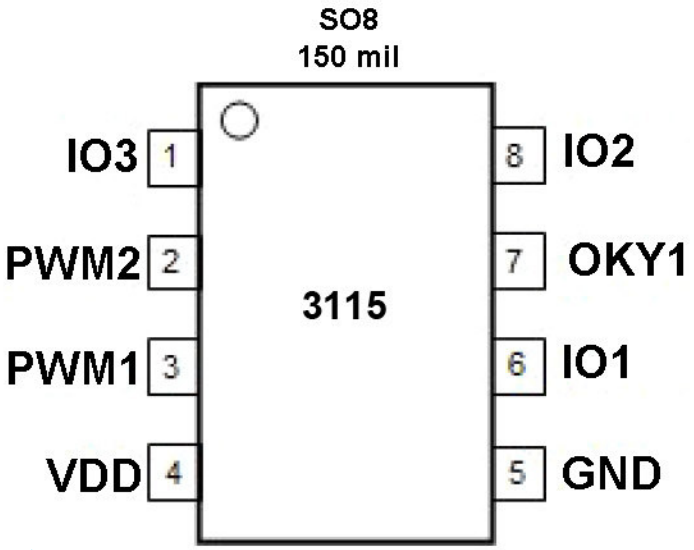



## FEATURES

- Wide operating voltage: 1.8V ~ 5.5V.
- Low Voltage Reset (LVR=1.8V) is supported.
- One 10-bit PWM output. There are 2 kinds of PWM output, normal and large. It can directly drive 8, 16, 32, 64Ω speaker.
- Only build in an accurate internal oscillator of +/- 0.5% tolerance, *no external R oscillator*.
- There are 4 kinds of output current option for all output pins.
  (a). Normal Sink Current output: Output is connected a LED with VDD. ($I_{ol}$=22mA/33mA @$V_{DD}$=3V/4.5V)
  (b). Large Sink Current output: Output is connected a LED with VDD. ($I_{ol}$=65mA/85mA @$V_{DD}$=3V/4.5V)
  (c). Constant Sink Current output: Output is connected a LED with VDD. Whenever VDD is 3V or 4.5V, the output current is constant and LED brightness is uniform. ($I_{ol}$=20mA/21mA @$V_{DD}$=3V/4.5V)
  (d). Drive Current output: Output is connected a LED with GND. ($I_{oh}$=7mA/11mA @$V_{DD}$=3V/4.5V)
- There are 9 kinds of output option for all output pins:
  (a). Stop_Low pulse: Low active stop-pulse output whenever device stops playing.
  (b). Stop_High pulse: high active stop-pulse output whenever device stops playing.
  (c). Busy_High active: high active signal output during playing. (Drive output)
  (d). Busy_Low active: low active signal output during playing. (Sink output)
  (e). LED 3Hz flash: 3Hz sink signal output to drive LED during playing.
  (f). LED 6Hz flash: 6Hz sink signal output to drive LED during playing.
  (g). LED 12Hz flash: 12Hz sink signal output to drive LED during playing.
  (h). LED dynamic 1/2: according to 1/2 sound level, dynamic sink signal output to drive LED during playing.
- Input option for input pin:
  Each input can select Edge/Level, Hold/Unhold and Retrigger/Irretrigger trigger modes.
  Each input can select 300K、1.5M pull-low resistor or Floating type.
  Each input can select Debounce time: Long debounce for push-button. Short debounce for fast switch.
  . Only one input pin can select Toggle On/Off function (1st Trigger → play, 2nd trigger → stop, ……).

## PAD DESCRIPTION

| Pad Name | Pin No. | ATTR. | Description |
|---|---|---|---|
| IO3 | 1 | I/O | Output or input pin. To be input, active high. |
| PWM2 | 2 | O | PWM output 2 |
| PWM1 | 3 | O | PWM output 1. |
| VDD | 4 | Power | Positive power. |
| GND | 6 | Power | Negative power. |
| IO1 | 3 | I/O | Output or input pin. To be input, active high. |
| OKY1 | 7 | I | Input pin, active high. |
| IO2 | 8 | I/O | Output or input pin. To be input, active high. |

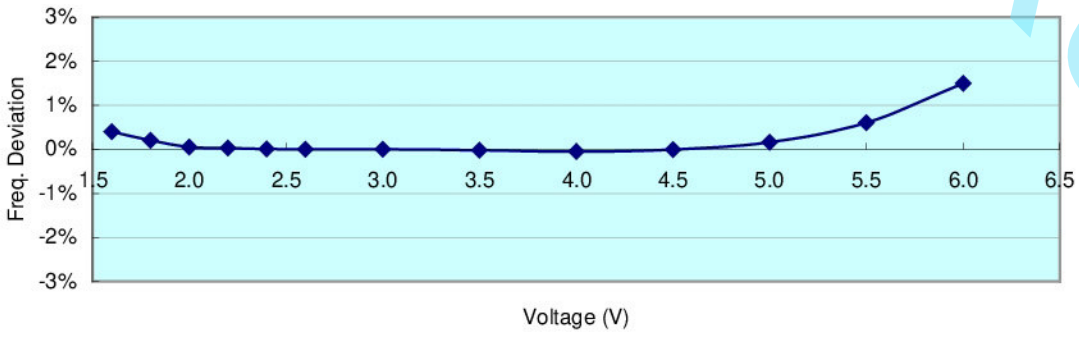
## ABSOLUTE MAXIMUM RATING

| Symbol | Rating | Unit |
|---|---|---|
| VDD~GND | -0.5 ~ +7.0 | V |
| $V_{in}$ | GND-0.3 < $V_{in}$ < VDD+0.3 | V |
| $V_{out}$ | GND < $V_{out}$ < VDD | V |
| $T_{op}$ (operating) | -0 ~ +70 | ºC |
| $T_{st}$ (storage) | -55 ~ +150 | ºC |

## DC CHARACTERISTICS

| Symbol | Parameter | VDD | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|---|
| VDD | Operating voltage | -- | 1.8 | 3.0 | 5.5 | V | 1.54MHz |
| $I_{SB}$ | Standby current | 3.0 | | 0.1 | 0.5 | uA | LVR and POP disabled |
| | | 4.5 | | 0.1 | 0.5 | | |
| | | 3.0 | | 1.0 | | | LVR or POP enabled |
| | | 4.5 | | 2.0 | | | |
| $I_{OP}$ | Operating current | 3.0 | | 0.4 | | mA | No load. |
| | | 4.5 | | 0.7 | | | |
| $I_{IH}$ | Input current (1.5M ohms pull-low) | 3.0 | | 2 | | uA | $V_{IL}$=VDD |
| | | 4.5 | | 5 | | | |
| | Input current (300K ohms pull-low) | 3.0 | | 30 | | uA | |
| | | 4.5 | | 85 | | | |
| $I_{OH}$ | Output drive current | 3.0 | | -7 | | mA | $V_{OH}$=2.0V |
| | | 4.5 | | -11 | | | $V_{OH}$=3.5V |
| $I_{OL}$ | Output normal sink current | 3.0 | | 22 | | mA | $V_{OL}$=1.0V |
| | | 4.5 | | 33 | | | |
| | Output large sink current | 3.0 | | 65 | | mA | |
| | | 4.5 | | 85 | | | |
| | Output constant sink current | 3.0 | | 20 | | mA | |
| | | 4.5 | | 21 | | | |
| $I_{PWM}$ | PWM output current (Normal) | 3.0 | | 60 | | mA | Load=8 ohms |
| | | 4.5 | | 100 | | | |
| | PWM output current (Large) | 3.0 | | 70 | | mA | |
| | | 4.5 | | 117 | | | |
| ΔF/F | Frequency deviation by voltage drop | 3.0 | | 0.1 | | % | $\frac{Fosc(3.0v)-Fosc(2.4v)}{Fosc(3v)}$ |
| | | 4.5 | | -0.1 | | | $\frac{Fosc(4.5v)-Fosc(3.0v)}{Fosc(4.5v)}$ |
| | Frequency lot deviation | -- | -0.5 | | 0.5 | % | $\frac{Fmax(VDD)-Fmin(VDD)}{Fmax(VDD)}$ |
| Fosc | Oscillation Frequency | -- | 1.50 | 1.54 | 1.58 | MHz | VDD=1.8~5.5V |

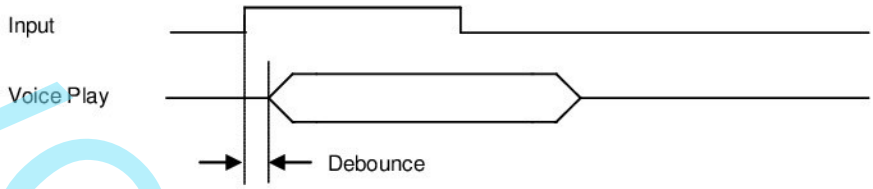
**Voltage vs Freq. Deviation** (SR=6.0KHz@3V)



## TIMING DIAGRAM

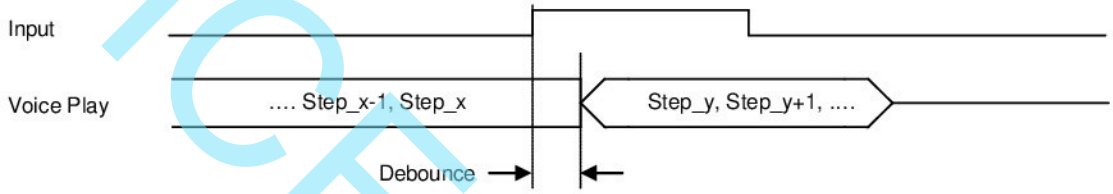
### (1) Debounce Time

***(a). Trigger while no playing voice***




※ Debounce time is configured by 6.67 kHz S.R and the value is fixed. That is, Long debounce=31ms, Short debounce = 42us

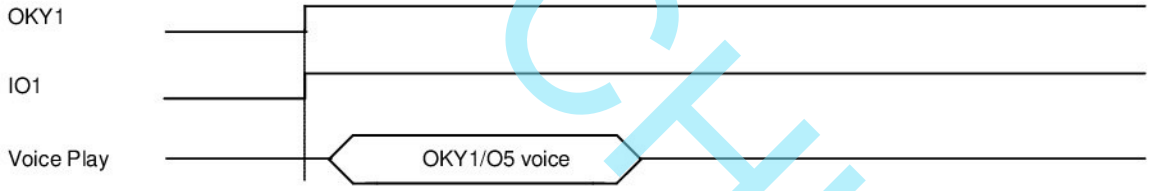
***(b). Trigger While playing voice***




※ Debounce Time is configured by the S.R. of Step_x. At S.R. = 6kHz, Long debounce = 45ms, Short debounce = 50us

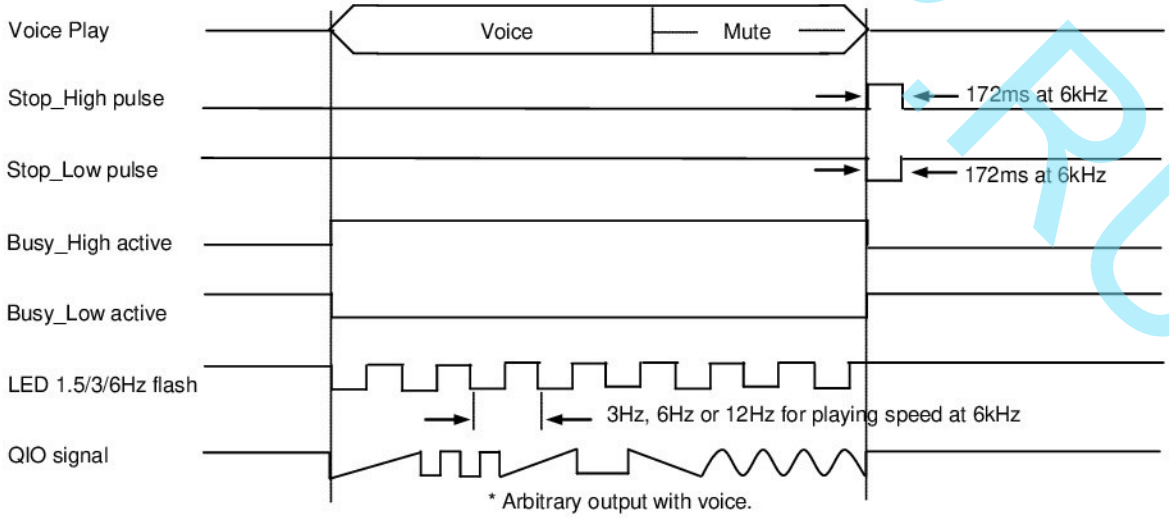
For example, if Step_x S.R. = 8kHz, Long debounce = 45ms*(6k/8k) = 15ms, Short debounce = 50us*(6k/8k) = 37.5us

### (2) Input Priority




※ Priority: OKY1/O5 > OKY2 > IO1 > IO2 > IO3

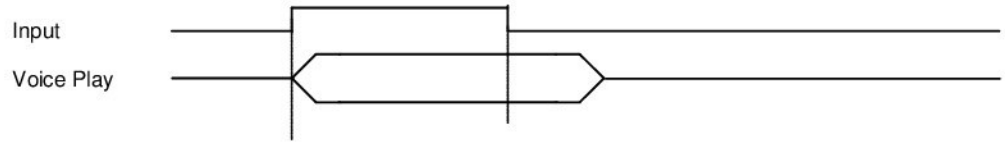
### (3) Output Signal (IO1, IO2, IO3, O4)



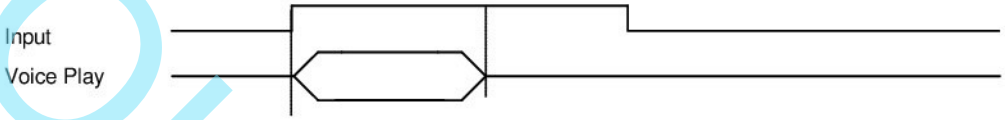

LED dynamic 1/2: When the voice amplitude is higher than 1/2 level, LED will be ON, i.e. output signal is low.

## (4) Basic Operation

***(a). Edge mode, Edge trigger***

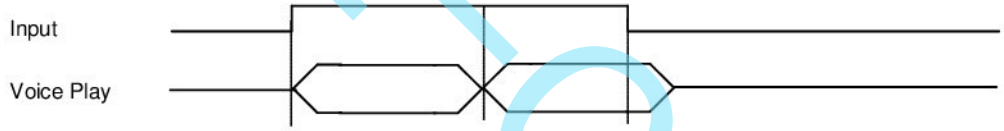



***(b). Edge mode, Level trigger***

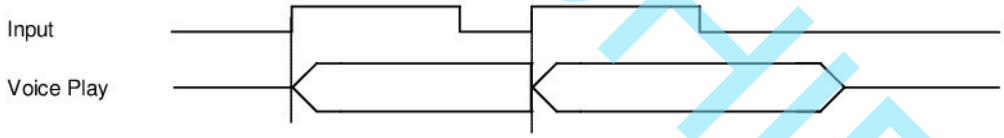



***(c). Level mode, Edge trigger***


***(d). Level mode, Level trigger***

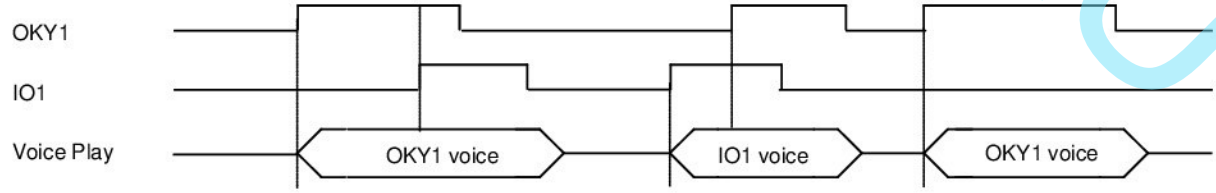



***(e). Retrigger mode***




***(f). Irretrigger mode***

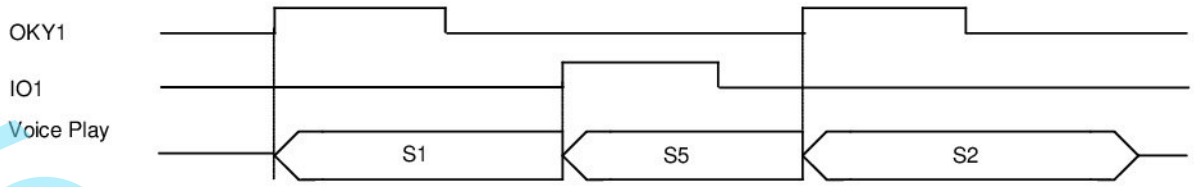

***(g). Retrigger mode, first key priority***



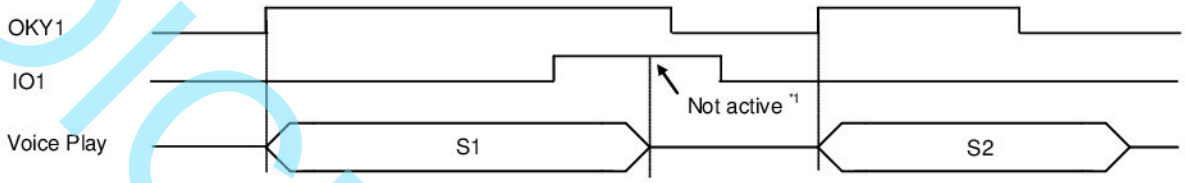
## (5) Advanced Operation

***(a). Different Input Reload*** *( OKY1 is in Sequential mode )*

*(a-1) OKY1 (E/U/R) = S1 S2 S3 S4, IO1(E/U/R) = S5 (S1 means Sentence 1)*

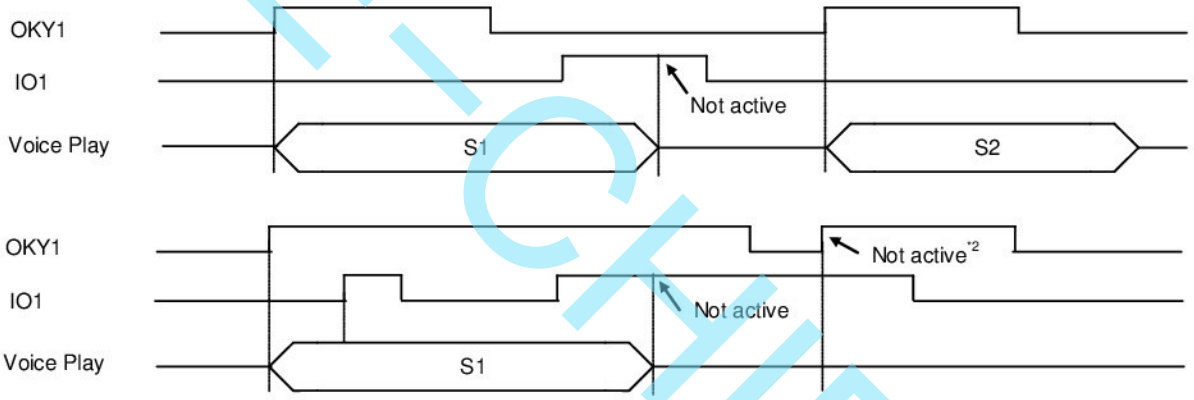



*(a-2) OKY1 (E/U/R) = S1 S2 S3 S4, IO1 (L/x/x) = S5*



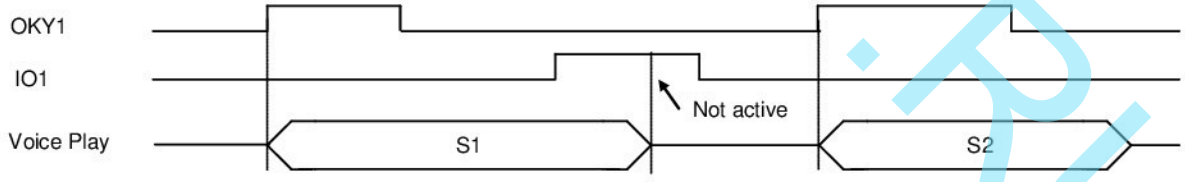

*1: If you press IO1 during OKY1 voice playing, at the moment of S1 end, the trigger mode follows OKY1

*(a-3) OKY1 (E/U/I) = S1 S2 S3 S4, IO1 (E/x/x) = S5*

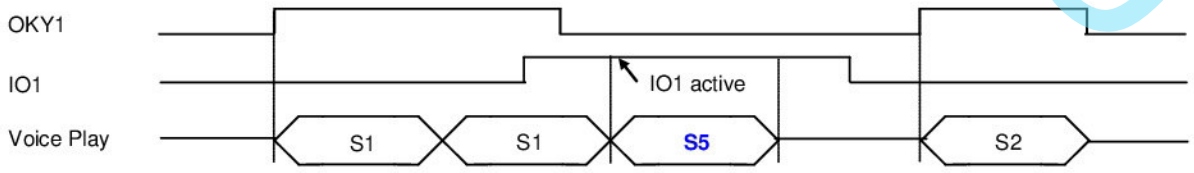



*2: Because IO1 signal is still high in the same time IC can't accept the OKY1 Edge signal.

*(a-4) OKY1 (E/U/I) = S1 S2 S3 S4, IO1 (L/x/x) = S5*



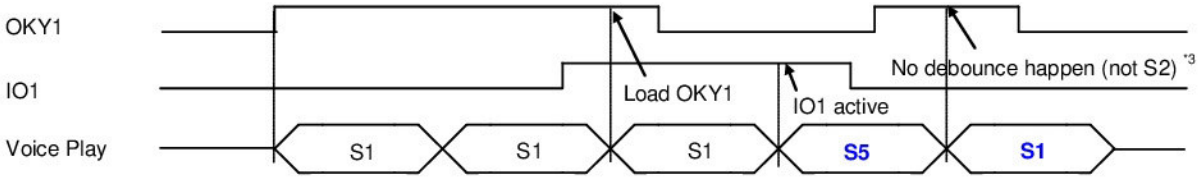

*(a-5) OKY1 (L/U/x) = S1 S2 S3 S4, IO1 (E/x/x) = S5*




※ In the time of Sentence end: When S1 end, the trigger mode follows OKY1 (L/U/x). When S5 end, it follows IO1 (E/x/x).

※ Once S5 is played (just leave S1 ending), the trigger mode follows IO1 (E/x/x) immediately.

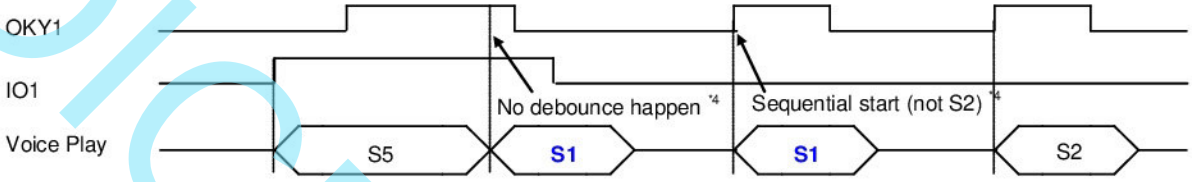
*(a-6) OKY1 (L/U/x) = S1 S2 S3 S4, IO1 (L/U/I) =S5*




※ Reload key priority: OKY1 > IO1

*3: In OKY1 mode, Sequential number is counted only if there is debounce happened.

*(a-7) OKY1 (L/U/x) = S1 S2 S3 S4, IO1 (L/U/x) =S5*

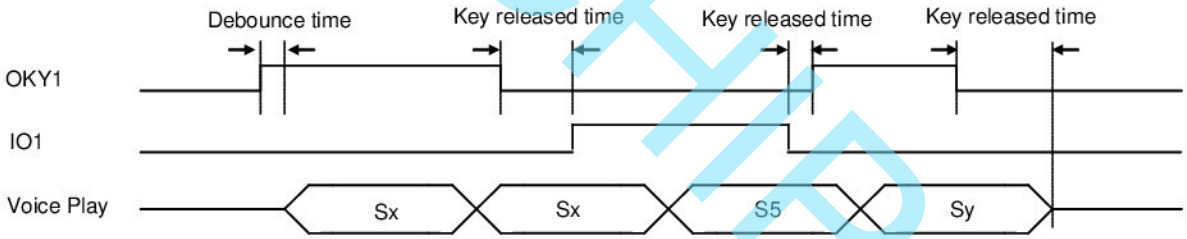



*4: In OKY mode, 1st trigger without debounce and Sequential number is still "1". 2nd trigger with debounce, after trigger the Sequential number become "2".

***(b). Random Function***

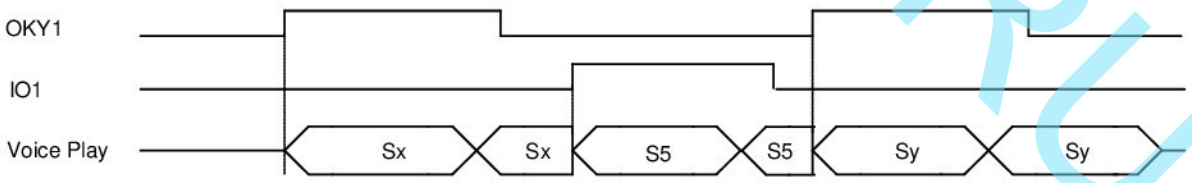
*(b-1) OKY1 (L/U/I) =S1 S2 S3 S4, IO1 (L/U/I) =S5*

Random (or Sequential) number is counted during "debounce time" or "key released time". But the first-time trigger only relies on "debounce time" due to no "key release time".



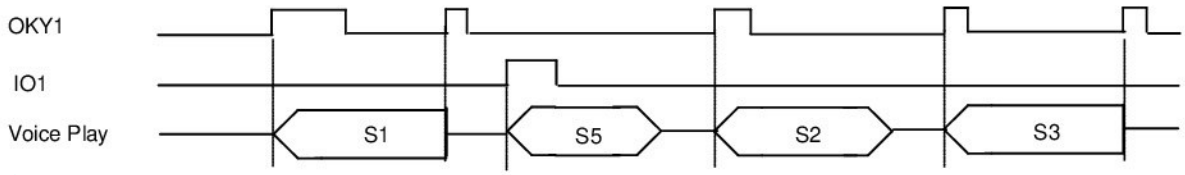

x=1, 2, 3 or 4; y=1, 2, 3 or 4 (x and y are random number)

*(b-2) OKY1 (L/U/R) =S1 S2 S3 S4, IO1 (L/U/R) =S16*

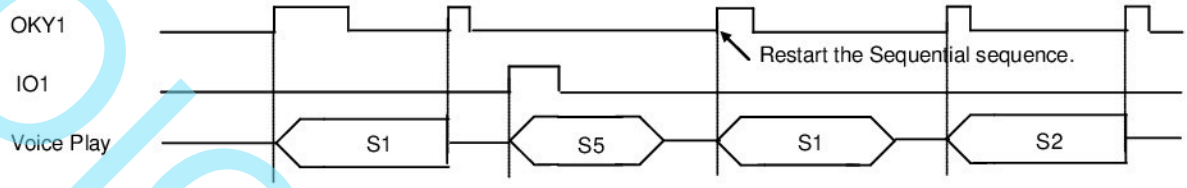


***(c). Toggle On/Off Function***

*(c-1) OKY1 (E/U/R) =S1 S2 S3 S4, IO1 (E/U/R) =S5 (OKY1 is Sequential mode without Reset)*



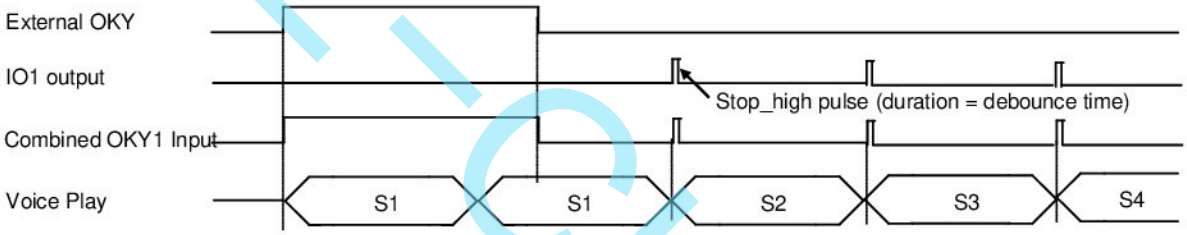

*(c-2) OKY1 (E/U/R) =S1 S2 S3 S4, IO1 (E/U/R) =S16 (OKY1 is Sequential mode with Reset)*




※ When OKY1 Sequential counter is going, to trigger other inputs will reset OKY1 Sequential sequence.

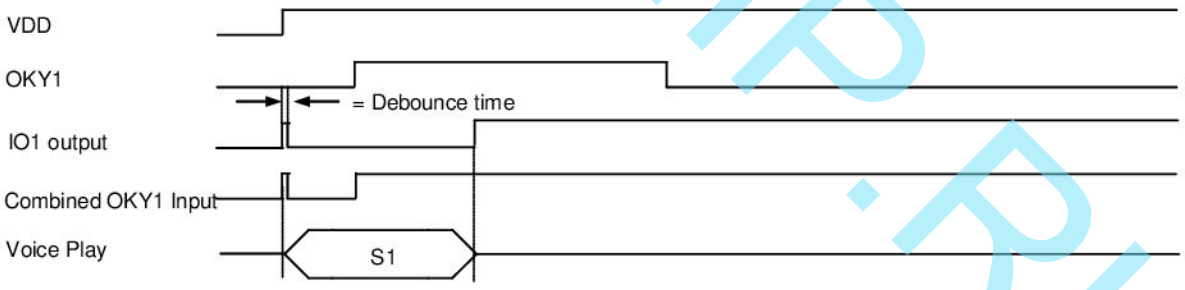
***(d). External Feedback Function*** *( IO1 is output and connected to OKY1 input )*

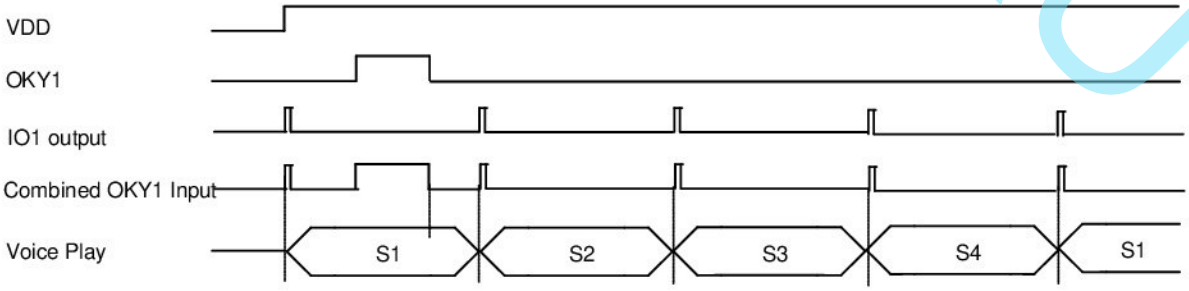
*(d-1) OKY1 (L/U/I) =S1 S2 S3 S4, IO1=Stop_high pulse (When voice ends, IO1 shows a high pulse.)*




※ Originally the duration of Stop_high pulse is 172ms at 6kHz, but the high signal will trigger voice and turn low after debounce.

*(d-2) OKY1 (E/U/I) = S1 S2 S3 S4, IO1= Busy_low (When not playing voice, IO1 is high.)*



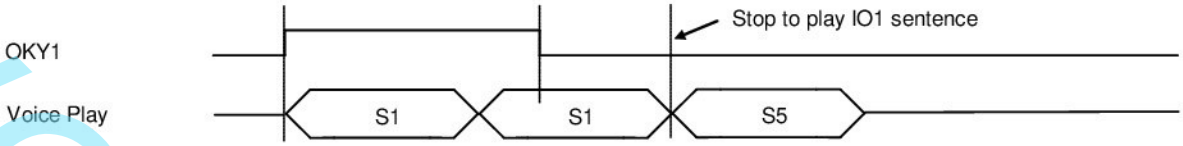

※ When power on, IO1 will generate a high pulse at Busy_low status and the duration is equal to debounce time.

***(e). Internal-Feedback Function*** *( OKY1/O5 is fixed as input )*

Each sentence can assign an Internal-Feedback Path to play a fixed sentence after IO's sentence stop.

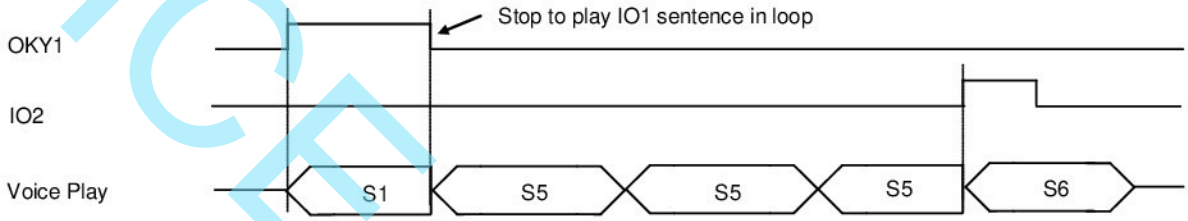
*(e-1) OKY1 (L/U/I) = S1 S2 S3 S4, OKY2 = S5, Internal-Feedback Path = OKY1/O5 → OKY2*

*If S1 is optioned with Internal-Feedback Path,*




*(e-2) OKY1 (L/H/I) = S1 S2 S3 S4, OKY2 (x/x/R) = S5, IO2 (E/U/I) = S6, Internal-Feedback Path = OKY1/O5 → OKY2*

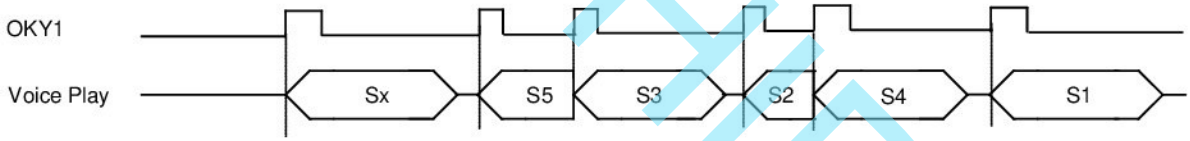
*If both S1 and S5 are optioned with Internal-Feedback Path,*




***(f). Table-Random Function***

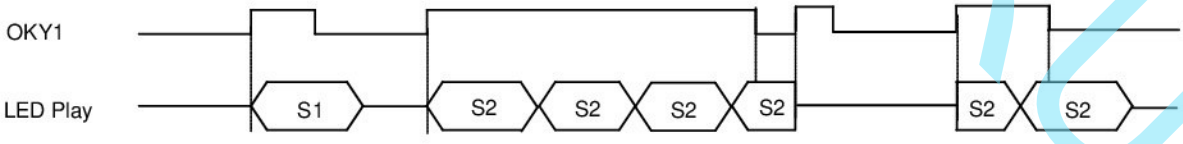
When power in on, a random number is counted automatically. The first-time trigger will play the sentence of random number (Sx), and the next trigger will be sequential.

*(f-1) OKY1 (E/U/R) = S3 S2 S5 S4 S1 S3 S2 ..... Sx S5 S3 S2 S4 S1 S3 S2 S5 S1 S4 S5 S3 S1 S2*



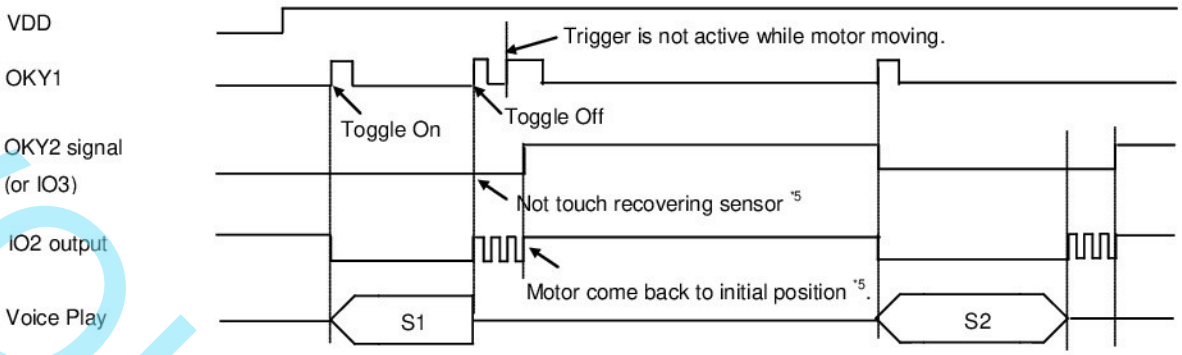

***(g). Pause-Resume Function***

*(g-1) OKY1 (L/U/R) = S1 S2*



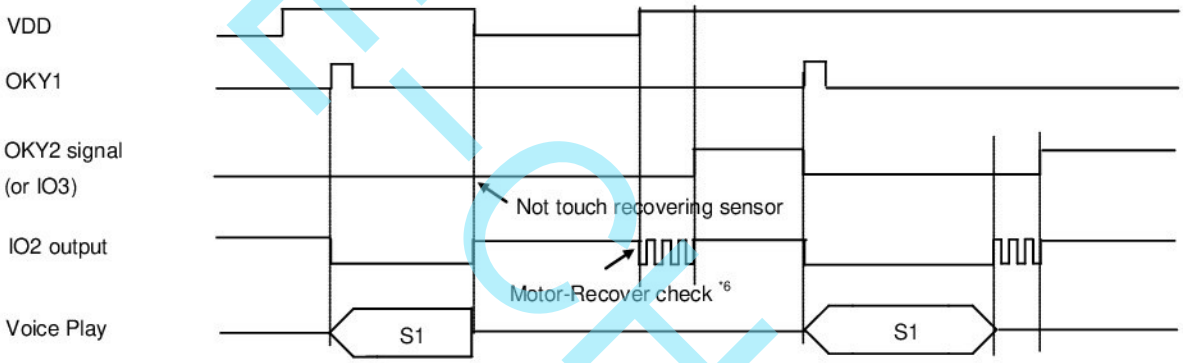
***(h). Motor-Recover Function***

*(h-1) OKY1 (E/U/R) = S1 S2 S3 S4, IO2= Busy_low (OKY1 is Toggle On/Off and OKY2 is connected to sensor.)*




*5: If motor doesn't stop at initial position when voice stop playing, IO2 will output one kind of signal (DC, 15Hz or 30Hz option) to keep motor moving to initial position.

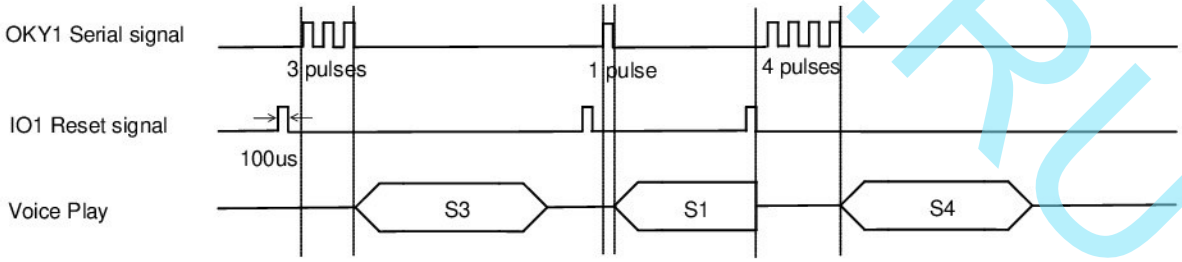
*(h-2) OKY1 (E/U/R) = S1 S2 S3 S4, IO2= Busy_low (OKY1 is Toggle On/Off and OKY2 is connected to sensor.)*




*6: If motor doesn't stay at initial position when power-on, IO2 will output one kind of signal (DC, 15Hz or 30Hz option) to keep motor moving to initial position.

***(i). Serial-Trigger Function*** *(All inputs must be set as short debounce)*

*OKY1 (E/U/R) =S1 S2 S3 S4, IO1 (E/U/R) =S5 (OKY1 Reset is enabled, and S5 is a short mute Sentence)*

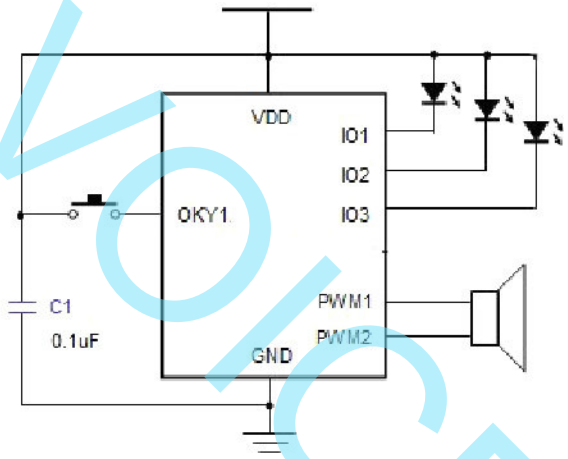



※ The pulse width must be longer than 50us (i.e. short debounce time), and users can set the typical pulse width as 100us.

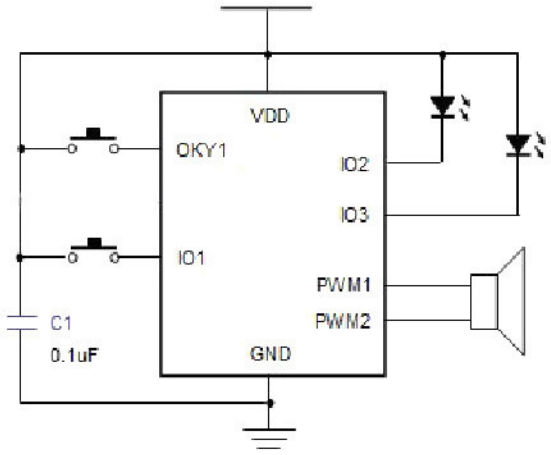
※ The above is the simplest 2-wire control by external MCU. If necessary, user can use 3-wire control with Busy_High output signal to do feedback.

## APPLICATION

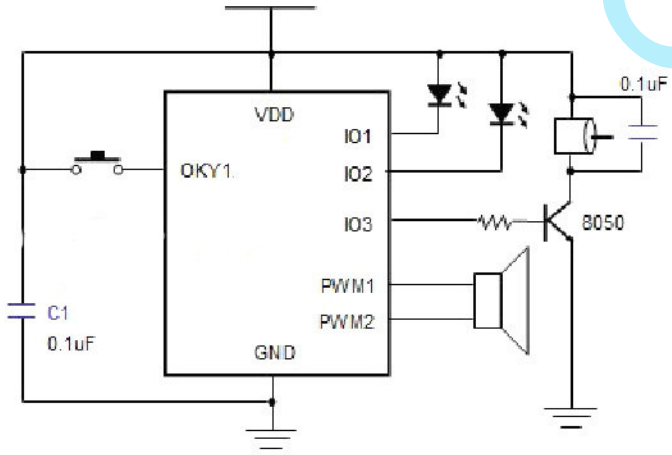
(1) 1 trigger with 3 LEDs (Sink)



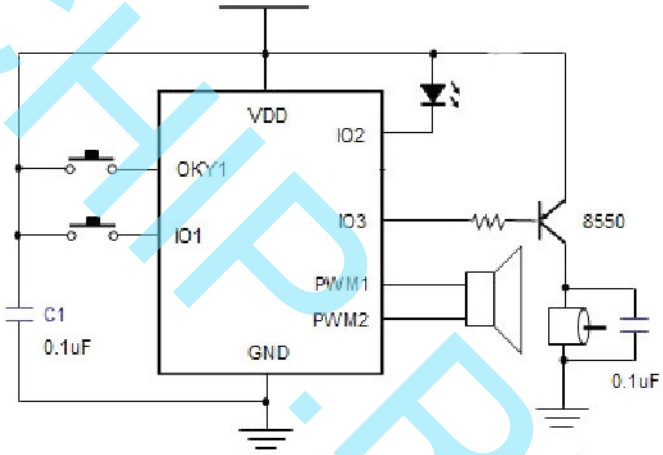

(2) 2 triggers with 2 LEDs (Sink)




(3) 1 triggers with 2 LEDs (Sink) and 1 motor (Drive)




(4) 2 triggers with 1 LED (Sink) and 1 motor (Sink)




*Note: C1 is VDD power cap, please MUST connect a 0.1uF cap between VDD and GND, or there will be noise while playing voice.*