佑 華 微 電 子 股 份 有 限 公 司

AM9AH Series

Data Sheet

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Revision History

Rev	*Date*	*Description*	*Page*
1.00	2008/8/1	New release.	-
1.01	2009/9/11	1. Revise Chap 2: Features. 2. Revise pad description. 3. Revise code development and demo system. 4. Revise absolute maximum rating. 5. Revise Iop. 6. Revise application diagram. 7. Revise bounding diagram.	3, 5 7 7 7 8 10 10

1 一般規格

AM9AH003x、AM9AH007x 皆爲單晶片 CMOS 語音合成 IC，他們都是非常低成本，同時具有相當實用功能的語音 IC 產品。他們以 4-bit LOGPCM 編碼方式，合成長達 3.5、7 (3.37, 6.78)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。另外使用者可用佑華所提供的 EzSpeech 工具軟體來進行開發。

2 特性

(1) 單一工作電壓範圍爲 2.2 ~ 5.5 伏特。

(2) 語音總長度可達 3.5、7，且最多可被分割成256個語音段(voice_section)，每段長度可不同。

(3) 每一段語音的長度分別最多可達 3.5、7 秒(在6kHz取樣頻率下)。
每一段 “語音+ 靜音時間” 的長度，分別最多可達 3.5、7 秒(在6kHz取樣頻率下)。

(4) 共有256個語音格(voice_step)，可規劃成8對語音組(sub_table)，每個語音組可放的語音格並沒有限制(但最多只有256個語音格)。

(5) 內建變頻振盪器，共有8種不同播放速度的選擇(playback speed: 5k ~ 14.5kHz)：

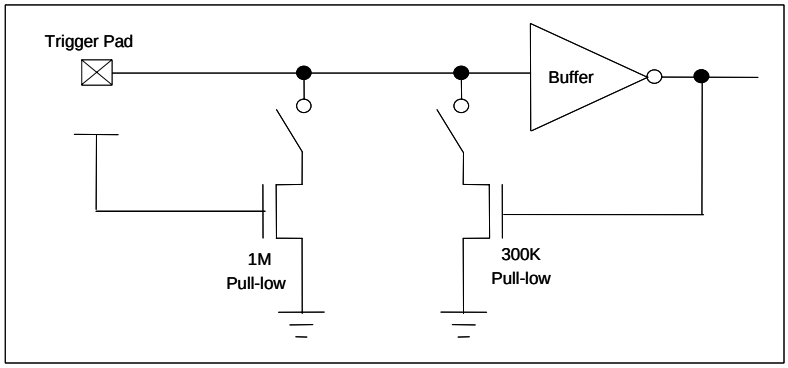
A	B	C	D	E	F	G	H
14.5kHz	11.6kHz	9.7kHz	8.3kHz	6.8kHz	6kHz	5.5kHz	5kHz

(6) 選擇 “OKY輸入”
   a) 每一種輸入可選擇不同觸發方式 (光罩選擇)：
      邊緣觸發 / 位準觸發(Edge/Level)；保持 / 非保持(Hold/Unhold)；
      後段蓋前段 / 非後段蓋前段(Retrigger/Irretrigger)。
   b) 每一種輸入可選擇 CDS+1M、CDS、1M pull-low 或 floating 的輸入方式。
   c) OKY 輸入最多有8個sub_table的 One-Key sequential的選擇。
   d) 每一種輸入可選擇不同防止誤動作(Debounce)時間：Long - 提供一般手動操作；Short - 提供跳動開關使用。

(7) PWM1，PWM2 可直接驅動 Buzzer 或 8、16、32、64Ω Speaker。

輸入方式選項：

選 項	功 能 描 述
CDS + 1M	一般選項，大多用在按鍵觸發。當按鍵按下時，IC內部爲 1M 的下拉電阻；而當按鍵放開時，IC內部爲 1M+300K (並聯) 的下拉電阻。
CDS	IC內部爲 300K 的下拉電阻，通常與光敏電阻一起使用。
1M pull-low	IC內部爲 1M 的下拉電阻，保留給一些特殊應用使用。
Floating	IC內部無下拉電阻，通常連接到其他輸出腳來做控制使用；如果沒連接其他輸出腳，一定要將此腳位外拉電阻到地。



1 GENERAL DESCRIPTION

The AM9AH003x and AM9AH007x are single-chip voice synthesizing CMOS IC. They are low cost with proper functions and can synthesize voice up to 3.5 and 7 seconds, using Alpha 4-bit LOGPCM algorithm. Customer speech data can be programmed into ROM by changing one mask during the device fabrication. The user has an interactive development tool “EzSpeech” which is ready for user-friendly programming.

2 FEATURES

(1) Single power supply can operate from 2.2V to 5.5V.

(2) The total voice duration is about 3.5 or 7 seconds those can be partitioned up to 256 voice_sections. Each voice_section length is flexible.

(3) Voice length can be individually up to 3.5 or 7 seconds at 6kHz S.R. for each voice_section.
Voice+mute length can be individually up to 3.5 or 7 seconds at 6kHz sample rate for each voice_section.

(4) Total 256 voice_steps are available for 8 sub_tables. Each sub_table can only use maximum 256 voice_steps.

(5) Build in oscillator, 8 kinds of playback speed option for internal oscillation used (playback speed: 5k ~ 14.5kHz):

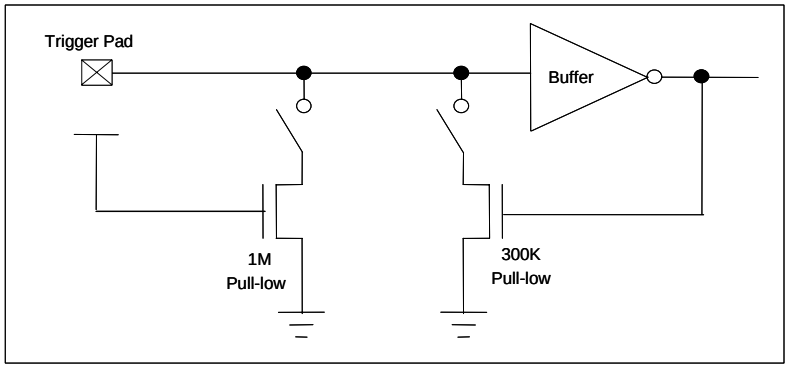
A	B	C	D	E	F	G	H
14.5kHz	11.6kHz	9.7kHz	8.3kHz	6.8kHz	6kHz	5.5kHz	5kHz

(6) “One Trigger Input” (OKY pin only).
   a) Each input pin has mask options for Edge/Level, Hold/Unhold and Retrigger/Irritrigger trigger modes.
   b) Each input can choose CDS+1M, CDS, 1M pull-low or floating input type.
   c) OKY input can choose One-Key Sequential for maximum 8 sub_tables.
   d) Debounce time: Long debounce for push buttons. Short debounce for switches.

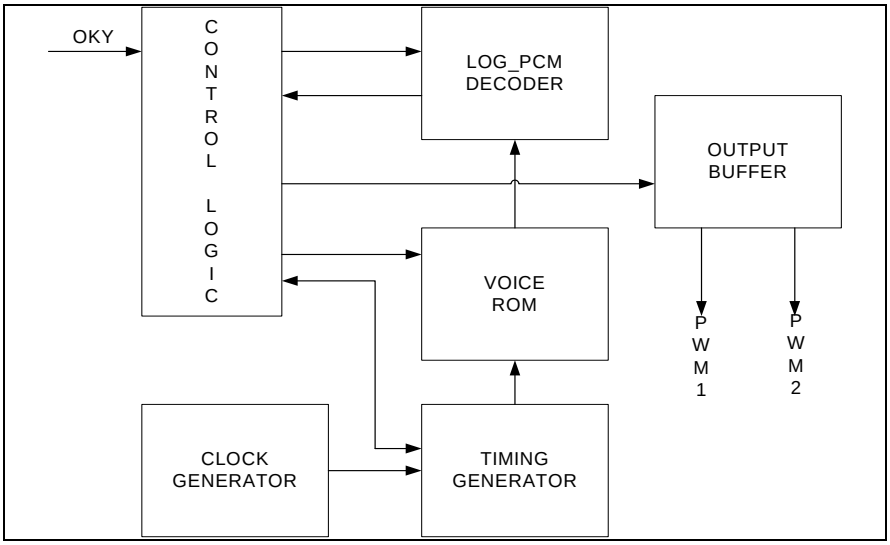
(7) PWM1 and PWM2 can directly drive buzzer or 8, 16, 32 or 64 ohms speaker.

Input Type Description:

Option	Description
CDS + 1M	Normal selection for button trigger. Only 1M pull-low resistance when key-pressed, and 1M+300K(parallel) pull-low resistance when key-released.
CDS	Internal 300K ohms pull-low resistance, usually for photo-resistor trigger.
1M pull-low	Internal 1M ohms pull-low resistance, reserve for some special applications.
Floating	No internal resistor connection, usually connected to other output pin or connected to GND by an external resistor.



3 BLOCK DIAGRAM



4 PAD DESCRIPTION

Pad Name	Pad No.	ATTR.	Function
Vss	1	Power	Negative power supply.
VDD	2	Power	Positive power supply.
PWM1	3	O	Audio output.
PWM2	4	O	Audio output.
OKY	5	I	Input for trigger.

5 CODE DEVELOPMENT AND DEMO SYSTEM

User can use "EzSpeech" software tool to develop the desired functions. For details, please see EzSpeech user manual. After finishing the code programming, user will get 2 files of ".eva" and ".htm", the binary file and function check list. User can download the ".eva" file into AM9AA_DB demo board to demonstrate the AM9AH function. The related mapping of AM9AA_DB is as following,

	AM9AH	AM9AA_DB	AM9AA_DB Description
I/O Pin	OKY	OKY	The same.
	PWM1, PWM2	PWM1, PWM2	PWM output to directly drive speaker.

For some input type option, user may need to connect an external resistor. Please refer to the table below,

	AM9AH	AM9AA_DB	AM9AA_DB Description
Input Type	CDS + 1M	CDS + 1M	The same.
	CDS	CDS	The same.
	1M pull-low	1M pull-low	The same.
	Floating	Floating	The same.

Once the function has been approved, user only need to send the ".eva" file to Alpha for code tape-out.

6 ABSOLUTE MAXIMUM RATING

Symbol	Rating	Unit
Vss~VDD	-0.5 ~ +6.0	V
Vin	Vss-0.3 < Vin < VDD+0.3	V
Vout	GND < Vout < VDD	V
Top (operating)	0 ~ +70	ºC
Tst (storage)	-25 ~ +85	ºC

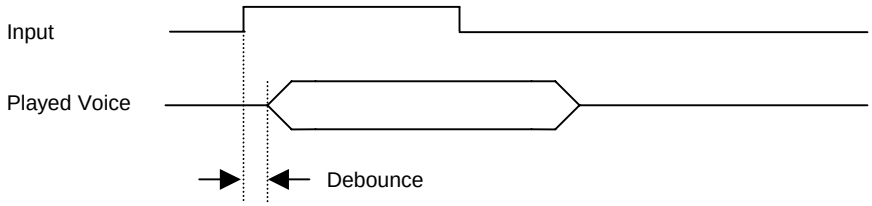
7 DC CHARACTERISTICS

Symbol	Parameter		Min.	Typ.	Max.	Unit	Condition
V_{DD}	Operating voltage		2.2	3.0	5.5	V	
I_{sb}	Supply current	Standby			1	uA	V_{DD}=3V, I/O open 6kHz S.R.
I_{op}		Operating		300			
I_{ih}	Input current: OKY (1M pull low)				3	uA	V_{DD}=3V
I_{il}				0			
I_{ih}	Input current: OKY (CDS)				10	uA	V_{DD}=3V
I_{il}				0			
I_{oh}	PWM1, PWM2 output current			-30		mA	V_{DD}=3V, Vop=2.4V
I_{ol}				30			V_{DD}=3V, Vop=0.6V
dF/F	Frequency stability		-5		5	%	$\frac{Fosc(3v)-Fosc(2.4v)}{Fosc(3v)}$
dF/F	Fosc lot variation		-6		6	%	V_{DD}=3V

8 TIMING DIAGRAM

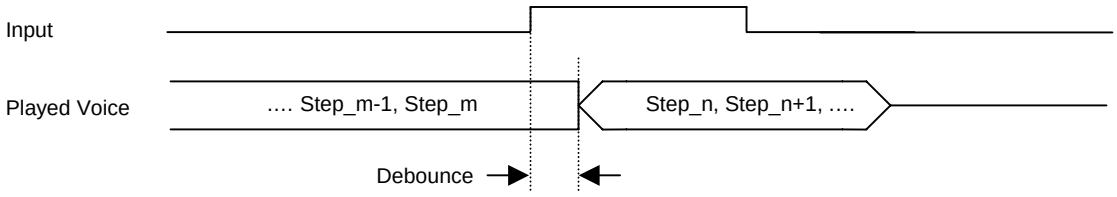
(1) Debounce Time

a) *Trigger while no playing voice*



Debounce time is configured by 6 kHz S.R and the value is fixed. That is, Slow debounce=22ms, Fast debounce < 400us

b) *Trigger while playing voice*

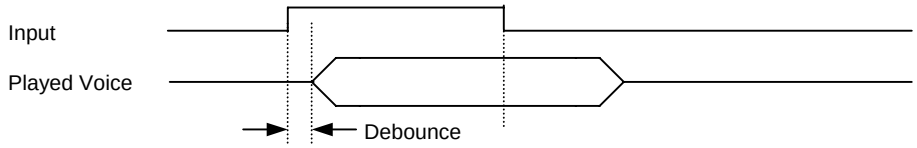


Debounce Time is configured by the S.R. of Step_m.

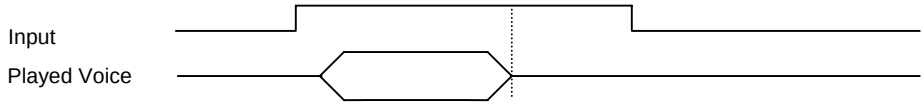
For example, if Step_m S.R. = 8kHz, Slow debounce = 22*(6k/8k) ms = 16.5ms, Fast debounce < 400*(6k/8k) us =300us

(2) General Timing Diagram

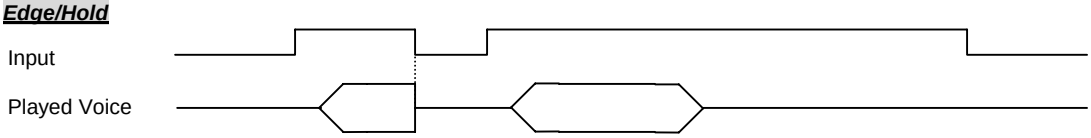
a) *Edge mode, Edge trigger*



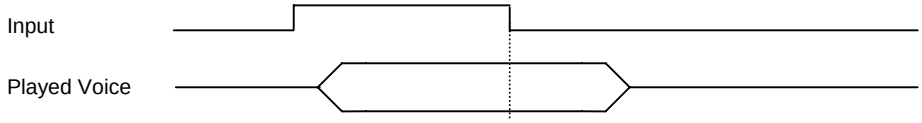
b) *Edge mode, Level trigger*



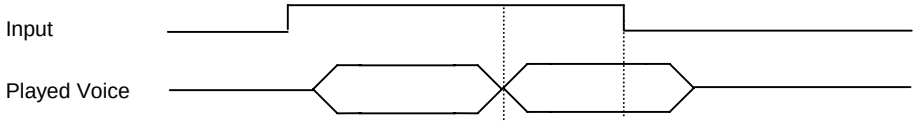
Edge/Hold



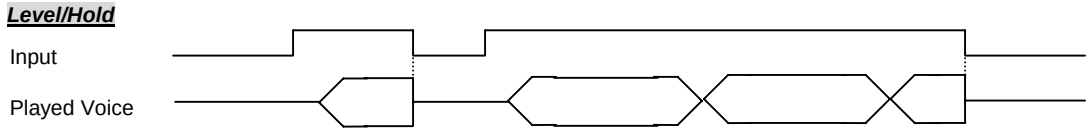
c) *Level mode, Edge trigger*



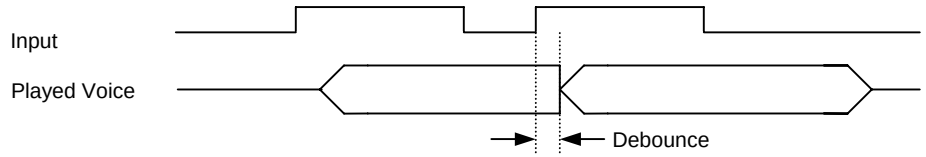
d) *Level mode, Level trigger*



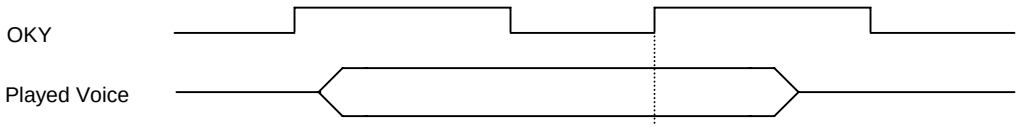
Level/Hold



e) *Retrigger mode*

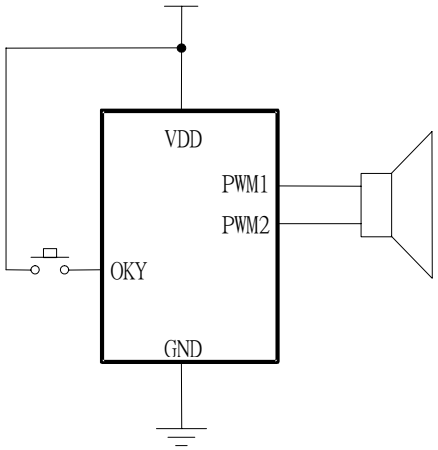


f) *Irretrigger mode*

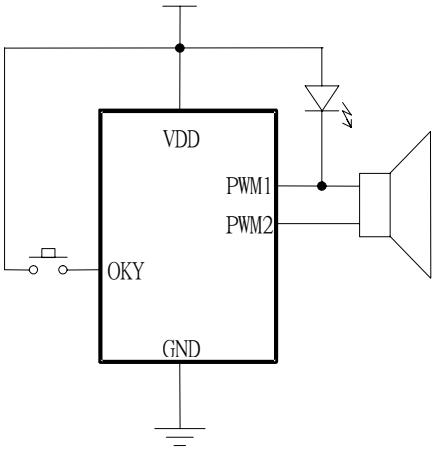


9 APPLICATION

(1) 1 trigger



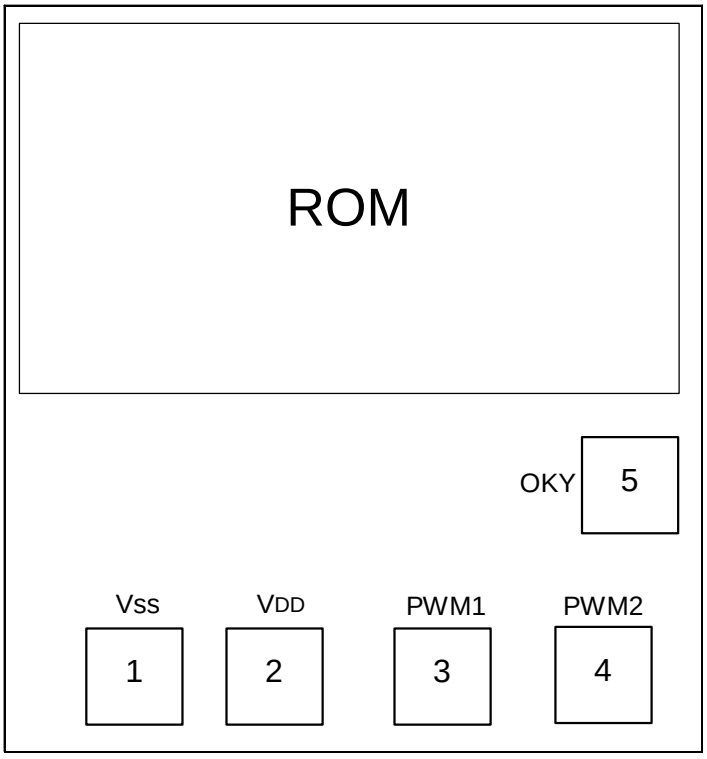
(2) 1 trigger, 1 LED



While driving motor, one capacitor is suggested to put between V_{DD} and GND.

Note: The above application circuits are for reference only; user can contact Alpha for more information.

10 BONDING DIAGRAM



Note: The IC substrate must be connected to GND.