佑 華 微 電 子 股 份 有 限 公 司

AM9BE Series

Data Sheet

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Rev 1.01 2009/3/26

Revision History

Revision	Date	Description	Page
1.00	2008/6/10	New release.	-
1.01	2009/3/26	1. Revise operating range. 2. Revise Chap 2: Features. 3. Revise pad description. 4. Revise absolute maximum rating. 5. Revise Chap 7: DC CHARBDTERISTICS 6. Revise motor recovery function.	3, 6, 10 3, 6 9 9 10 24

1. 一般規格

AM9BE004A、AM9BE008A、AM9BE012A、AM9BE016A、AM9BE024A、AM9BE032A、AM9BE040A、AM9BE048A、AM9BE056A、AM9BE064A、AM9BE072A、AM9BE080A、AM9BE088A、AM9BE096A、AM9BE0104A 、AM9BE0112A，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 ADPCM 編碼方式，合成長達 4、8、12、16、24、32、40、48、56、64、72、80、88、96、104、112 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。另外使用者可以有最多 4 個很彈性的 PowerIO pin 選擇(IO1, IO2, IO3, OKY2/O4)，來配合不同之應用，並可用佑華所提供的 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(在此範圍內，可採用單一 Rosc 電阻值)。

(2) 語音總長度可達 4、8、12、16、24、32、40、48、56、64、72、80、56、64、72、80、88、96、104、112 秒，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 4、8、12、16、24、32、40、48、56、64、72、80、88、96、104、112 秒。(在 6kHz 取樣頻率下)每一段 “靜音時間” 的長度最多可達 131 秒。(在 6kHz 取樣頻率下)，每一段語音可編入四組 Sync 訊號給 IO1, IO2, IO3, OKY2/O4 使用，可由 PowerIO 編輯器來做 Sync 訊號編輯。

(4) 有 256 個語音格(voice_step)，可規劃成 32 對語音組(sub_table)，每對語音組是由一個起始語音組(Start sub_table)和一個循環語音組(Loop sub_table)所組成，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)。每一語音格可指定一語音段和播放速度，並搭配 IO1, IO2, IO3, OKY2/O4 的輸出致能或非致能(IO1, IO2, IO3, OKY2/O4 當作輸出時)。另外在每一語音格中還可以設定 Retrigger/Irretrigger 轉換(Invert 功能)，和進行語音組跳躍(Jumping/Looping 功能)。

(5) 在語音組的最後一個語音格中可設定 “語音組跳躍” 功能(Jumping)，可將現在的語音組(Start sub_table, 例如 S1)播完後，接著播放指定的語音組(Loop sub_table, 例如 L1)，並可進一步設定這個指定的語音組 L1 是否要無限循環的播放(Looping)。

(6) 特殊功能選項 ”KeyReleaseJump” (按鍵離開立即跳躍)功能，可以配合 Jumping 設定來使用，當按鍵一離開，則正在播放的起始語音組 S1 會立刻停止，並跳到對應的循環語音組 L1，而使用者可以配合 Looping 設定是否要將 L1 做無限循環的播放。

(7) 內建變頻振盪器，使用者可在 4kHz ~ 10kHz (+/- 3%誤差) 與 10.01kHz ~ 14kHz (+/- 5%誤差)中選擇任意播放速度。

(8) IO1, IO2, IO3, OKY2/O4 可選擇作輸入腳或是輸出腳 (光罩選擇)。

(9) 可選擇 ”電源啓動(PowerOnPlay)觸發輸入+多按鍵觸發輸入模式”(OKY 當輸入，IO1, IO2, IO3, OKY2/O4 當作輸入或輸出)。

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)。
(※ PowerOnPlay 觸發輸入模式只能固定爲 Edge / Unhold / Retrigger)

b) OKY 輸入最多有 64 個 sub_table 的 One-Key sequential 或 random 的選擇，而 OKY2 輸入最多有 28 個 sub_table 的 One-Key sequential 的選擇，在 One-Key sequential 時並可選擇 sub-table 的順序是否要 Reset(當其他按鍵被觸發後)。

c) OKY 輸入可選擇是否有 Toggle On/Off 的功能。
OKY 輸入可選擇 40K、300K、300K+1M、1M pull-low 或 floating 的輸入方式。IO1 輸入可選擇 300K+1M、300K、1M pull-low 或 floating 的輸入方式。IO2 輸入可選擇 300K+1M、300K、1M pull-low 或 floating 的輸入方式。IO3 輸入可選擇 10M+1M、10M、1M pull-low 或 floating 的輸入方式。
OKY2/O4 輸入可選擇 300K+1M、300K、1M pull-low 或 floating 的輸入方式。

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。

e) 優先順序：OKY > IO1 > IO2 > IO3 > OKY2/O4。

(10) IO1, IO2, IO3, OKY2/O4 可做以下 2 種輸出或大電流選擇：

a) LED dynamic 2/4 : 播放時 LED 動態 2/4 位準訊號。

b) Power IO 輸出：可隨聲音作任意的輸出變化並可設定初始值(需開啓 PowerIO 編輯器來做 Sync 訊號編輯)。

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

(12) 每一語音段中的語音或靜音長度爲 10HEX 的整數倍

(13) 選擇頻率振盪器：

a) 選擇外部電阻可調式頻率振盪器 : 將 OSC 外接電阻到正電源。

b) 選擇內建頻率振盪器 : 將 OSC 接地。

(14) 馬達重設功能：

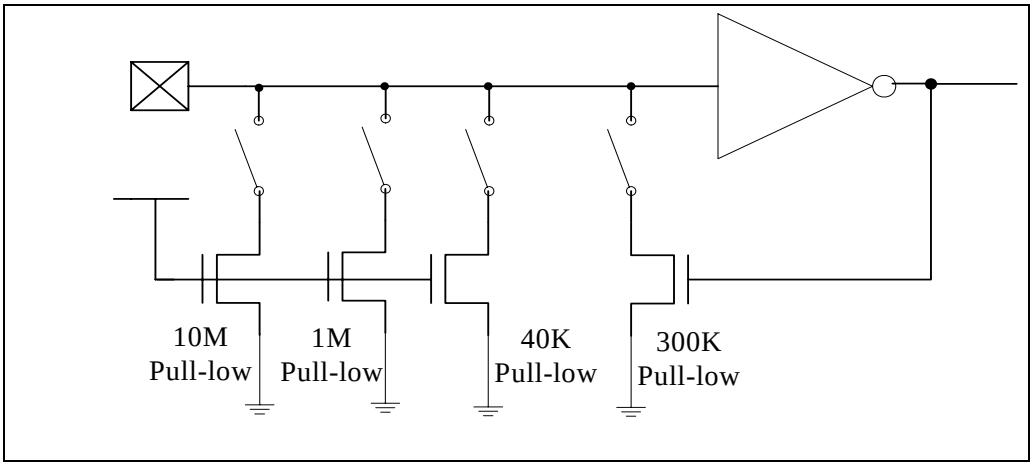
在 Ezspeech 中，可選擇打開馬達重設的功能，並且在 subtable 頁面選擇哪一個 step 上打開接受 IO3 重設偵測，並在 IO3 執行想做的功能。

(15) LVR：

當電壓瞬間過低時，IC 會自動 RESET。

輸入方式選項：

選 項	功 能 描 述
40K	IC 內部爲 40K 的下拉電阻，給一些按鍵阻抗較小，系統雜訊較大的應用使用。
300K + 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。
300K	IC 內部爲 300K 的下拉電阻，通常與光敏電阻一起使用。
1M	IC 內部爲 1M 的下拉電阻，保留給一些特殊應用使用。
10M	IC 內部爲 10M 的下拉電阻，通常使用在觸控的應用。
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 AM9BE004A, AM9BE008A, AM9BE012A, AM9BE016A, AM9BE024A, AM9BE032A, AM9BE040A, AM9BE048A, AM9BE056A, AM9BE064A, AM9BE072A, AM9BE080A , AM9BE088A, AM9BE096A, AM9BE0112A are single-chip voice synthesizing CMOS IC. They are low cost with proper functions and can synthesize voice up to 4, 8, 12, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, 96, 104, 112 seconds, using Alpha ADPCM algorithm. Customer speech data can be programmed into ROM by changing one mask during the device fabrication. Besides, not only the very flexible and functional PowerIO pins (IO1, IO2, IO3, OKY2/O4) are available for user to apply in various applications, but also an interactive development tool “EzSpeech” is ready for user-friendly programming.

2. FEATURES

(1) Single power supply can operate from 2.2V to 5.5V (in this range, user can set Rosc as a fixed value).

(2) The total voice duration is about 4, 8, 12, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, 96, 104, 112 seconds that can be partitioned up to voice_sections. Each voice_section length is flexible. Besides, there are 1 end-address points to select for each voice_sections.

(3) Voice length can be individually up to 4, 8, 12, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, 96, 104, 112 seconds, and mute length can be individually up to 131 seconds at 6kHz sample rate for each voice_section. SYNC signal can be edited into each voice by PowerIO editor (4 Syncs for IO1, IO2, IO3, OKY2/O4).

(4) Total 256 voice_steps are available for 32 pairs of sub_table. Each pair consists of one Start sub_table and one Loop sub_table. The number of voice_step for each sub_table is flexible, but maximum is 256. For each voice_step, it can specify one voice_section, playback speed and IO1, IO2, IO3, OKY2/O4 output enable options if IO1, IO2, IO3, OKY2/O4 are set as output. Besides, in voice_step there are also other selections of the Retrigger/Irretrigger Invert and Jumping/Looping instruction.

(5) In last voice_step of sub_table, a “Jumping” instruction is available. Herein you can specify another Loop sub_table (Ex. L1) next to the current sub_table of Start sub_table (Ex. S1) to playback continuously. Then to decide whether L1 sub_table is played in loop or not, i.e. “Looping” instruction.

(6) Using the special “KeyReleaseJump” function with Jumping setup, the playing Start sub_table S1 will stop and immediately play associated Loop sub_table L1 when key is released. User can also set Looping in L1 to play L1 in loop.

(7) Built-in variable oscillator, user can choose any playback speed of 4kHz ~ 10kHz (+/- 3% deviation) and 10.01kHz ~ 14kHz (+/- 5% deviation).

(8) IO1, IO2, IO3, OKY2/O4 can be either input or output pin (Mask option).

(9) Optional “PowerOnPlay + other Trigger Input” (OKY is input and IO1, IO2, IO3, OKY2/O4 are input or output), or “One Triggers Input” (OKY is input, IO1, IO2, IO3, OKY2/O4 are output).

a) Each input pin has mask options for Edge/Level, Hold/Unhold and Retrigger/Irritrigger trigger modes. (※ PowerOnPlay has only “Edge / Unhold / Retrigger” trigger mode.)

b) OKY input can choose One-Key Sequential or Random for maximum 64 sub_tables. OKY2 input can choose One-Key Sequential for maximum 32 sub_tables. At One-Key Sequential, the Reset function of sub_table sequence can be chosen when other keys are triggered.

c) OKY input can choose Toggle On/Off function or not.

d) OKY input can choose 40K, 300K+1M, 300K, 1M pull-low or floating input type. IO1 input can choose 300K+1M, 300K, 1M pull-low or floating input type. IO2 input can choose 300K+1M, 300K, 1M pull-low or floating input type. IO3 input can choose 300K+10M, 300K, 10M pull-low or floating input type. OKY2/O4 input can choose 300K+1M, 300K, 1M pull-low or floating input type.

e) Each input can choose debounce time: Long debounce for push buttons. Short debounce for fast switches.

f) Input pin priority：OKY > IO1 > IO2 > IO3 > OKY2/O4.

(10) IO1, IO2, IO3, OKY2/O4 have 2 kinds of output or large current option :

a) LED dynamic 2/4 : dynamic sink signal output for driving LED during playing.

b) Synchronous output : arbitrary output with voice, user can edit the Sync signal by PowerIO editor.

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

(12) The voice or mute length in voice_section must be the multiple of 10HEX

(13) Oscillator selection:

a) External oscillator: Connect OSC pin to Vdd with a resistor, Rosc.

b) Internal oscillator: Connect OSC pin to GND.

(14) Motor Recovery Function:

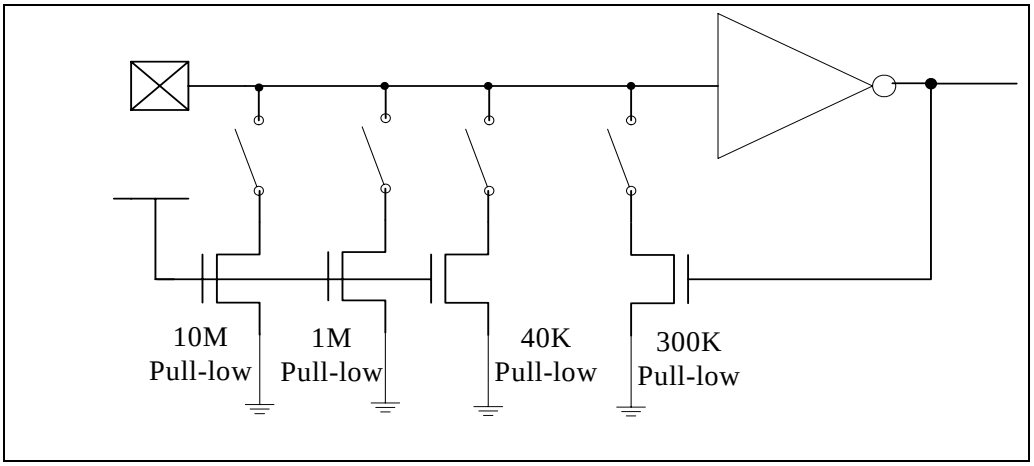
In Ezspeech, customer can open motor recovery function and choose which step can be used to accept motor recovery function.

(15) LVR (Low Voltage Reset):

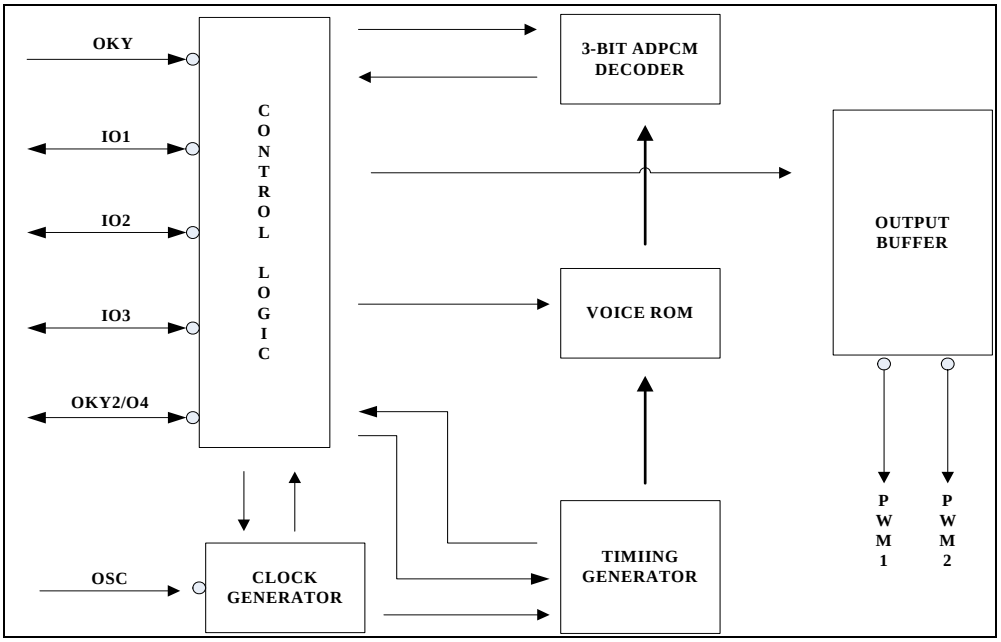
When voltage is too low, IC will reset by itself.

※Input Type Description:

Option	Description
40K	Internal 40K ohms pull-low resistance, usually for large noise applications.
300K + 1M	Normal selection for button trigger. Only 1M pull-low resistance when key-pressed, and 1M+300K(parallel) pull-low resistance when key-released.
300K	Internal 300K ohms pull-low resistance, usually for photo-resistor trigger.
1M	Internal 1M ohms pull-low resistance, reserve for some special applications.
10M	Internal 10M ohms weak pull-low, usually for touching trigger.
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
PWM1,2	1,3	O	Audio output.
VCC	2,11	Power	Positive power supply.
VSS	4,12	Power	Negative power supply.
OKY	5	I	input for trigger.
IO1,2,3,4	6,7,8,9	I/O	Status output or input for trigger.
OSC	10	I	Oscillator input. For using internal oscillator, connect OSC to GND.

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 AM9BA_DB demo board to demonstrate the AM9BE function. The related mapping of AM9BA_DB is as following:

	AM9BE	AM9BA_DB	AM9BA_DB Description
I/O Pin	OKY	OKY	The same.
	IO1	IO1	The same.
	IO2	IO2	The same.
	IO3	IO3	The same.
	IO4	IO4	The same.
	PWM1, PWM2	PWM1, PWM2	PWM output to directly drive speaker.
	OSC	Rosc	Rosc is connected with 160K ohms resistor at 6kHz.

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

6. ABSOLUTE MAXIMUM RATING

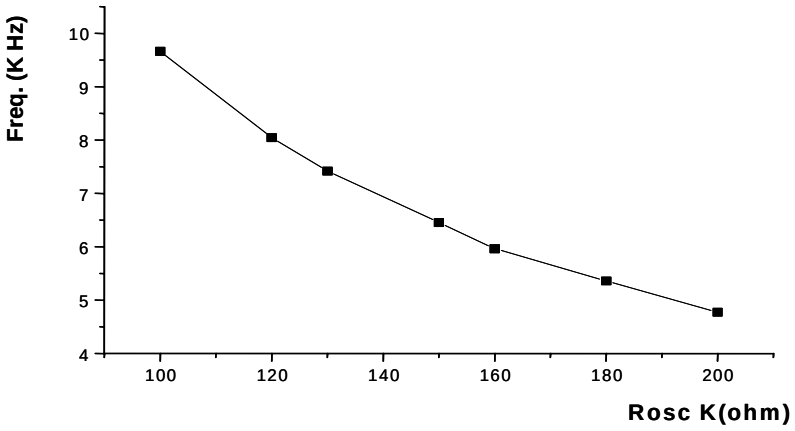
Symbol	Rating	Unit
Vdd~Vss	-0.5 ~ +6.0	V
Vin	Vss-0.3 < Vin < Vdd+0.3	V
Vout	GND < Vout < Vdd	V
Top (operating)	0 ~ +70	ºC
Tst (storage)	-25 ~ +85	ºC

7. DC CHARBDTERISTICS

Symbol	Parameter		Min.	Typ.	Max.	Unit	Condition
Vdd	Operating voltage		2.2	3.0	5.5	V	
Isb	Supply current	Standby			1	uA	Vdd=3V, I/O open (with Rosc or OSC grounded)
Iop		Operating		150	200		
Iih	Input current: OKY (40K pull low)				100	uA	Vdd=3V
Iil				0			
Iih	Input current: OKY, IO1 (1M pull low)				3	uA	Vdd=3V
Iil				0			
Iih	Input current: OKY (10M pull low)				0.3	uA	Vdd=3V
Iil				0			
Iih	Input current: OKY, IO1 (CDS)				10	uA	Vdd=3V
Iil				0			
Ioh	PWM1, PWM2 output current			-30		mA	Vdd=3V, Vop=2.4V
Iol				30			Vdd=3V, Vop=0.6V
Ioh	IO1/IO2/IO3/IO4 output current (normal)			-1.55		mA	Vdd=3V, Vop=2.6V
				-4.5			Vdd=4.5V, Vop=3.7V
Iol				3.6			Vdd=3V, Vop=0.4V
				8			Vdd=4.5V, Vop=0.8V
Iol	IO1/IO2 /IO3/IO4 output current (large)			8.81			Vdd=3V, Vop=0.4V
				22			Vdd=4.5V, Vop=0.8V
dF/F	Frequency stability		-5		5	%	$\frac{Fosc(3v)-Fosc(2.4v)}{Fosc(3v)}$
dF/F	Fosc lot variation		-10		10	%	Vdd=3V, Rosc=160KΩ

8. FREQUENCY and EXTERNAL Rosc

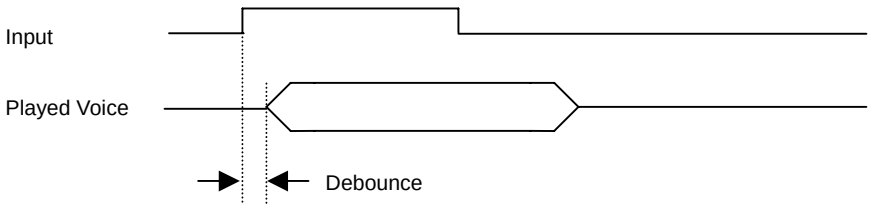
(measured at internal option of 6kHz playback speed)



9. TIMING DIAGRAM

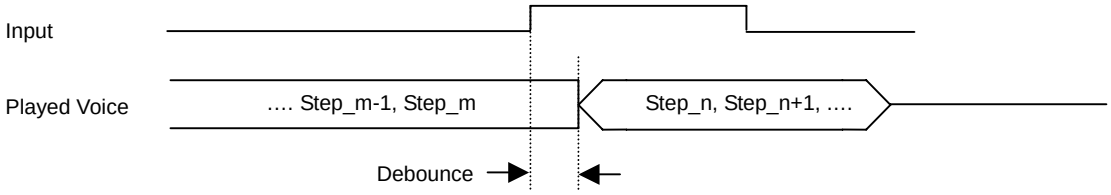
(1) Debounce Time

a) Trigger while no playing voice



※ Debounce time is configured by 6 kHz S.R and the value is fixed. That is, Slow debounce=20ms, Fast debounce < 50us

b) Trigger while playing voice

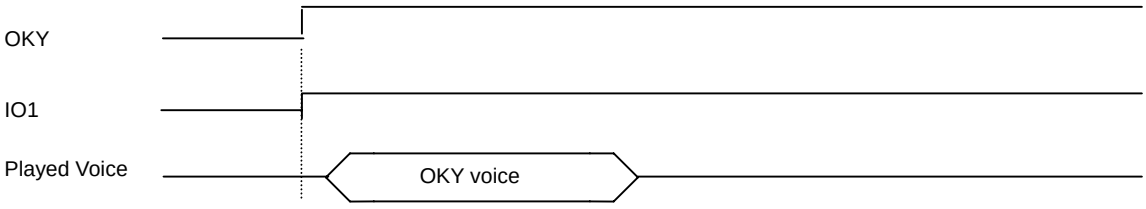


※ Debounce Time is configured by the S.R. of Step_m.

For example, if Step_m S.R. = 8kHz, Slow debounce = 20*(6k/8k) ms = 15ms, Fast debounce < 50*(6k/8k) us =37.5us

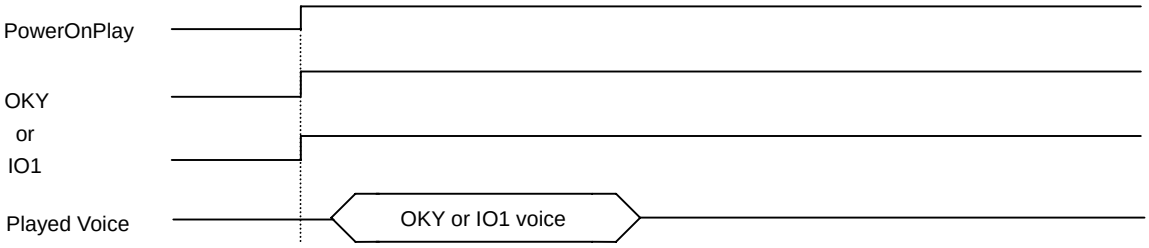
(2) Input Priority

a) Without PowerOnPlay



※ Priority: OKY > IO1 > IO2 > IO3 > OKY2/O4

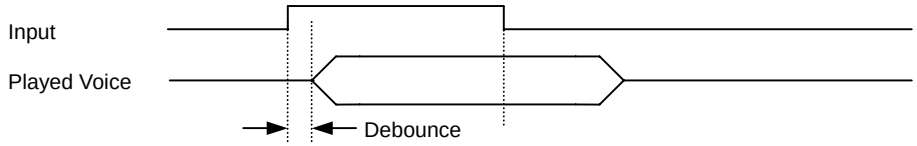
b) With PowerOnPlay



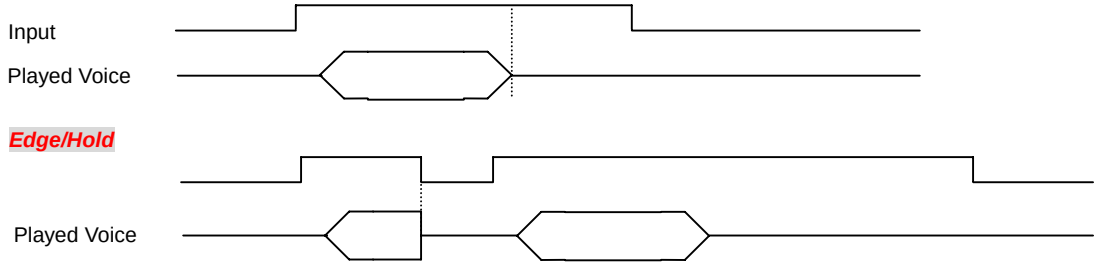
※ Priority: OKY > IO1 > IO2 > IO3 > OKY2/O4 > PowerOnPlay

(3) General Timing Diagram

a) Edge mode, Edge trigger

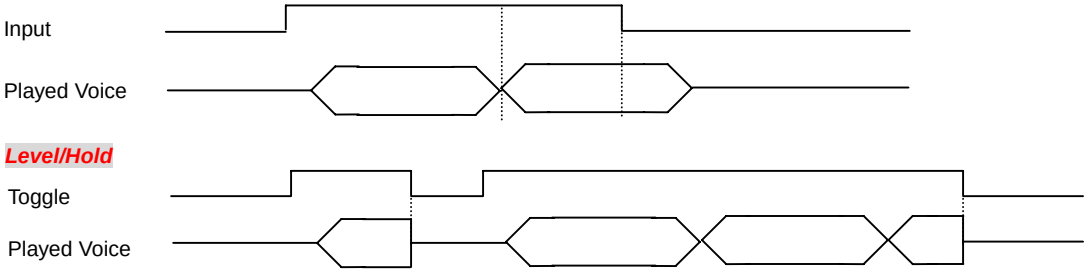


b) Edge mode, Level trigger

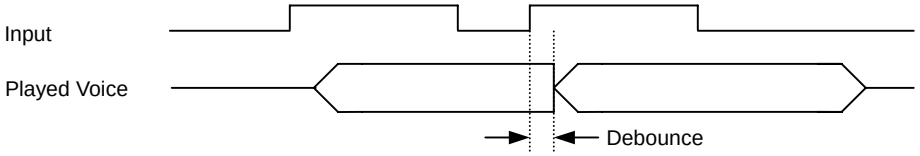


c) Level mode, Edge trigger

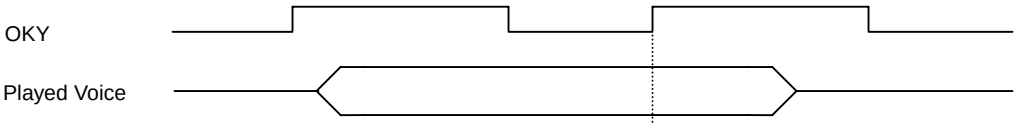
d) Level mode, Level trigger



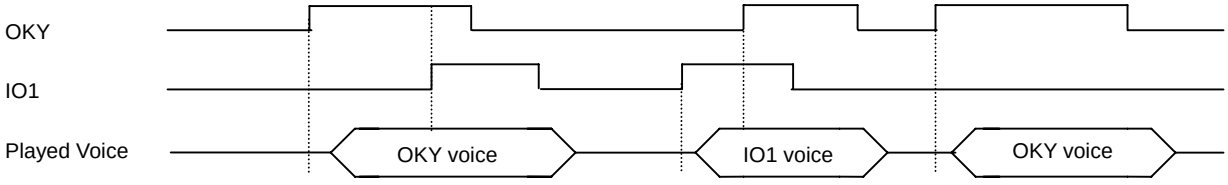
e) Retrigger mode



f) Irretrigger mode



g) Retrigger mode, first key priority

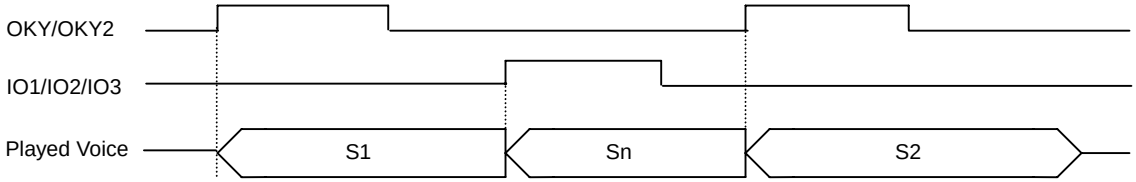


(4) Special Timing Diagram

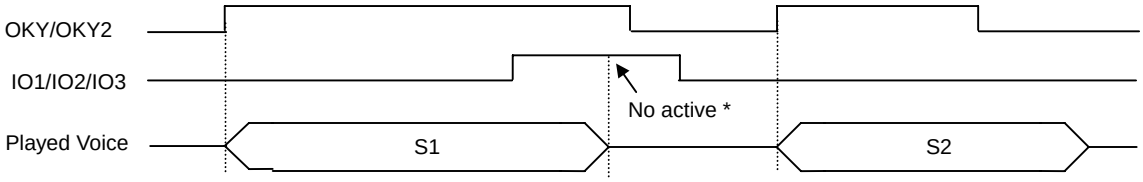
Henceforth, the debounce time is ignored for the following diagrams.

a) Different Input Reload (No Jumping and Looping function exist.)

I) OKY/OKY2(E/U/R)=S1 S2, IO1/IO2/IO3 (E/U/R)=Sn (S1 means sub_table 1, Sn means sub_table n,)

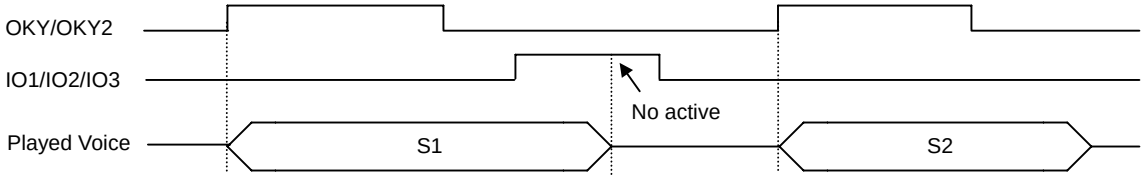


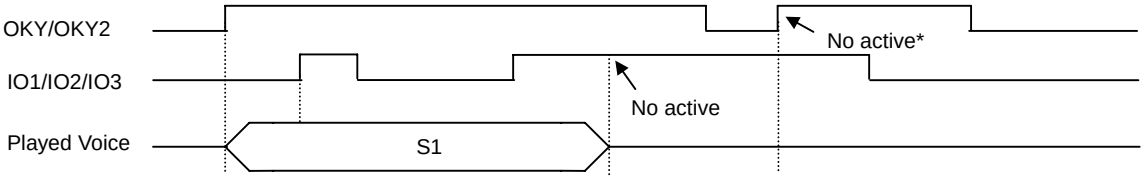
II) OKY/OKY2(E/U/R)=S1 S2, IO1/IO2/IO3 (L/x/x) =Sn



* If you press IO1 during OKY voice playing, in the time of S1 end, the trigger mode follows OKY (E/U/R).

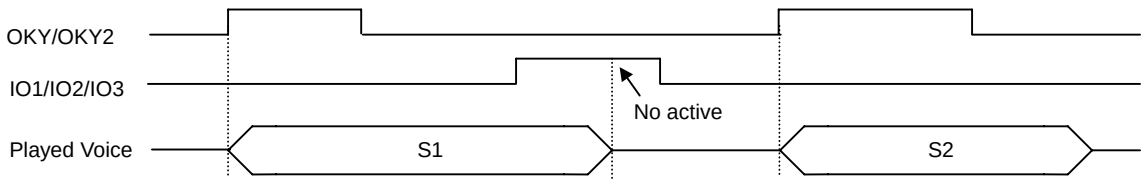
III) OKY/OKY2(E/U/I)=S1 S2, IO1/IO2/IO3 (E/x/x) =Sn



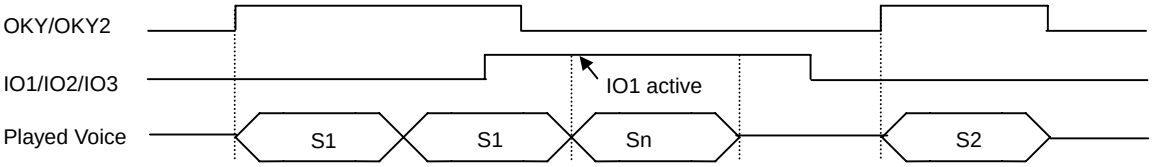


* Because IO1 signal is still high, the OKY Edge signal is not active.

IV) OKY/OKY2(E/U/I)=S1 S2, IO1/IO2/IO3 (L/x/x) =Sn



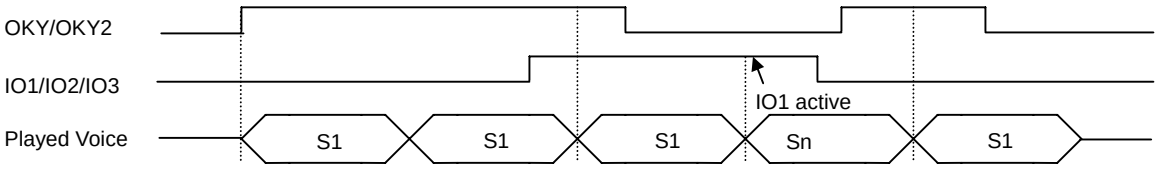
V) OKY/OKY2(L/U/X)=S1 S2 , IO1/IO2/IO3 (E/x/x) =Sn



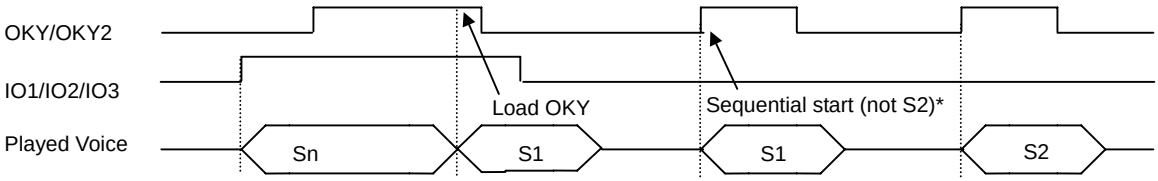
※ In the time of sub_table end: When S1 end, the trigger mode follows OKY (L/U/x). When Sn ends, it follows IO1 (E/x/x).

※ Once Sn is played (just leave S1 ending), the trigger mode follows IO1 (E/x/x) immediately.

VI) OKY/OKY2(L/U/X)=S1 S2, IO1/IO2/IO3 (L/U/I) =Sn



※ Reload key priority: OKY > IO1 > IO2 > IO3 > OKY2/O4



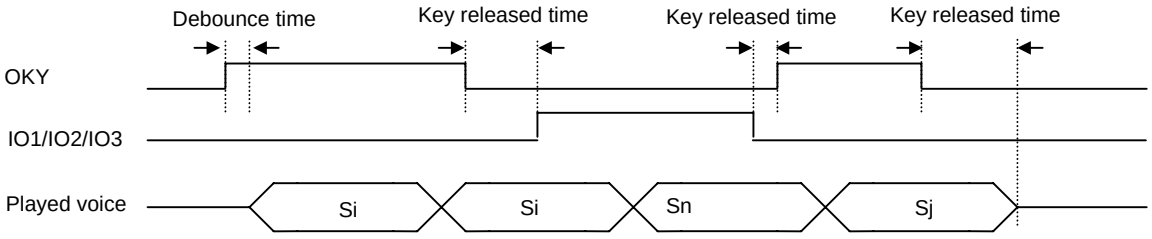
※ When IO1 is triggered first and its voice play, to trigger OKY don't follow sequential trigger because no debounce happen.

* In OKY, 1st debounce happen, so to play S1. OKY Sequential number is counted only if there is debounce happened.

b) Random Function

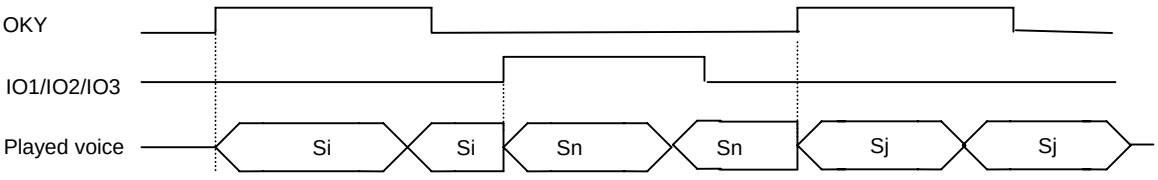
I) OKY(L/U/I)=S1 S2, IO1/IO2/IO3 (L/U/I) =Sn

Random is counting at "debounce time" and "voice playing but input key is released". But the first trigger only counts "debounce time" due to no "key release time".



i=1 or 2 or 3 or 4; j=1 or 2 or 3 or 4 (i and j are random number)

II) (c-2) OKY(L/U/R) =S1 S2, IO1/IO2/IO3 (L/U/R) =Sn

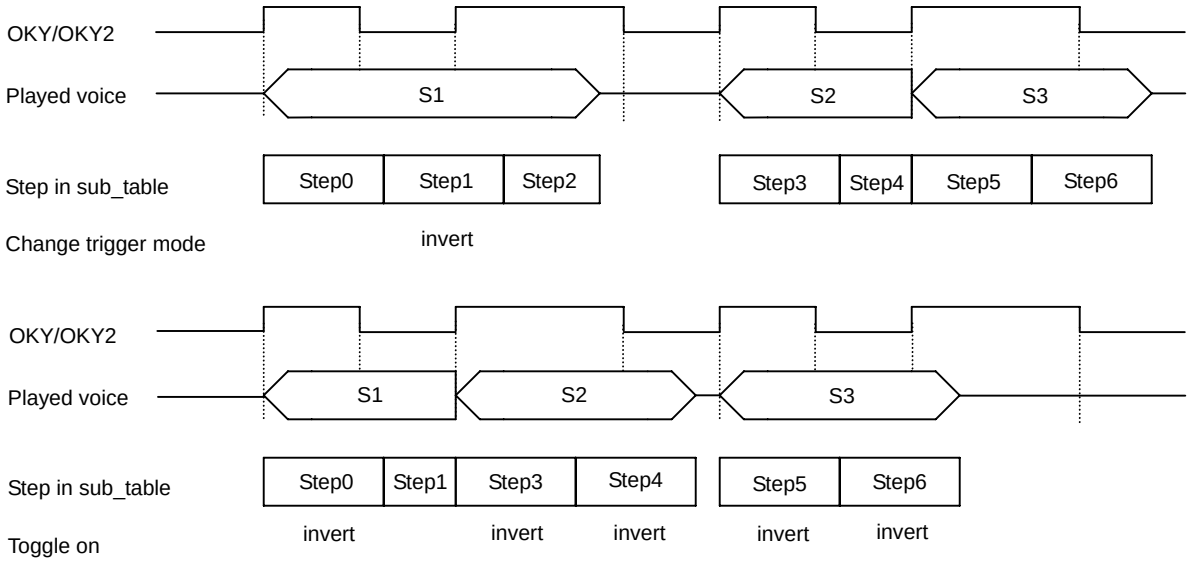


i=1 or 2 or 3 or 4; j=1 or 2 or 3 or 4 (i and j are random number)

c) Change the Trigger mode while playing voice (Invert Retrigger/Irretrigger function in voice_step)

Use Invert function can change the Retrigger mode to Irretrigger mode or change the Irretrigger mode to Retrigger in each voice_step of sub_table.

OKY/OKY2(E/U/R) = S1 S2 S3, (S1= step0 + step1 + step2, S2= step3 + step4, S3= step5 + step6)



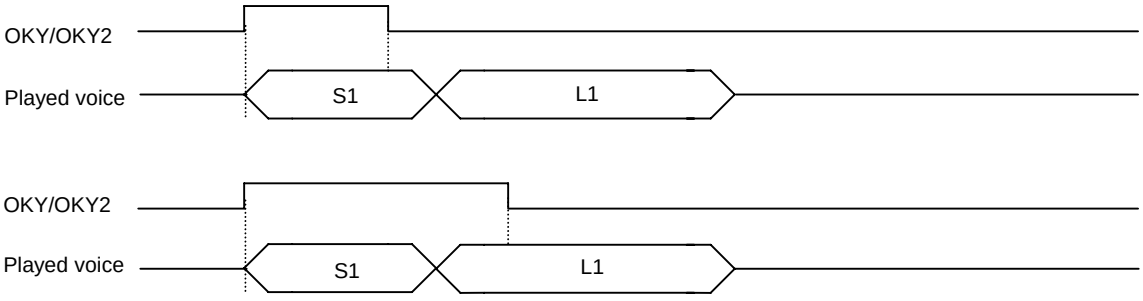
(5) Jumping and Looping Function

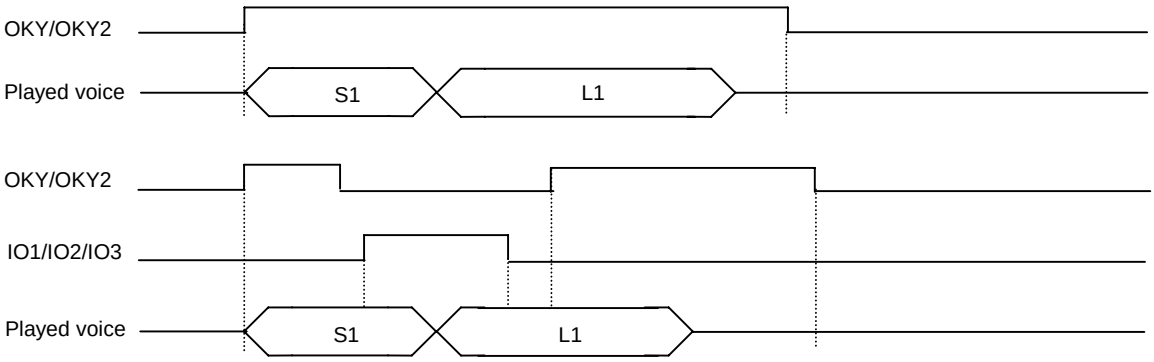
In the end of any Start sub_table, you can set a Jump instruction and indicates the associated Loop sub_table for Jumping function. If you do, when 1st Start sub_table is end, IC will detect the instruction and the 2nd Loop sub_table will be played immediately and automatically. In Loop sub_table, you can also set a Loop instruction for self-looping function.

Note: In Jumping and Looping function, "Different Input Reload" function in (4-a) doesn't work.

a) If S1 is set Jumping without Looping

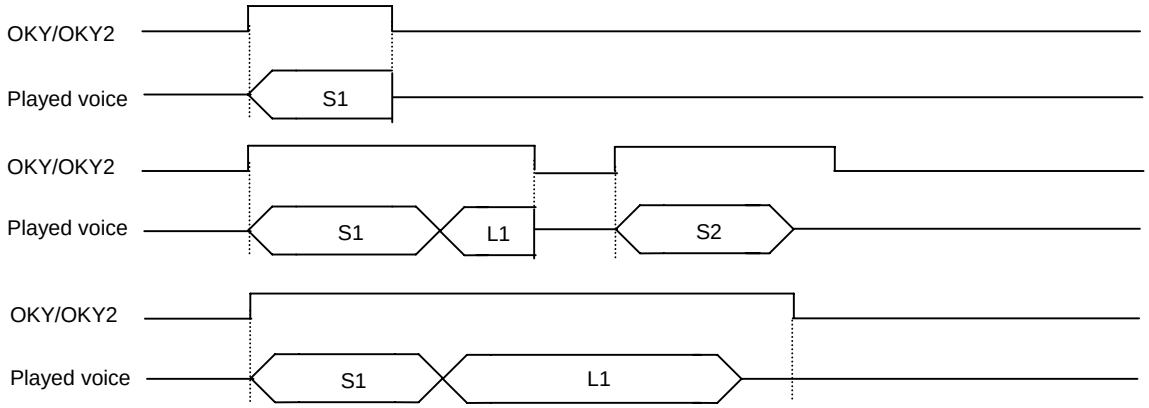
I) OKY/OKY2(E/U/I) =S1 L1 S2 S3, IO1/IO2/IO3 (x/x/x) = Sn (L1 means the Jumping sub_table of S1)



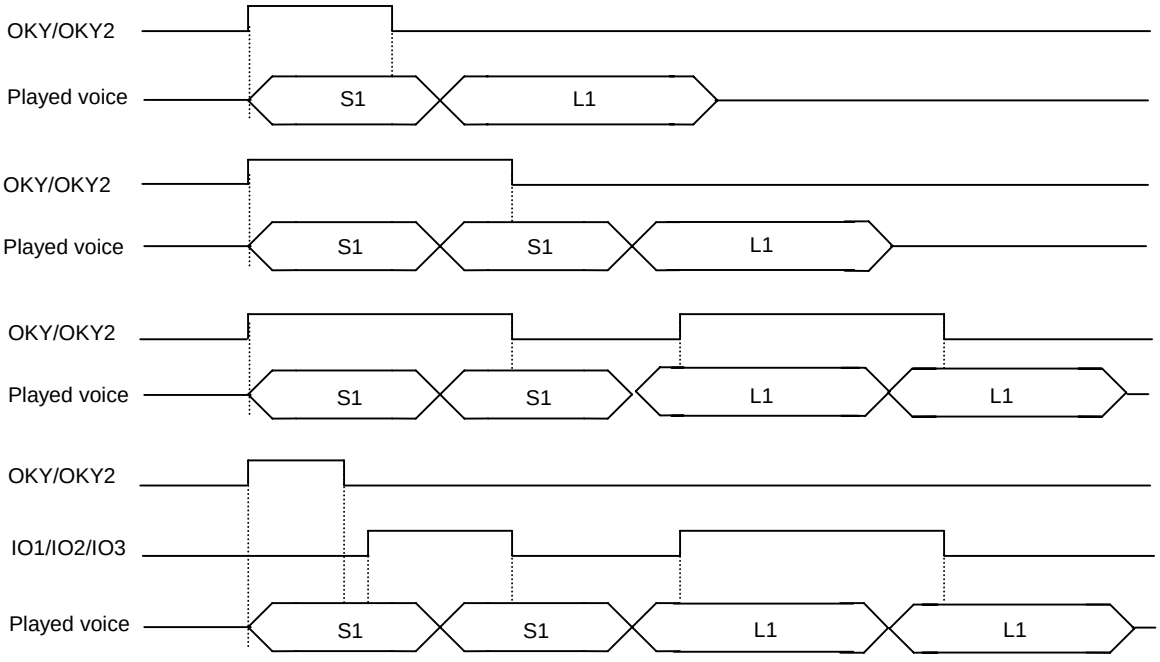


※ While playing OKY's voice (S1 or L1), to trigger OKY or IO1 is not active at Edge/Irretrigger mode.

II) OKY/OKY2(E/H/x) =S1 L1 S2 S3

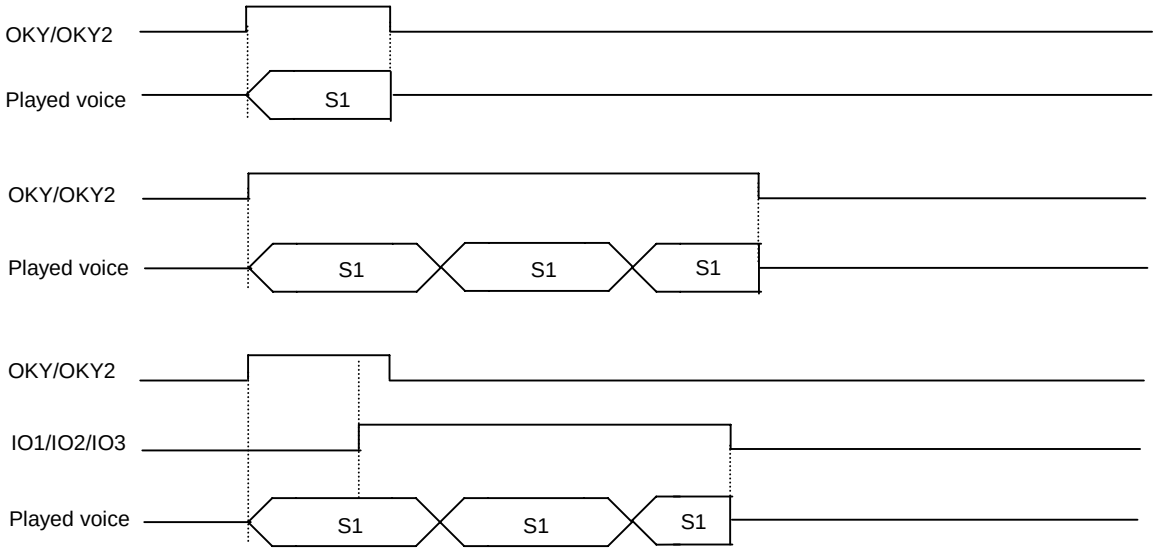


III) OKY/OKY2(L/U/I) =S1 L1 S2 S3, IO1/IO2/IO3 (x/x/x) = Sn



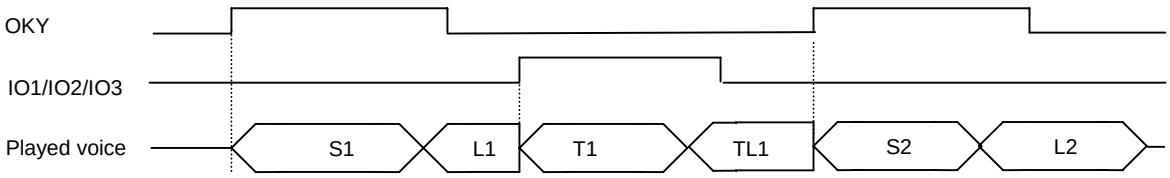
※ Without Different Input Reload, while playing OKY's voice, to trigger IO1 is recognized as to trigger OKY.

IV) OKY/OKY2(L/H/x) =S1 L1 S2 S3, IO1/IO2/IO3 (x/x/x) = Sn



※ Without Different Input Reload, while playing OKY's voice, to trigger IO1 is recognized as to trigger OKY.

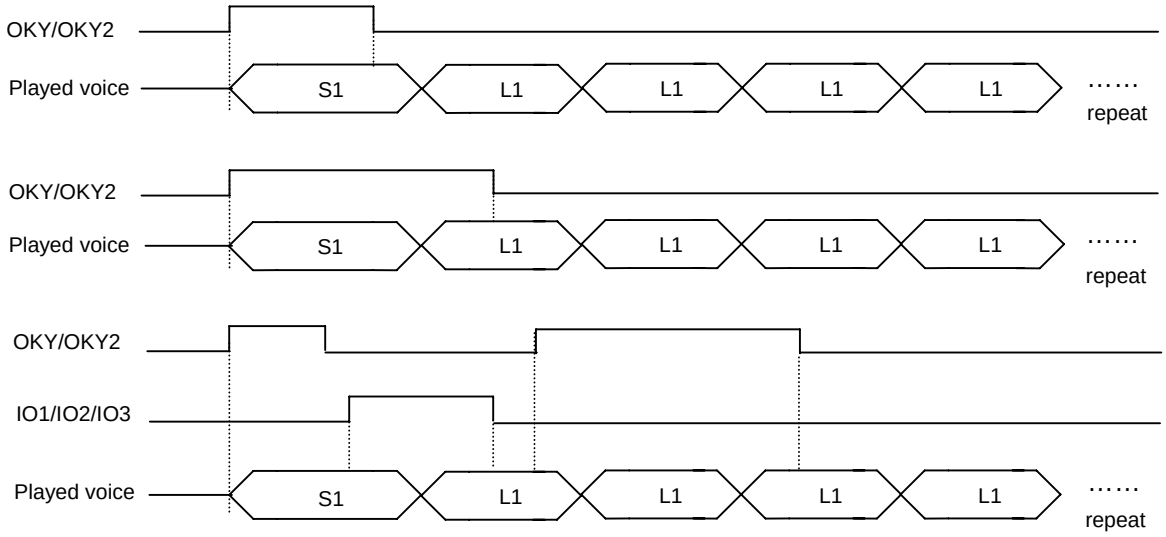
V) OKY(E/U/R) = S1 L1 S2 L2 , OKY2 (E/U/R) =T1 TL1



b) If S1 is set Jumping with Looping

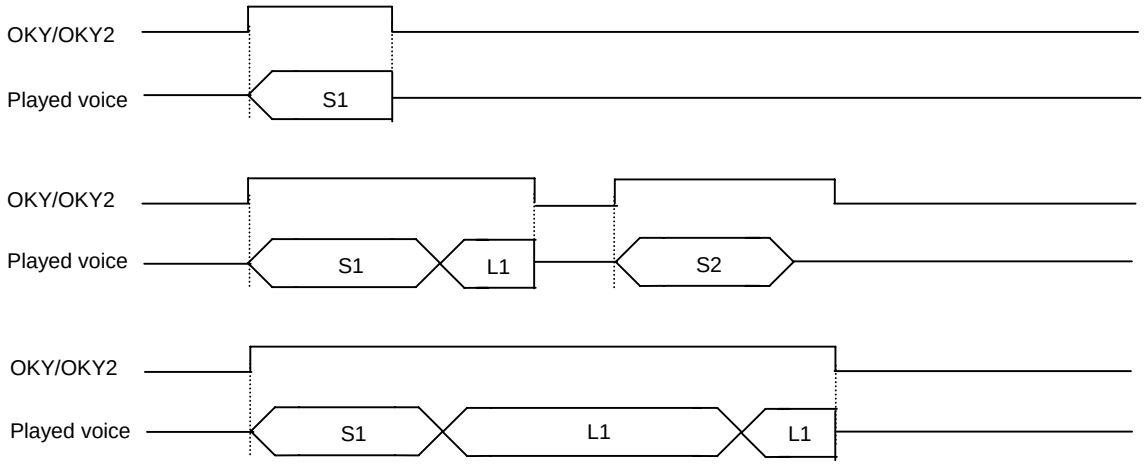
The timing diagram is similar with (5-a) "Jumping without Looping" except the last self-looping.

I) OKY/OKY2(E/U/I) =S1 L1 S2 S3, IO1/IO2/IO3 (x/x/x) = Sn

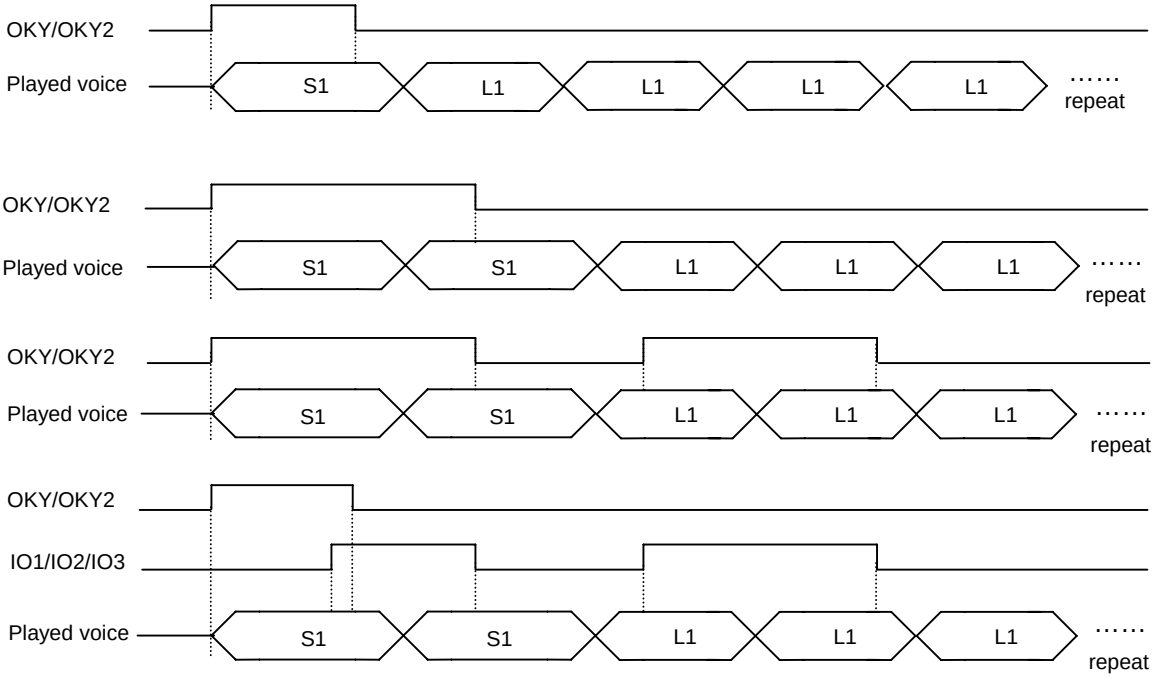


※ While playing OKY's voice (S1 or L1), to trigger OKY or IO1 is not active at Edge/Irretrigger mode.

II) OKY/OKY2(E/H/x) =S1 L1 S2 S3

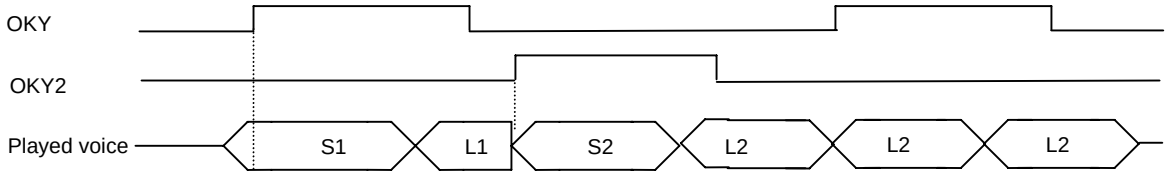


III) OKY/OKY2(L/U/I) =S1 L1 S2 S3

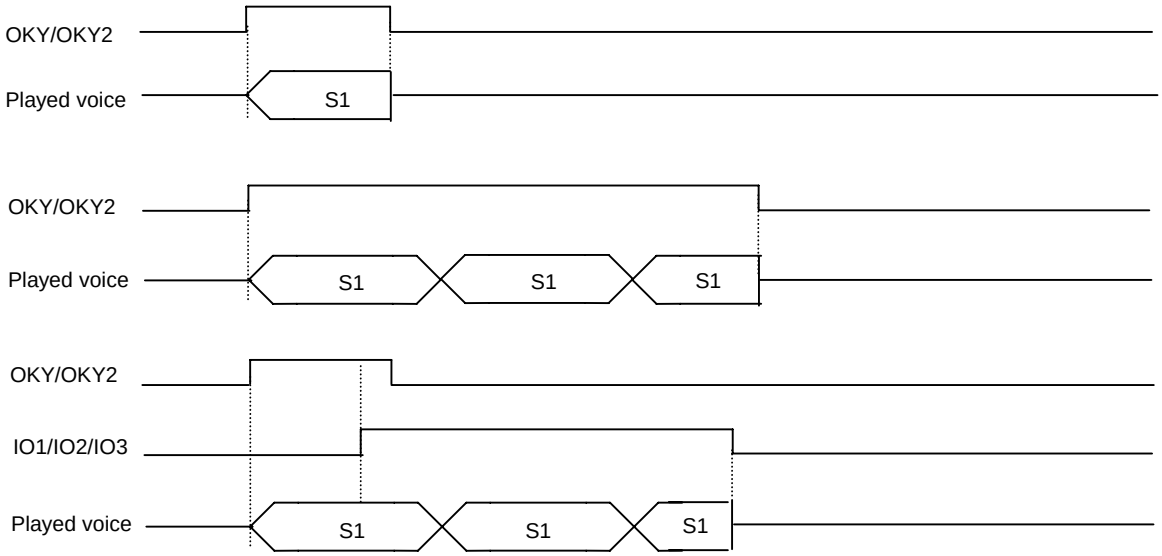


※ While playing OKY's voice, to trigger IO1 is recognized as to trigger OKY. Reload function doesn't work.

IV) OKY(E/U/R) = S1 L1 , OKY2 (E/U/I) =S2 L2



V) OKY/OKY2(L/H/x) =S1 L1 S2 S3, IO1/IO2/IO3 (x/x/x) = Sn

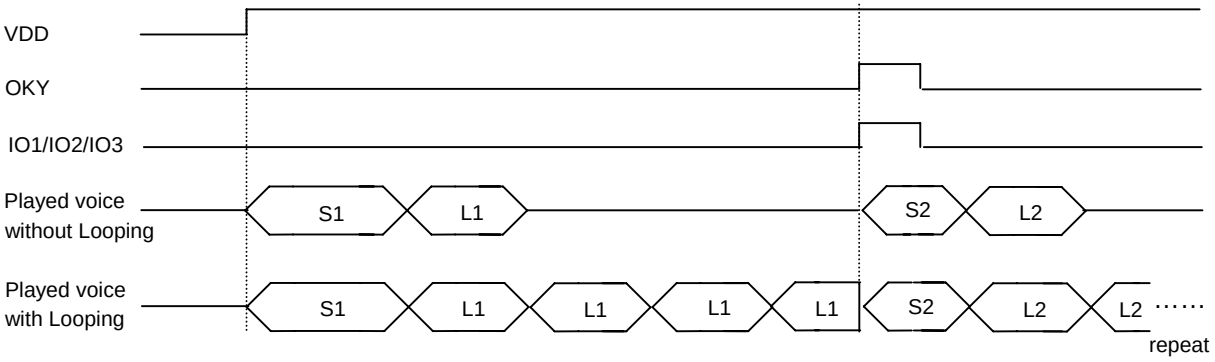


※ Without Different Input Reload, while playing OKY's voice, to trigger IO1 is recognized as to trigger OKY.

c) PowerOnPlay with Jumping and Looping or without Looping

The trigger mode of PowerOnPlay is fixed as E/U/R, other trigger signal will stop PowerOnPlay's voice immediately and play the interrupted trigger's voice no matter what condition is Reload or Jumping.

PowerOnPlay (E/U/R) =S1 L1, OKY/OKY2(x/U/l) = S2 L2, IO1/IO2/IO3 = S3 L3



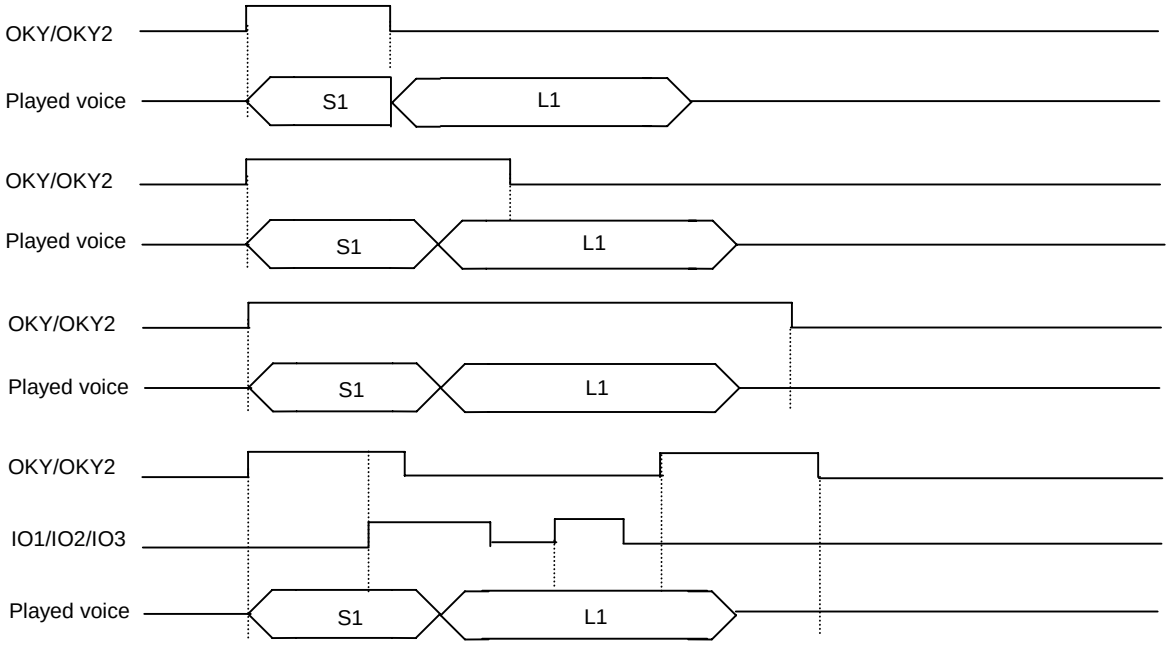
※ Priority: OKY > IO1 > IO2 >IO3 > OKY2/O4 > PowerOnPlay

(6) KeyReleaseJump Function

KeyReleaseJump is a combined function of Hold and Jumping. It is a special setting, when trigger is released, the voice immediately stop and jump to Jumping sub_table. When tick this option, all input pins are in KeyReleaseJump condition.

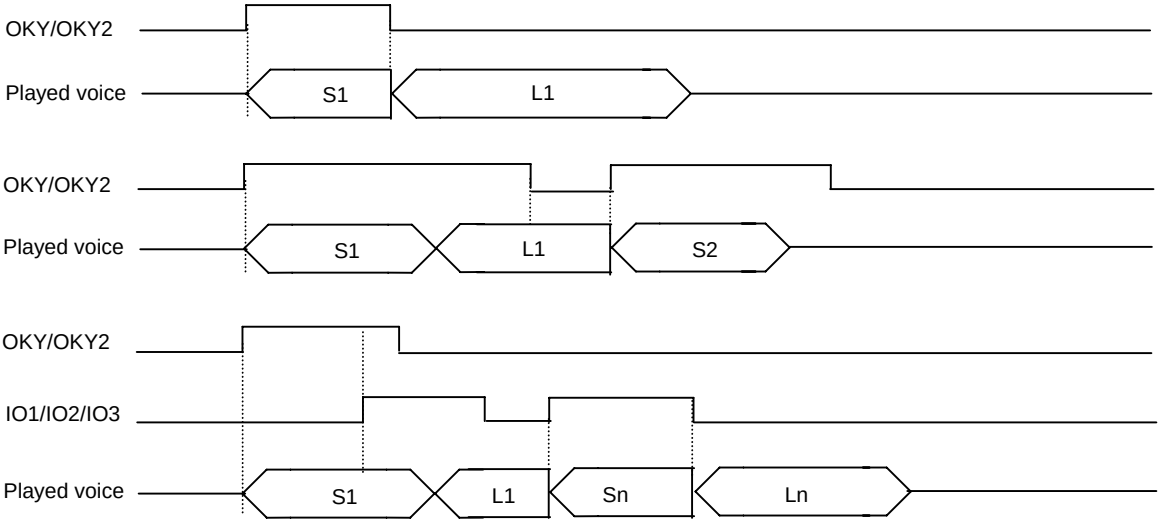
a) KeyReleaseJump with Jumping and without Looping

I) OKY/OKY2(E/x/I) =S1 L1 S2 S3, IO1/IO2/IO3 (x/x/x) = Sn Ln (L1 means the Jumping sub_table of S1)



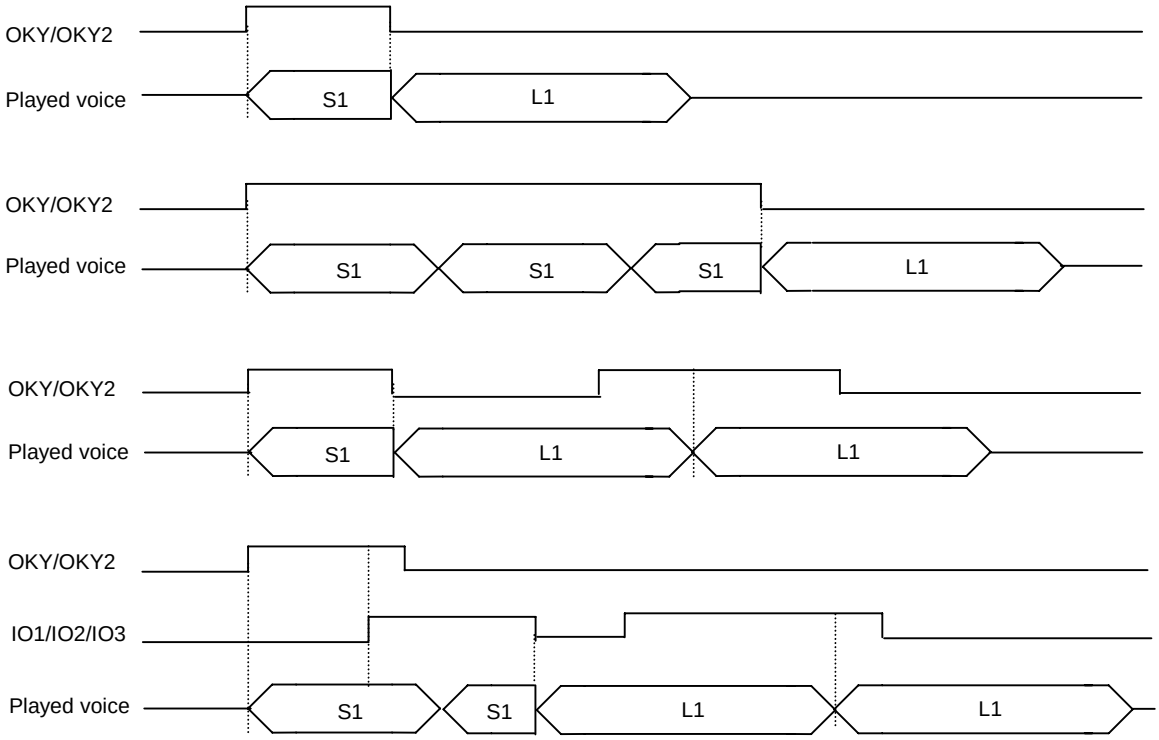
※ While playing OKY's voice (S1 or L1), to trigger OKY or IO1 is not active at Edge/Irretrigger mode.

II) OKY/OKY2(E/x/R) =S1 L1 S2 S3, IO1/IO2/IO3 (x/x/x) = Sn Ln



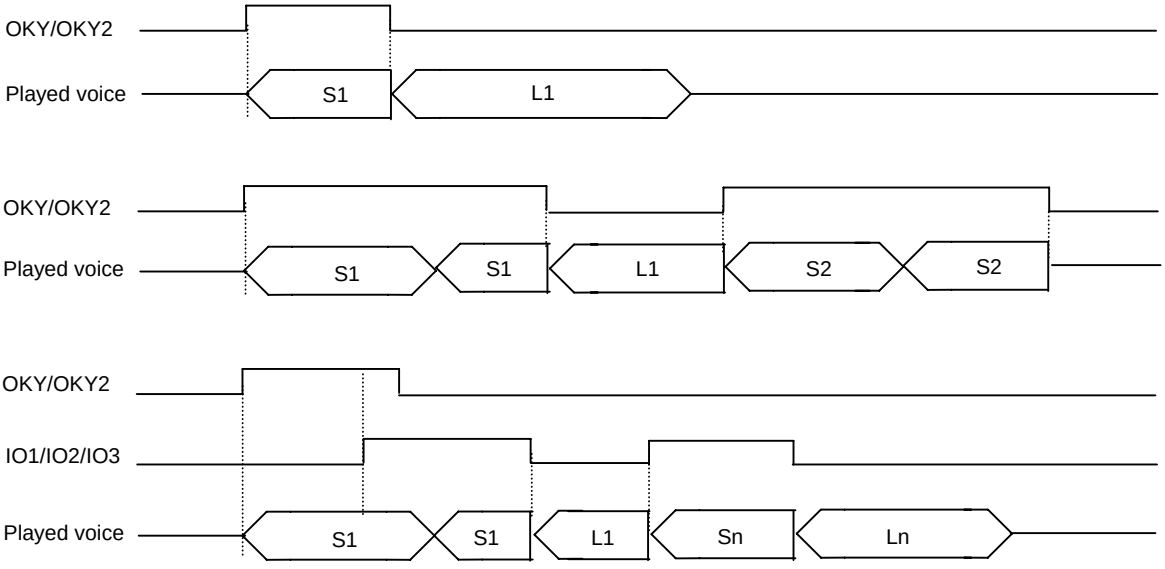
※ While playing OKY's Looping voice (L1, key is released), to trigger OKY or IO1 is active at Retrigger mode.

III) OKY/OKY2(L/x/l) =S1 L1 S2 S3, IO1/IO2/IO3 (x/x/x) = Sn Ln



※ While playing OKY's voice (S1 or L1), to trigger IO1 is recognized as to trigger OKY.

IV) OKY/OKY2(L/x/R) =S1 L1 S2 S3, IO1/IO2/IO3 (x/x/x) = Sn Ln

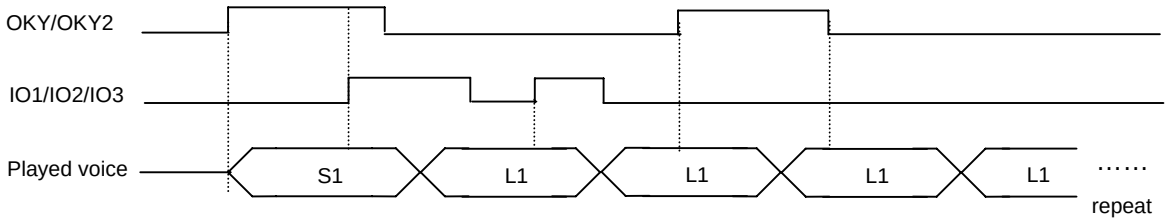


※ While playing OKY's Looping voice (L1, key is released), to trigger OKY or IO1 is active at Retrigger mode.

b) KeyReleaseJump with Jumping and Looping

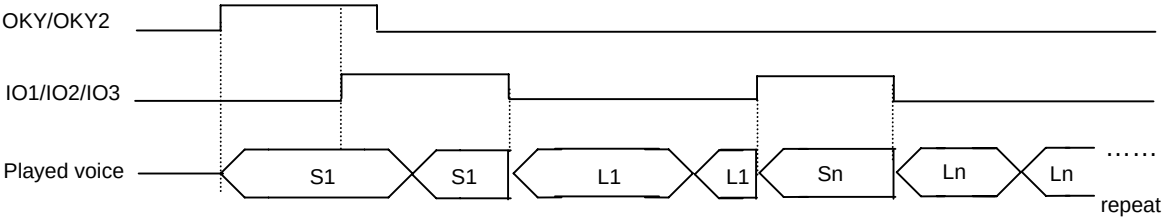
The timing diagrams are similar with (6-a.) “Jumping Without Looping” except the last self-looping.

I) OKY/OKY2(E/x/I) =S1 L1 S2 S3, IO1/IO2/IO3 (x/x/x) = Sn Ln (L1 & Ln are set Looping)



※ While playing OKY’s voice (S1 or L1), to trigger OKY or IO1 is not active at Edge/Irretrigger mode.

II) OKY/OKY2(L/x/R) =S1 L1 S2 S3, IO1/IO2/IO3 (x/x/x) = Sn Ln (L1 & Ln are set Looping)

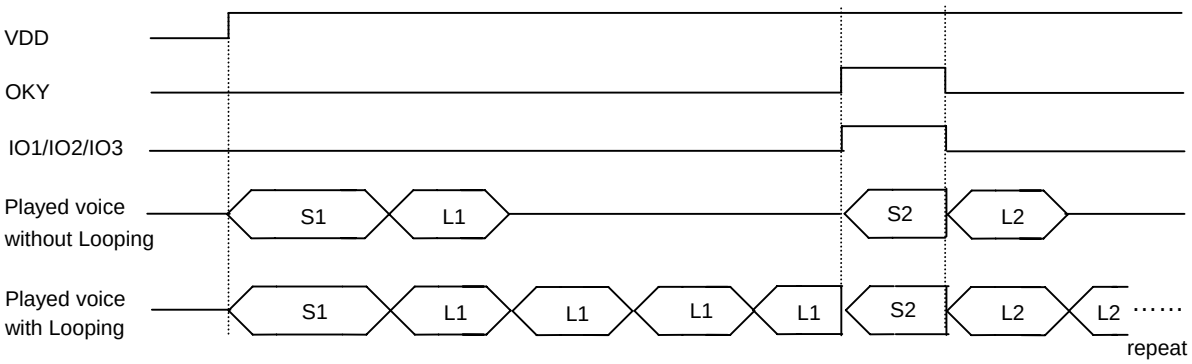


※ While playing OKY’s Looping voice (L1, key is released), to trigger OKY or IO1 is active at Retrigger mode.

c) PowerOnPlay with KeyReleaseJump

The trigger mode of PowerOnPlay is fixed as E/U/R, other trigger signal will stop PowerOnPlay’s voice immediately and play the interrupted trigger’s voice no matter what condition is Reload or Jumping.

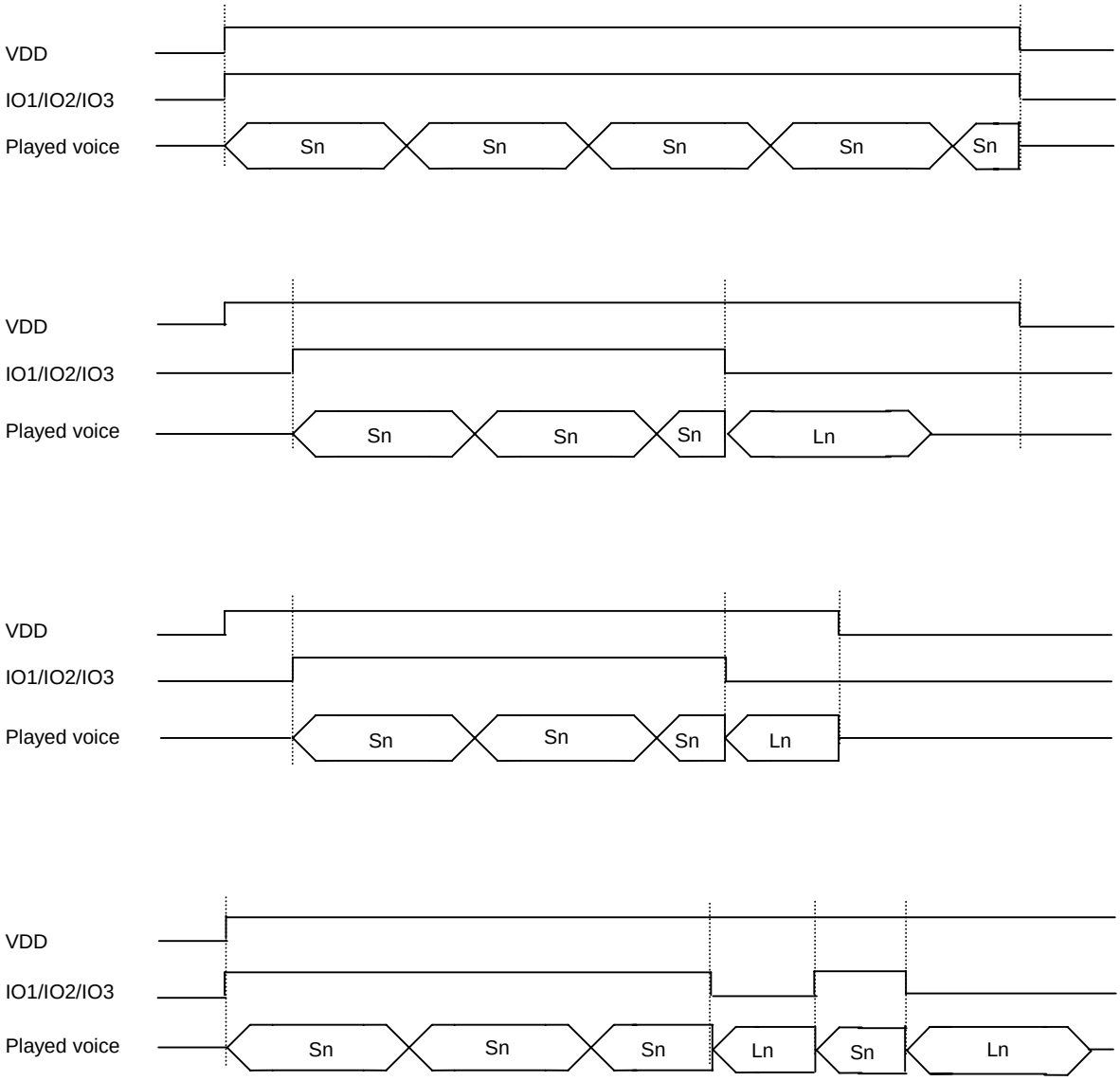
PowerOnPlay (E/U/R) =S1 L1, OKY/OKY2(x/U/I) = S2 L2, IO1/IO2/IO3 = S3 L3



※ Priority: OKY > IO1 > IO2 >IO3 > OKY2/O4 > PowerOnPlay

(7) KeyReleaseJump function is set.

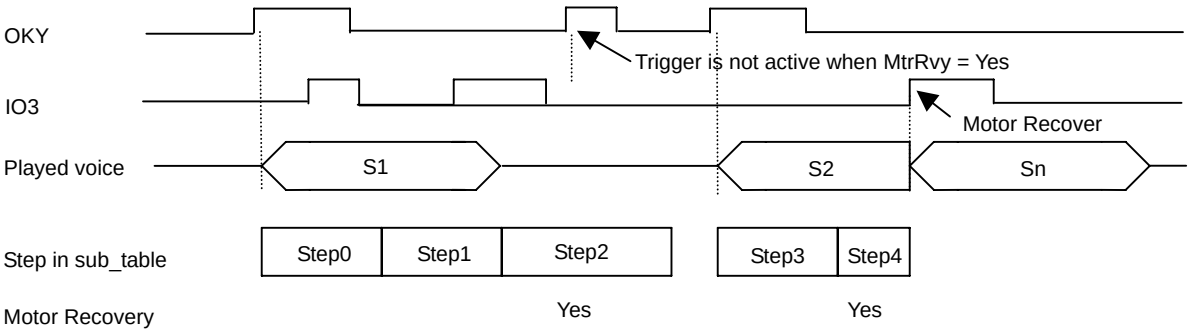
IO1/IO2/IO3 (L/x/R) =Sn Ln, long debounce (Ln is for Jumping, usually play greeting voice)



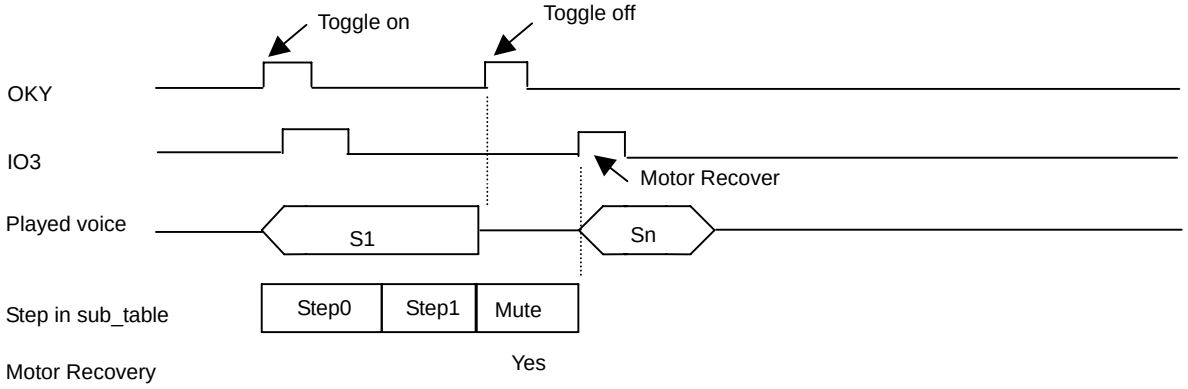
(8) Motor Recovery Function

Use Motor Recovery function can make IO3 be triggered only when MtrRvy function invoked by the voice_step of sub_table.

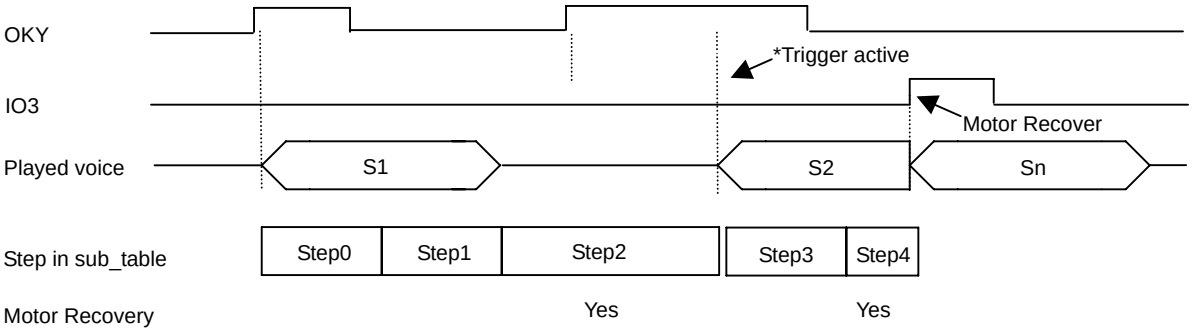
OKY (E/U/R) = S1 S2, (S1= step0 + step1 + step2, S2= step3 + step4), IO3 (E/U/R) =Sn



OKY (E/U/R) = S1 S2, (S1= step0 + step1 + step2 (Jump to Mute), S2= step3 + step4), IO3(E/U/I) =Sn



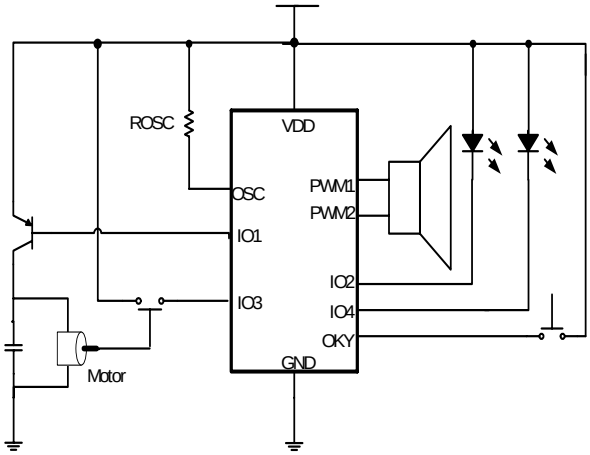
OKY (E/U/R) = S1 S2, (S1= step0 + step1 + step2, S2= step3 + step4), IO3 (E/U/R) =Sn



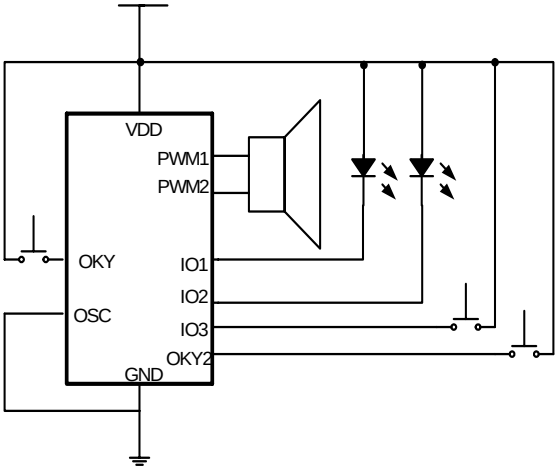
*Because trigger disable when MtrRvy=Yes but will enable when MtrRvy end.

10. APPLICATION

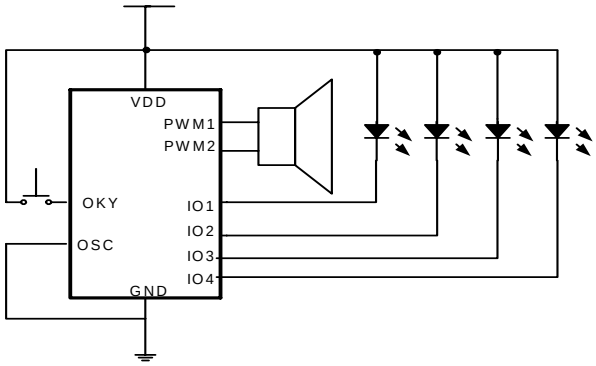
(1) OKY is input, IO1 is output, IO3 is for Motor recovery input



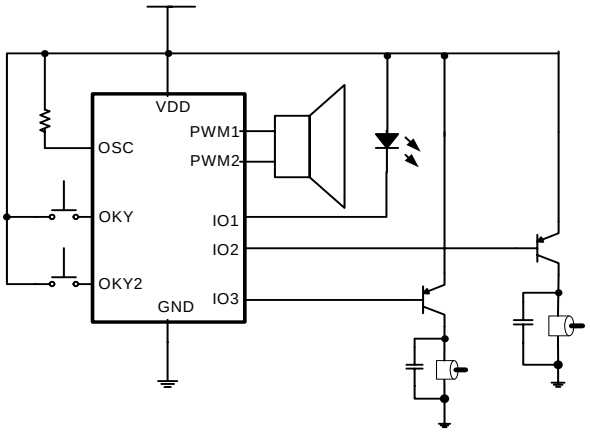
(2) 3 triggers, 2 LED, using external oscillator



(3) 1 input, 4 LEDs, internal oscillator
IO1/IO2/IO3/IO4 are output



(4) 2 triggers, 1 LED, 2 motors, external oscillator
IO1/IO2/IO3 are output



* IO1/IO2/IO3 are set to output mode, select "Sync output" for driving 2 motors, 1 LED.

* While driving motor, one capacitor is suggested to put between Vdd and GND.

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

11.BONDING DIAGRAM