playback speed: 5.35 to 16k Hz. Total has 20 playback speeds.

Voice playback speed (Hz): 5.35 5.66 6.00 6.36 6.73 7.14 7.56 8.01 8.49 9.08 9.53 10.10 10.70 11.33 12.00 12.72 13.47 14.28 15.27 16.0

Voice playback pitch: -6# -7 1 1# 2 2# 3 4 4# 5 5# 6 6# 7 +1 +1# +2 +2# +3 +4

Melody Tempo: 82 88 95 103 112 123 137 154 176 205 246 beats/minute

Total has 11 different tempo.

Rhythm difference: 1/8 1/4 3/8 1/2 5/8 3/4 1 1-1/4 1-1/2 2 2-1/2 3 3-1/2 4 0 beat

Total has 15 different rhythm

**6. 3 Mask option trigger type: MATRIX, ALONE, CPU trigger.**

MATRIX:

⊙ 4\*4matrix inputs: M1--M16(MODE=0 --> sub\_table 1-16) (MODE=1 --> sub\_table 17-32).

⊙ Priority: Mn+1>Mn+2>Mn+3>Mn+4 (n=0>4>8>12).

⊙ Debounce time: depend on current playback speed (5.3Hz to 16Hz), or trigger during standby  
the dependent speed is 7.64k  
long--4.2 ms to 12.5 ms  
short--150us to 430 us

ALONE:

⊙ 8 alone inputs: A1--A8 (MODE=0-->sub\_table 1-8) (MODE=1-->sub\_table 9-16), with resistive type schmitt input (270---1M) for CDS interface.

⊙ Priority: A1>A2>A3>A4>A5>A6>A7>A8

⊙ Debounce time: depend on current playback speed (5.3Hz to 16Hz), or trigger during standby.  
the dependent speed is 7.6k.  
long--4.2 ms to 12.5 ms  
short--150 us to 430 us

In both mode, all the trigger inputs could be assigned as different playing\_type with following options:  
EDGE/LEVEL, HOLD/UNHOLD, RETRIGGER/IRRETRIGGER.

- Parallel CPU\_trigger: in this mode, could access sub\_table 1-32. Some mask option must set as follow:  
MATRIX/ALONE-->ALONE, SEQUENTIAL/NORMAL --> NORMAL, RESET/UNRESET-->RESET,  
DEBOUNCE -->short

& for all the playing type:

EDGE/LEVEL --> EDGE, HOLD/UNHOLD -->UNHOLD, RETRIGGER/IRRETRIGGER-->RETRIGGER

In this mode, ROW1-4 & COL1 are used as (sub\_table binary adress-1) input (sub\_table1--32). COL4 is used as low active enable input.

STS1, STS2, STS3 must have one selected as busy low or busy high for CPU interface strobe.

### 7. A8 or M16 could be mask\_selected as NORMAL, SEQUENTIAL:

- NORMAL: normal subtable mode as in item 6.

- SEQUENTIAL:

A> if the input was triggered sequentially the device will response by one subtable by one subtable of voice\_step sequentially and cyclically, form subtable\_1 to user defined subtable\_n(n:1--32).

B> The relationship between SEQUENTIAL(A8/M16) and other inputs (A1-A7/M1-M15) could be mask\_selected as RESET or UNRESET:

- RESET : once the other inputs were triggered the SEQUENTIAL sequence will reset to subtable 1.
- UNRESET : sequential sequence and other inputs are independent.

### 8. Three status output (STS1, STS2, MODE/STS3) have following mask options:

**STS1:**

a>stop high\_pulse  
b>stop low\_pulse  
c>busy high\_active  
d>both melody ch1 & ch2 on  
at first 1/4 or 1/8 beat  
e>programmable  
0>disable  
1>led6 Hz or racing lamp  
2>led3 Hz or racing lamp  
3>voice dynamic 2/4  
4>melody ch1 on at first 1/4 or 1/8 beat  
5>melody ch2 on at first 1/4 or 1/8 beat  
6>busy low\_active

**STS2:**

a>stop high\_pulse  
b>stop low\_pulse  
c>busy high\_active  
d>busy low\_active  
e>pragrommable  
0>disable  
1>led 6Hz or racing lamp  
2>led 3Hz or racing lamp  
3>voice dynamic 2/4  
4>melody ch1 on at first 1/4 or 1/8 beat  
5>melody ch2 on at first 1/4 or 1/8 beat  
6>both melody ch1 & ch2 on  
at first 1/4 or 1/8 beat

**STS3:**

a>stop high\_pulse  
b>stop low\_pulse  
c>busy high\_active  
d>busy low\_active  
e>led 6Hz or racing lamp  
f>led 3Hz  
g>voice dynamic 2/4  
i>melody ch1 on at first 1/4 or 1/8 beat  
j>melody ch2 on at first1/4 or 1/8 beat  
k>both melody ch1 & ch2 on  
at first 1/4 or 1/8 beat

If both STS1 and STS2 are in 6Hz or 3Hz mode, they will flash alternatively, STS3 will flash synchronously with STS1. Dynamic means LED will flash depending on voice signal.

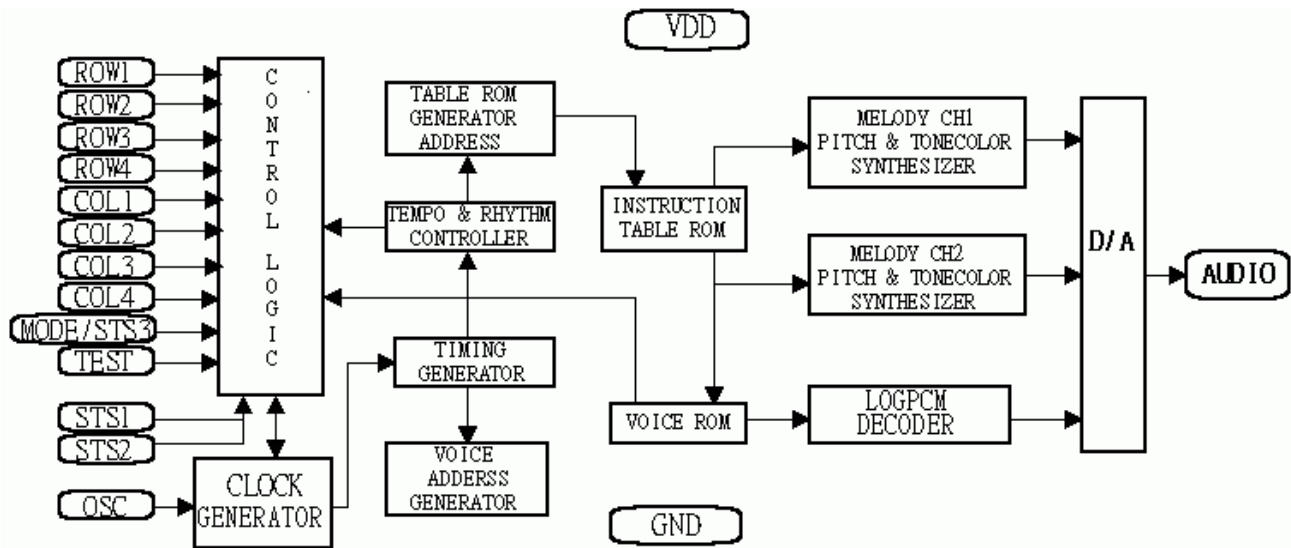
For each sub-table, the STS1, STS2, STS3 could be programmed within subtable as active or inactive. STS3 is enabled only when the MODE/STS3 is in STS3 option.

The pulse width of stop pulse: 15ms--45ms (40ms at playback speed 6KHz).

"e" item of STS1 and STS2 means the output status is controlled by program, and could be changed during synthesizing.

NOTE: The 3Hz and 6Hz depend on the ratio of current playback speed (5.3Hz to 16KHz).  
the stop pulse width depend on the ratio of final playback speed.

### 9. The internal stop pulse feedback mask options are offered. STS1, STS2, STS3 could only feedback to one of input pins (ROW 1-4, COL1-4). For one input could only have one output feedback to it.

**BLOCK DIAGRAM:**

**PAD DESCRIPTION:**

Pad Name	Pad No.	ATTR.	Function
Vdd	1	Power	Positive power supply.
OSC	2	I	Oscillator input (300K ohm connect to Vdd).
TEST	15	I	Test pad for production testing.
MODE/STS3	16	I/O	I/O pad, Mode: mode selection, STS3: status output.
ROW1-4	7~10	I/O	Trigger input, internal pull low (high active).
COL1-4	3~6	I	Trigger input, internal pull low (high active).
AUDIO	11	O	Current output for driving speaker.
STS1, STS2	12, 13	O	Audio signal; Status output; Option control input.
GND	14	Power	Negative power supply.

**ABSOLUTE MAXIMUM RATING:**

Symbol	Rating	Unit
Vdd~Vss	-0.5 ~ +7.0	V
Vin	Vss-0.3 < Vin < Vdd+0.3	V
Vout	GND < Vout < Vdd	V
Top (operating)	0 ~ +70	°C
Tst (storage)	-25 ~ +85	°C

**DC CHARACTERISTICS:**

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
Vdd	Operating voltage	2.4	3	6	V	
Isb	Supply current	Standby		0.1	uA	Vdd=3V, I/O open (with Rosc)
Iop		Operating		200		
Iih	Input current ROW1-4 : COL1-4 in Alone mode			5	uA	Vdd=3V
Iil		0				
Iaudio	Current output (AUDIO) (full scale)	-3.4	-4.3	-6.8	mA	Vdd=3V, Vop=0.7V current level=8
Iih Iil	Input current mode	0		1	uA	Vdd=3V
Ioh	Matrix mode output current ROW1-4	-5			mA	Vdd=3V, Vop=0V
Iol		5				Vdd=3V, Vop=3V
dF/F	Frequency stability	-5		5	%	$\frac{F_{osc(3v)} - F_{osc(2.4v)}}{F_{osc(3v)}}$
dF/F	Fosc lot variation	-10		10	%	Vdd=3V, Rosc=300K

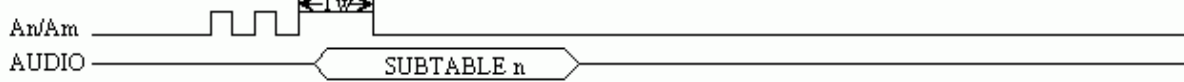


## TIMING DIAGRAM:

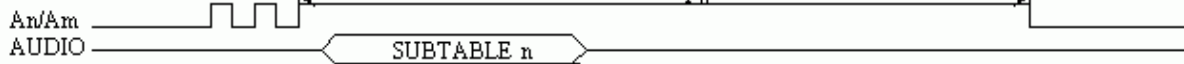
### 1.>EDGE/LEVEL

#### EDGE MODE:

##### EDGE TRIGGER:

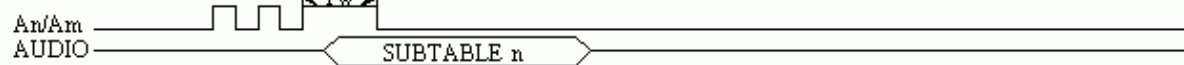


##### LEVEL TRIGGER:



#### LEVEL MODE:

##### EDGE TRIGGER:



##### LEVEL TRIGGER:



\* NOTE: Tw IS THE MINIMUM INPUT PULSE WIDTH > DEBOUNCE TIME (10 ms or 50 μs)

### 2.>HOLD/UNHOLD

#### HOLD:



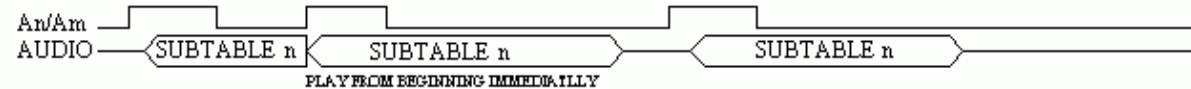
#### UNHOLD:



\*NOTE BOTH EDGE AND LEVEL HAVE HOLD AND UNHOLD OPTION.

### 3.>RETRIGGABLE/IRRETRIGGABLE

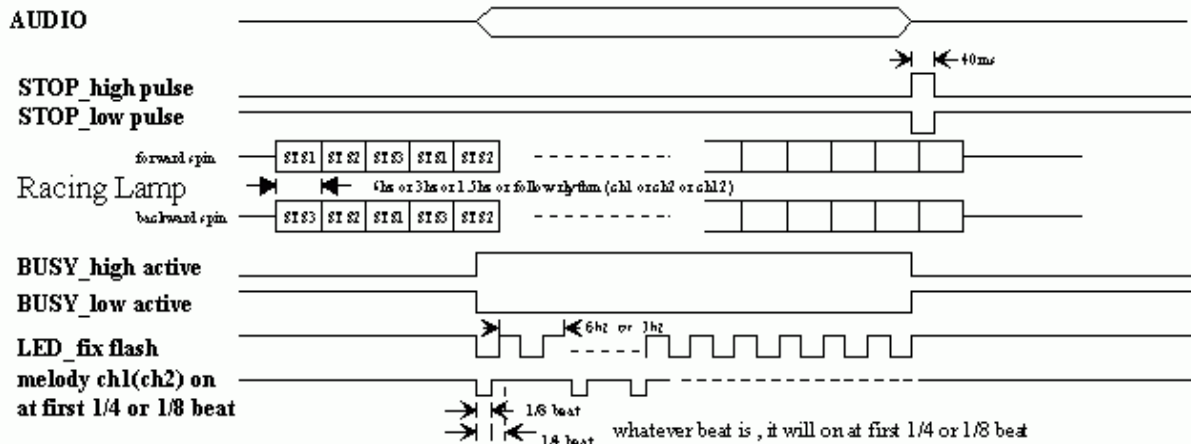
#### RETRIGGER:



#### IRRETRIGGER:



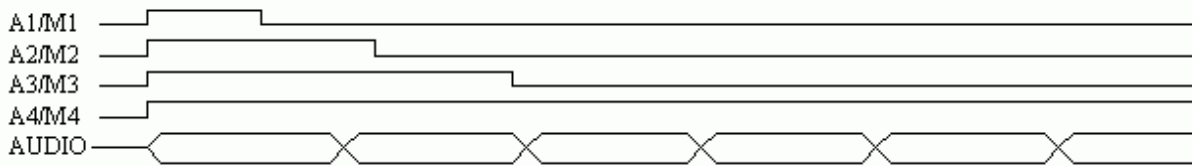
### 4.>STATUS OUTPUT(STS1; STS2; STS3)



DYNAMIC: Partition the voice amplitude 8 steps ( 0 1 2 3 4 5 6 7 )  
24.91.6.7 LED on.  
LED on means state output low.

Note: every new beginning of voice section will reset STS signal.

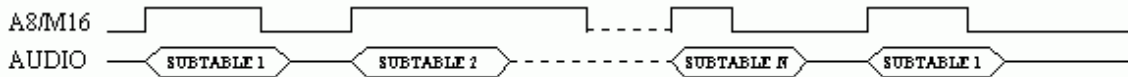
## 5.>PRIORITY



NOTE: PRIORITY A1>A2>A3>A4>A5>A6>A7>A8  
 M1>M2>M3>M4; M5>M6>M7>M8; M9>M10>M11>M12; M13>M14>M15>M16  
 THE DEVICE WILL DETECT THE INPUT PRIORITY AT START\_PLAYING OR LEVEL\_REPEAT.

## 6.>SEQUENTIAL

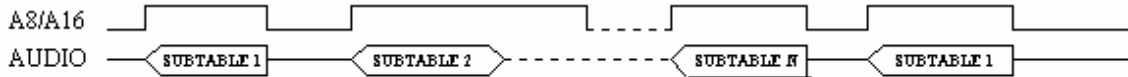
EDGE-UNHOLD



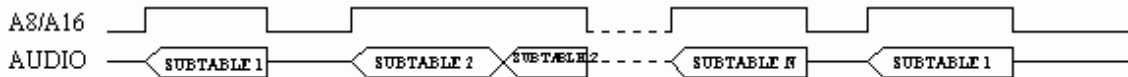
LEVEL-UNHOLD



EDGE-HOLD



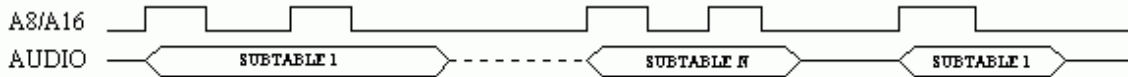
LEVEL-HOLD



RETRIGGER



IRRETRIGGER

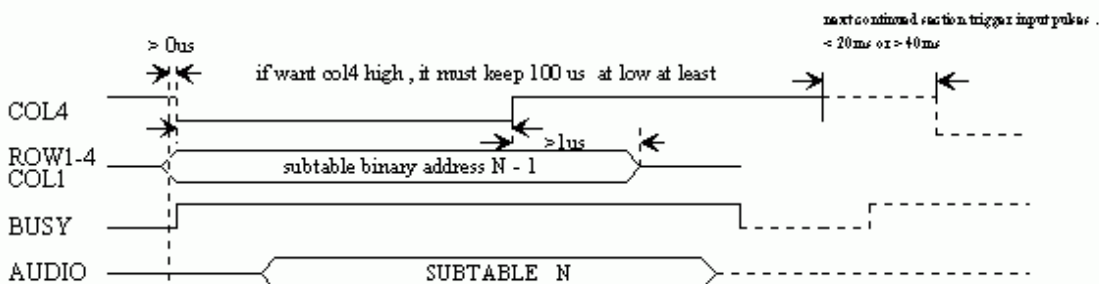


## 7.>Parallel CPU\_INTERFACE : addressing access mode by input pulse count.

IN THIS MODE, SOME OF THE MASK\_OPTIONS MUST SET AS FOLLOW :

MAIRXALONE-->ALONE, SEQUENTIALNORMAL-->NORMAL, RESEI/UNRESEI-->RESEI, DEBOUNCE-->SHORT

THE INPUT PLAYING MODE AS RIGHT. EDGE/LEVEL-->EDGE, HOLD/UNHOLD-->UNHOLD, RETRIGGER/INRETRIGGER-->RETRIGGER.



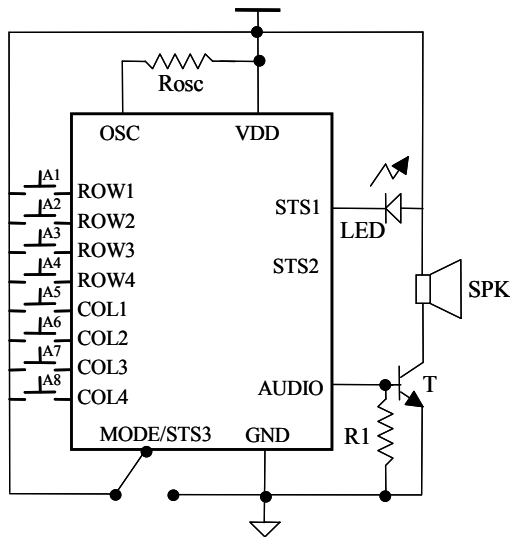
\*ALL the timing are base on 6 KHz sample rate .

NOTE : the 20ms ; 40ms above depend on the ratio of final current playback speed (5.3k to 16k)

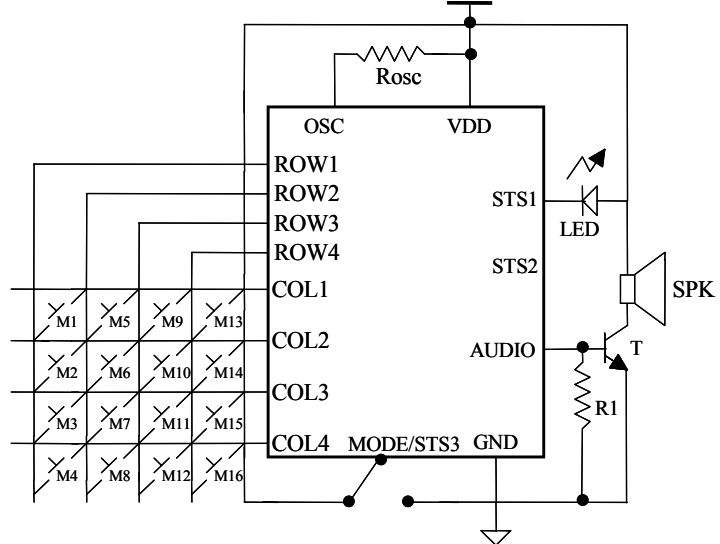
In this mode, ROW1-4 & COL1 in low state and COL4 in high state during standby . The corresponding interface from CPU . must in the same state , for avoid D.C. current between the interface junction .

## APPLICATION CIRCUIT:

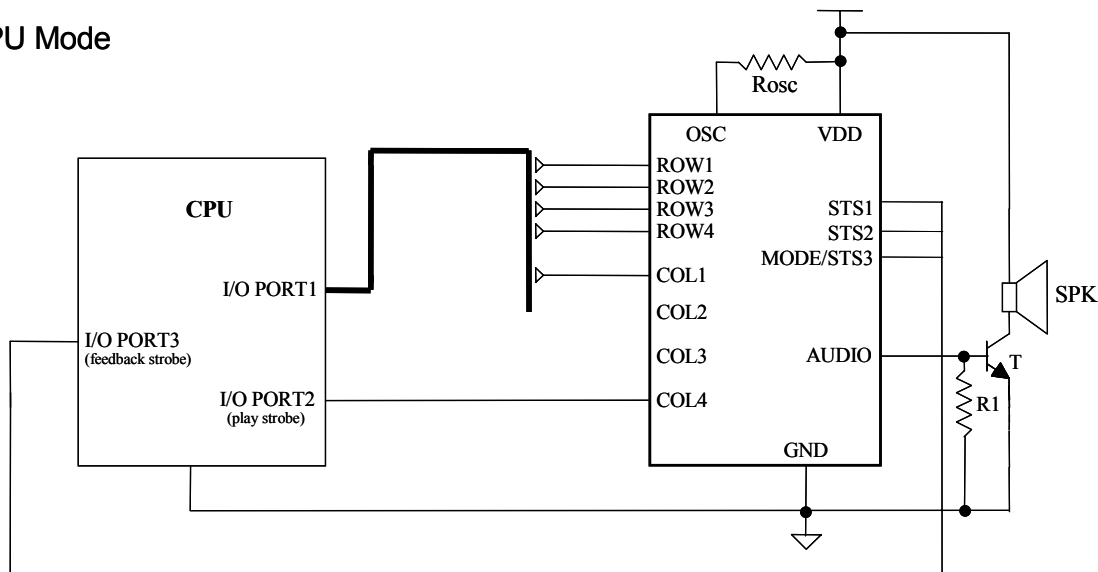
### A> ALONE, LED DRIVING.



### B> MATRIX, LED DRIVING



### C> CPU Mode



In Parallel CPU mode, STS1, STS2 and MODE/STS3 must have one selected as busy high or low for feedback strobe.

NOTE : Rosc=300K ohm , T=β 100 TRANSISTOR , R1=1K NEED ( ONLY WHEN WISH TO LOWER THE POWER CONSUMPTION).  
SPK=8 ohm SPEAKER ( ALL ARE TYPICAL ).

When using Racing Lamp, please pay attention to the restrictions as following:

- 1). Can't use MODE (must set STS3).
- 2). If use voice in songs, please extend every voice length using mute length as long as possible.
- 3). When want to use Racing Lamp forward spin, can't use 6Hz flash at STS1&2&3 simultaneously.  
When want to use Racing Lamp backward spin, can't use 3Hz flash at STS1&2 and 6Hz flash at STS3 simultaneously.
- 4). If use Racing Lamp, all STS LED can't flash simultaneously.
- 5). If need racing flash follow rhythm and all flash follow rhythm simultaneously, need not choose Racing Lamp mode.  
Please use STS programming in song files.

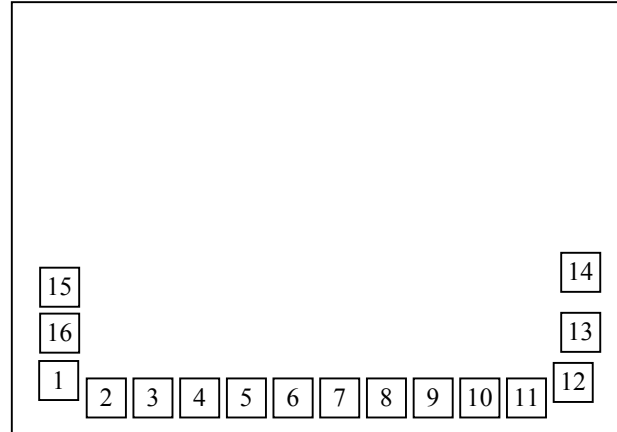
**BONDING DIAGRAM:**

AVM3324C			
Pad No.	Name	X	Y
1	Vdd	-1611.4	-756.75
2	OSC	-1330.75	-697.45
3	COL4	-1123.75	-697.45
4	COL3	-916.75	-697.45
5	COL2	-709.75	-697.45
6	COL1	-502.75	-697.45
7	ROW4	243.25	-697.45
9	ROW3	450.25	-697.45
9	ROW2	657.25	-697.45
10	ROW1	864.25	-697.45
11	AUDIO	1071.25	-697.45
12	STS1	1552.1	-756.75
13	STS2	1611.4	-469.25
14	GND	1604.75	-188.75
15	TEST	-1611.4	-152
16	MODE/STS3	-1611.4	-485.7

Substrate must be connected to GND.

Chip Size: 2000um x 1060um

Pad Size: 80um x 80um



**NOTE:** all data and specifications are subject to change without notice.