

# HK16XX

## VOICE/SPEECH IC

## 3-24 SECOND MASK IC BODY

### Features

- \* Single power supply can operate from 2.4v through 5v.
- \* The total voice duration is about 3,6,9,12,18,24 seconds could be partitioned up to 32 voice sections.  
each voice section could have 4 playing\_length, the longest one is the original voice+mute length.
- \* Voice + mute length could up to 22 seconds ( 6k sample rate ) for each voice section.
- \* One 255 voice-steps table, could be partitioned up to 32 groups of voice-step.  
For each voice-step, could specify one length of one voice section and one of 5 levels playback speed and STS1,STS2, STS3,STS4 enable options.  
playback speed : 1>4.3k ; 2>5k ; 3>6k ; 4>7.5k ; 5>10khz.  
STS4,3,2,1 enable options : each with one control bit.  
( dec to bin ; '0' -> enable , '1' -> disable )
- \* Three mask option trigger input mode : MATRIX , ALONE  
( with mode selection ,priority and debounce )  
one mode control input 'MODE' ,could be used as mode selection or STS4. ( mask option )  
MATRIX : 4x4 matrix inputs ; M1-- M16  
(MODE=0 -> subtable1 - 16 ;  
MODE=1-> subtable17 - 32 )  
priority : M1>M2>M3>M4 ; M5>M6>M7>M8 ;  
M9>M10>M11>M12 ; M13>M14>M15>M16.  
debounce : 11ms or 1ms.  
ALONE : 8 alone inputs ; A1 -- A8 ( MODE=0 -> subtable1 - 8 ;  
MODE=1 -> subtable9 - 16 )  
each input could be one of 3 resistive type input :  
1>10Mohm to GND ; 2>schmitt ( 270k - 1M ) for CDS  
interface ; 3>schmitt ( 270k - 10M ) for CDS interface.  
A1 could be trigger input or control outputs ( COUT,  
PWM, STS ) enable ( '1' ) or disable ( '0' ).  
priority : A1>A2>A3>A4>A5>A6>A7>A8 .  
debounce : 10ms or 50us  
If MODE/STS4 is in STS4 mode, MATRIX only  
( subtable1- 16 ), ALONE only ( subtable 1 - 8 )  
In both mode, all the trigger input could be assign as  
different playing mode with following options :  
EDGE/LEVEL ; HOLD/UNHOLD ;  
RETRIGGER/IRRETRIGGER.  
CPU\_INTERFACE : addressing access mode by input  
pulse count, in this mode A1 - A7 were disable, could  
be access up to 32 subtables.
- \* A8 or M16 could be mask\_selected as NORMAL,  
SEQUENTIAL or CPU\_INTERFACE.  
NORMAL : normal mode as in item 5 .  
SEQUENTIAL : could be mask\_selected as combined with  
MODE input or not.  
If A8 or M16 is in SEQUENTIAL and combined with MODE  
input :  
MODE=1 ->the device will response by one subtable  
sequentially and cyclically, from subtable1  
to user\_specify end subtable.

- MODE=0 ->the device will response by one subtable  
sequentially and cyclically, from subtable1  
to user\_specify end subtable.  
The number of subtables ( used in sequence ) in MODE=1  
and MODE=0 must be equal ; this number must less than 16.  
If A8 or M16 is in SEQUENTIAL and not combined with  
MODE input :  
The device will response by one subtable sequentially and  
cyclically, from subtable1 to user defined end subtable.  
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 indenpent.
- \* 4 OUT pins with following options :  
OUT1 : COUT or STS1      OUT2 : PWM1 or STS2  
OUT3 : PWM2 or STS3      OUT4 : MODE or STS4  
COUT has 3 current output levels : 1>1.5mA ; 2>3mA ; 3>4.5mA .  
( full scall ; vdd=3v )  
PWM1 and PWM2 must be selected on the same time, can  
direct driving BUZZER or 8 or 32 or 64 ohm SPEAKER.
  - \* 4 status outputs ( STS1, STS2, STS3, STS4 ) , one mask  
option status output ( MODE/STS4 ) :  
\* STS1  
a>cout  
b>stop high\_pulse      c>stop low\_pulse  
d>busy high\_active      e>busy low\_active  
f>led 6hz ( flash at mute )      g>led 3hz ( flash at mute )  
h>led 6hz ( off at mute )      i>led 3hz ( off at mute )  
j>led dybzl 0.34sec.      k>led dybzl 0.68sec.  
l>led dybzl 1.02sec.      m>busy high, except mute  
n>busy low, except mute  
\* STS2  
a>pwm1  
b>stop high\_pulse      c>stop low\_pulse  
d>busy high\_active      e>busy low\_active  
f>led 6hz ( flash at mute )      g>led 3hz ( flash at mute )  
h>led 6hz ( on at mute )      i>led 3hz ( on at mute )  
j>led 6hz ( off at mute )      k>led 3hz ( off at mute )  
l>led dynamic 1/4      m>led dynamic 2/4  
n>led dynamic 3/4  
\* STS3  
a>pwm2  
b>stop high\_pulse      c>stop low\_pulse  
d>busy high\_active      e>busy low\_active  
f>led 6hz ( flash at mute )      g>led 3hz ( flash at mute )  
h>led 6hz ( off at mute )      i>led 3hz ( off at mute )  
j>led dybzl 0.34sec.      k>led dybzl 0.68sec.  
l>led dybzl 1.02sec.      m>busy high, except mute  
n>busy low, except mute

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**\* STS4**

a>mode  
 b>stop high\_pulse  
 d>busy high\_active  
 f>led 6hz ( flash at mute )  
 h>led 6hz ( on at mute )  
 j>led 6hz ( off at mute )  
 l>led dynamic 1/4  
 n>led dynamic 3/4  
 c>stop low\_pulse  
 e>busy low\_active  
 g>led 3hz ( flash at mute )  
 i>led 3hz ( on at mute )  
 k>led 3hz ( off at mute )  
 m>led dynamic 2/4

If both STS1(STS3) and STS2(STS4) are in 6hz or 3hz mode, they will flash alternatively.

For STS1 and STS3 options, the DYBZL must selected same level.

For STS2 and STS4 options, the DYNAMIC must selected same level.

STS4 was enabled only when the MODE/STS4 is in STS4 option.

For each voice\_step, the STS1, STS2, STS3, STS4 could be mask\_selected as active or inactive.

**\* Automatic Rosc selection : ( mask option )**

enable – the device will use external Rosc if it has external Rosc ; the device will use internal Rosc automatically if it hasn't external Rosc. ( it must be determined before operation )

disable – use external Rosc only.

Internal Rosc options : one of 13 internal Rosc options with different playback speed.

playback speed=4.3khz -> a>8.9k ; b>8.6k ; c>7.9k ; d>7.0k ;  
 e>6.3k ; f>5.8k ; g>5.4k ; h>5.1k ;  
 i>4.7k ; j>4.3k ; k>4.1k ; l>3.9k ;  
 m>3.6k hz. ( vdd=3v )

playback speed=5.0khz -> a>10.3k ; b>10.0k ; c>9.2k ;  
 d>8.2k ; e>7.3k ; f>6.8k ; g>6.3k ;  
 h>5.9k ; i>5.5k ; j>5.0k ; k>4.8k ;  
 l>4.6k ; m>4.2k hz. ( vdd=3v )

playback speed=6.0khz -> a>12.4k ; b>12.0k ; c>11.0k ;  
 d>9.8k ; e>8.8k ; f>8.1k ; g>7.5k ;  
 h>7.1k ; i>6.6k ; j>6.0k ; k>5.7k ;  
 l>5.5k ; m>5.0k hz. ( vdd=3v )

playback speed=7.5khz -> a>15.5k ; b>15.0k ; c>13.8k ;  
 d>12.3k ; e>11.0k ; f>10.1k ;  
 g>9.4k ; h>8.9k ; i>8.3k ; j>7.5k ;  
 k>7.1k ; l>6.9k ; m>6.3k hz.  
 ( vdd=3v )

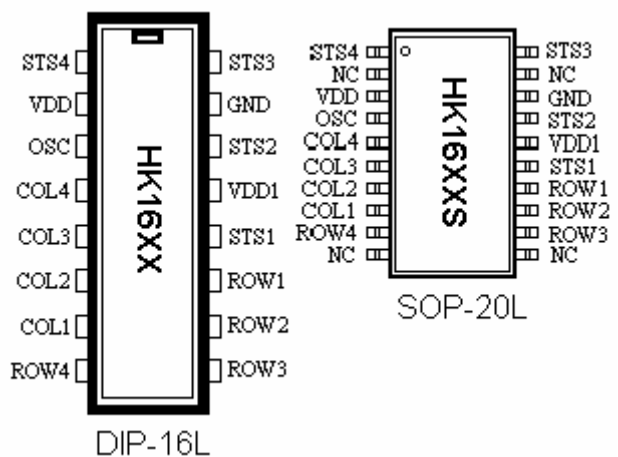
playback speed=10khz -> a>20.7k ; b>20.0k ; c>18.3k ;  
 d>16.3k ; e>14.7k ; f>13.5k ;  
 g>12.5k ; h>11.8k ; i>11.0k ;  
 j>10.0k ; k>9.5k ; l>9.2k ;  
 m>8.3k hz. ( vdd=3v )

## General Description

HONSITAK OFFER HK163, HK166, HK169, HK1612, HK1618, HK1624 is a single-chip synthesizing CMOS VLSI that can synthesize voice up to 3, 6, 9, 12, 18, 24 seconds, using qualified coding algorithm ( LOGPCM ). Customer speech data will be edited and programmed into ROM by changing one mask during the device fabrication.

- HK163 for 3 SEC. Voice IC Body
- HK166 for 6 SEC. Voice IC Body
- HK169 for 9 SEC. Voice IC Body
- HK1612 for 12 SEC. Voice IC Body
- HK1618 for 18 SEC. Voice IC Body
- HK1624 for 24 SEC. Voice IC Body

## PinOut Diagram

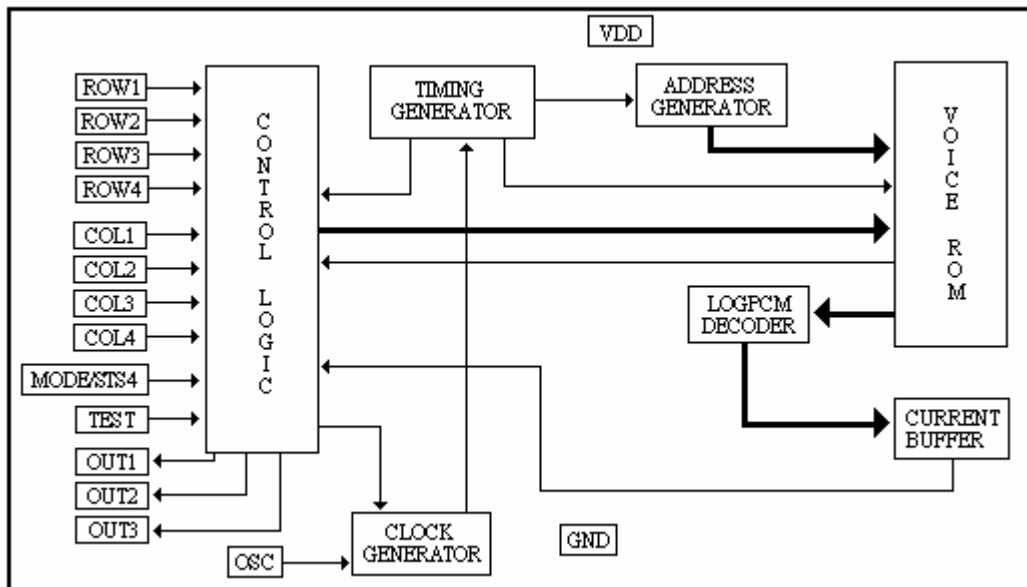


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### Block Diagram



### Pin Description

PAD NAME	FUNCTION
VDD, VDD1	Positive power supply.
OSC	Oscillator input ( 300K ohm connect to VDD ).
TEST	Test pad, for production testing ( test high for testing )
MODE/STS4	I/O pad, mode: mode selection, sts4 : status output
ROW 1-4	Output for MATRIX mode ; input for ALONE mode
COL 1-4	Trigger input, internal pull low ( high active )
OUT1	Status output or audio ( current output )
OUT2	Status output or audio ( pwm1 output )
OUT3	Status output or audio ( pwm2 output )
GND, GND1	Negative power supply.

### Absolute Maximum Rating

SYMBOL	RATING	UNIT
VDD ~ VSS	-0.5 ~ +7.0	V
VIN ( for all inputs )	VSS-0.3 < Vin < VDD+0.3	V
VOUT ( for all output )	GND < Vout < VDD	V
T ( operating )	-1.0 ~ +60	°C
T ( storage )	-25 ~ +75	°C

### DC Characteristics

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT	CONDITION
VDD	Operating Voltage	2.4	3	5	V	
Isb	Supply Current			0.1	uA	VDD = 3V, I/O open ( with Rosc )
Iop				200		
Iih	Input Current Row 1-4, Col 1-4 In ALONE Mode ( Schmitt 270K - 1M )			5	uA	VDD = 3V
Iil			0			

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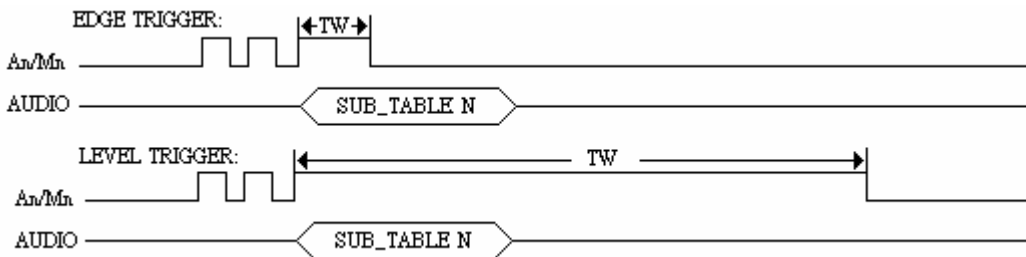
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lih	Input Current Row 1-4, Col 1-4 In ALONE Mode ( Schmitt 270K – 10M )			0.3	uA	VDD=3V
lil			0			
lih	Input Current Mode Input			0.5	uA	VDD=3V
lil			0			
loh	Matrix Mode ( Row 1 – 4 ) Output Current		-0.6		mA	VDD=3V , V O/P=0V
lol			10			VDD=3V , V O/P=3V
lcout	Out1 Use As Current Out ( Full Scale )	-1.2	-1.5	-1.8	mA	VDD=3V , V O/P=0.7V
		-2.4	-3	-3.6		
		-3.6	-4.5	-5.4		
loh	Out1, Out2, Out3 Use As Status Output During Operating		-0.6		mA	VDD=3V , V O/P=0V
lol		8	10	12		VDD=3V , V O/P=3V
dF/F	Frequency Stability	-10		10		$\frac{F_{osc}(3v)}{F_{osc}(2.4v)}$
dF/F	Fosc VARIATION	-10		10		VDD=3V , Rosc=300K

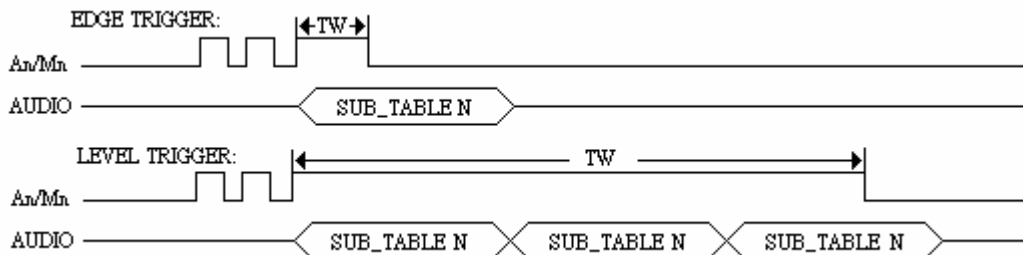
### TIMING DIAGRAM

#### 1.>EDGE/LEVEL

EDGE MODE:



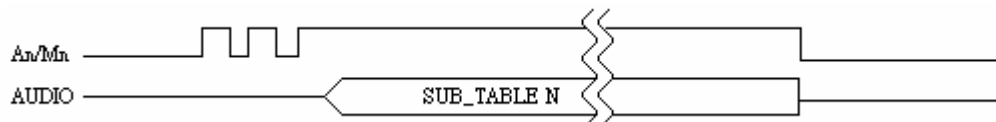
LEVEL MODE:



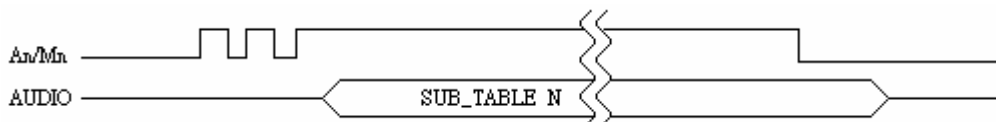
\* NOTE: Tw IS THE MINIMUM INPUT PULSE WIDTH > DEBOUNCE TIME ( 10ms or 50 us )

#### 2.>HOLD/UNHOLD

HOLD:



UNHOLD:



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

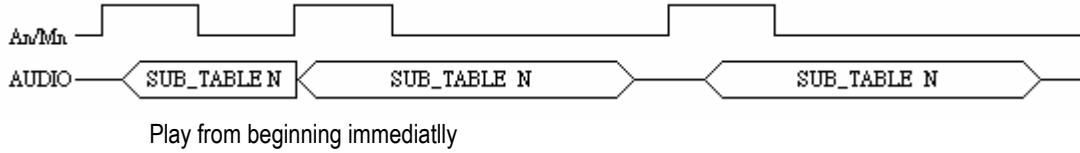
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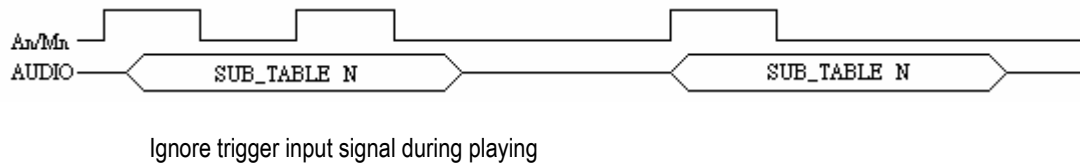
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### 3.>RETRIGGERABLE/IRRETRIGGERABLE

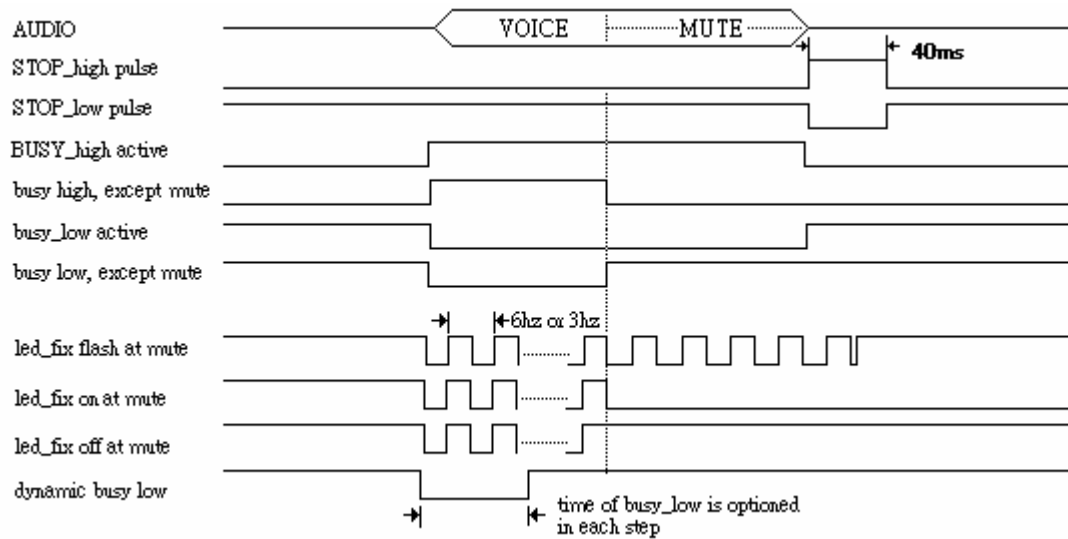
RETRIGGER:



IRRETRIGGER:



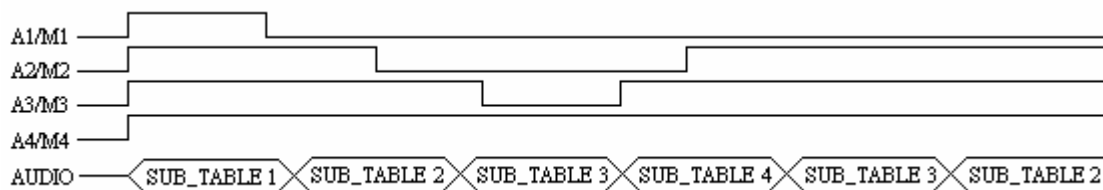
### 4.>STATUS OUTPUT ( STS1, STS2, STS3, STS4 )



DYNAMIC: Partition the voice amplitude 8 steps ( 01234567 );  
 1/4:0.7 LED on. 2/4:0.1.6.7 LED on. 3/4:0.1.2.5.6.7 LED on.

LED on means status output low. ; every beginning of voice step will reset status 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.

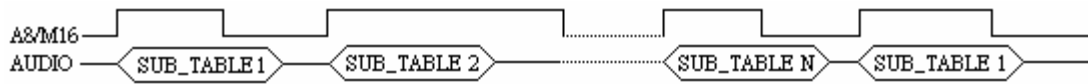
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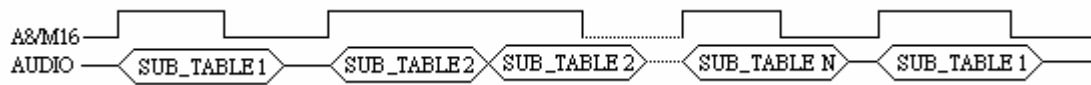
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### 6.>SEQUENTIAL

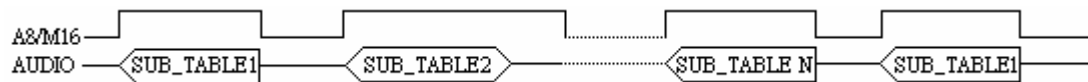
#### EDGE-UNHOLD:



#### LEVEL-UNHOLD:



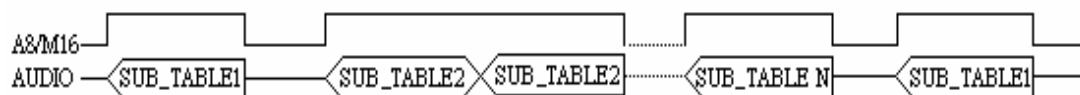
#### EDGE-HOLD:



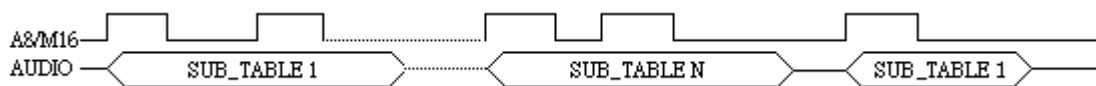
#### LEVEL-HOLD:



#### RETRIGGER:



#### IRRETRIGGER:



\*Sequential combined with MODE input:



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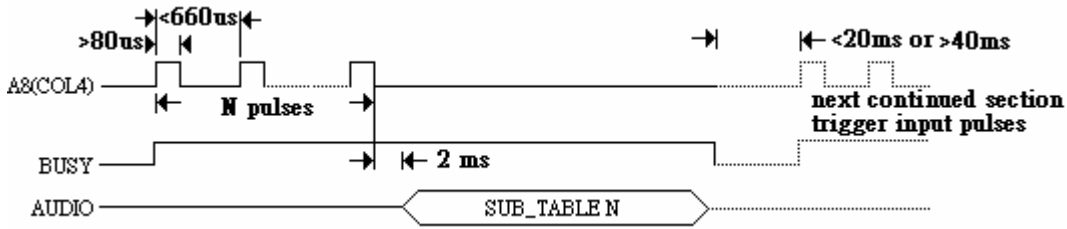
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### 7.>CPU\_INTERFACE : addressing access mode by input pulse count (A8)

In this mode, some of the mask\_options must set as follow :

MATRIX/ALONE -> ALONE ; SEQUENTIAL/NORMAL -> SEQUENTIAL ; sequential not combined with MODE ;  
 RESET/UNRESET -> RESET

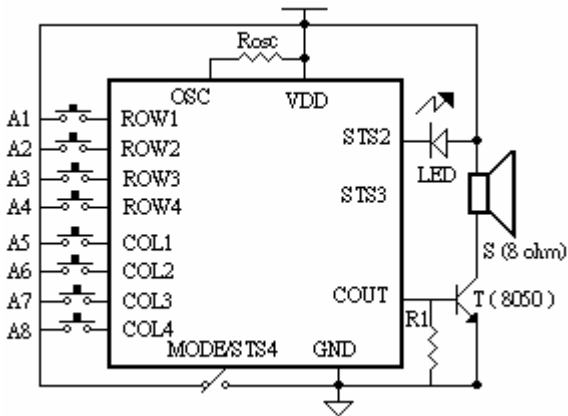
The A8 input playing mode as right, EDGE/LEVEL -> EDGE ; HOLD/UNHOLD -> UNHOLD ;  
 RETRIGGER/IRRETRIGGER -> RETRIGGRR



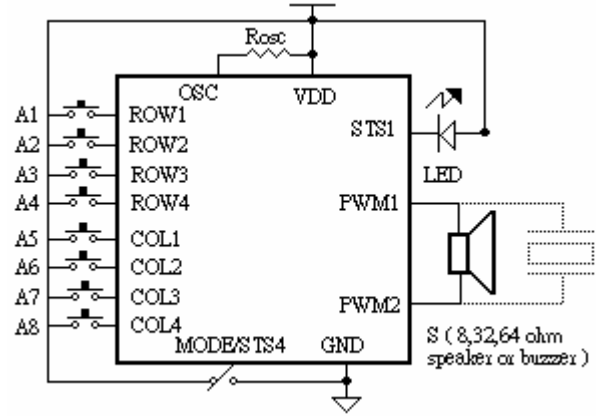
All the timing are base on 6khz sample rate.

### Application circuit :

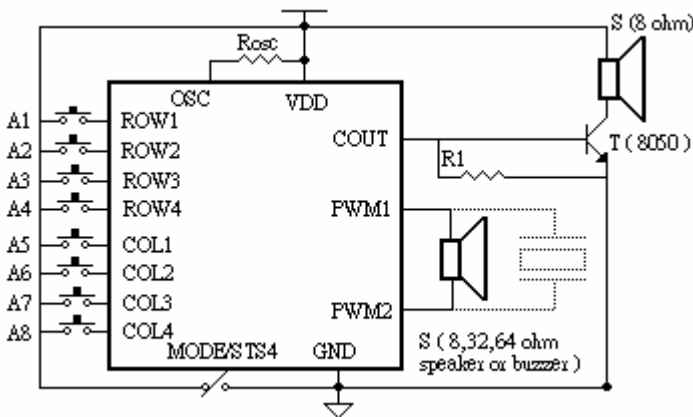
#### A> ALONE, COUT, LED DRIVING :



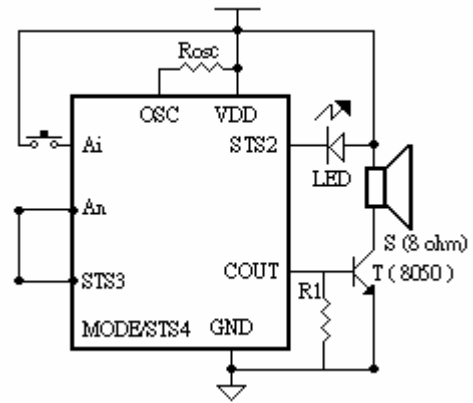
#### B> ALONE, PWM, LED DRIVING :



#### C> ALONE, COUT, PWM :



#### D> ALONE, use stop\_high pulse to trigger other TG input (An) :

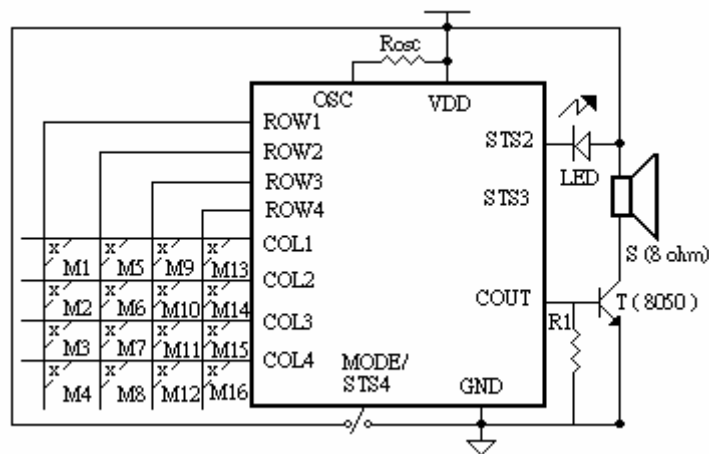


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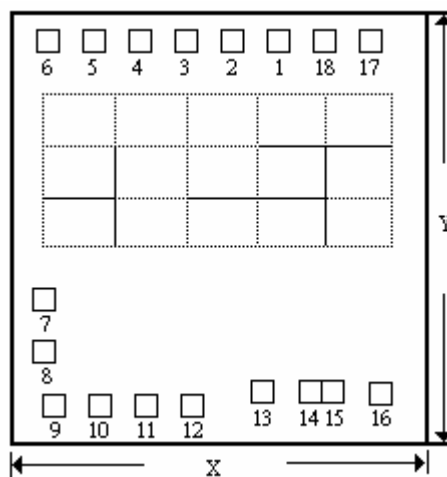
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E>MATRIX, COUT, LED DRIVING :



- NOTE:**
- 1> Rosc=300K ohm ( typical ) or use internal Rosc ( it must be determined before operation )  
Tbata=100 ( typical ). R1=1k needed only when wish to lower the power consumption.
  - 2> BUZZER: resonant frequency should around 1KHz.
  - 3> COUT, PWM1, PWM2 are tristate during standby.

### Bonding Diagram:



PRODUCT	X	Y	PAD SIZE ( $\mu\text{m}^2$ )	SUBSTRATE	UNIT
HK163	1600.0	1740.0	80 * 80	GND	um
HK166	1600.0	1930.0	80 * 80	GND	um
HK169	1600.0	2170.0	80 * 80	GND	um
HK1612	1600.0	2360.0	80 * 80	GND	um
HK1618	1600.0	2810.0	80 * 80	GND	um
HK1624	1600.0	3260.0	80 * 80	GND	um



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PIN NO.	NAME	HK163		HK166		HK169	
		X	Y	X	Y	X	Y
1	VDD1	292.4	733.0	292.4	829.9	292.4	950.7
2	OSC	138.6	733.0	138.6	829.9	138.6	950.7
3	COL4	-109.0	733.0	-109.0	829.9	-109.0	950.7
4	COL3	-286.5	733.0	-286.5	829.9	-286.5	950.7
5	COL2	-463.9	733.0	-463.9	829.9	-463.9	950.7
6	COL1	-641.4	733.0	-641.4	829.9	-641.4	950.7
7	ROW4	-665.2	-441.7	-665.2	-537.5	-665.2	-659.4
8	ROW3	-665.2	-585.7	-665.2	-681.5	-665.2	-803.4
9	ROW2	-609.8	-773.0	-609.8	-828.9	-609.8	-950.7
10	ROW1	-435.6	-773.0	-435.6	-828.9	-435.6	-950.7
11	OUT1	-288.9	-773.0	-288.9	-828.9	-288.9	-950.7
12	VDD	-122.0	-773.0	-122.0	-828.9	-122.0	-950.7
13	OUT2	149.5	-702.2	149.5	-798.0	149.5	-919.8
14	GND	296.4	-702.2	296.4	-798.0	296.4	-919.8
15	GND1	376.4	-702.2	376.4	-798.0	376.4	-919.8
16	OUT3	523.3	-702.2	523.3	-798.0	523.3	-919.8
17	TEST	641.4	733.0	641.4	828.9	641.4	950.7
18	MODE/STS4	494.6	733.0	494.6	828.9	494.6	950.7

PIN NO.	NAME	HK1612		HK1618		HK1624	
		X	Y	X	Y	X	Y
1	VDD1	292.4	1047.3	292.4	1271.3	292.4	1494.2
2	OSC	138.6	1047.3	138.6	1271.3	138.6	1494.2
3	COL4	-109.0	1047.3	-109.0	1271.3	-109.0	1494.2
4	COL3	-286.5	1047.3	-286.5	1271.3	-286.5	1494.2
5	COL2	-463.9	1047.3	-463.9	1271.3	-463.9	1494.2
6	COL1	-641.4	1047.3	-641.4	1271.3	-641.4	1494.2
7	ROW4	-665.2	-755.9	-665.2	-979.9	-665.2	-1202.9
8	ROW3	-665.2	-899.9	-665.2	-1123.9	-665.2	-1346.9
9	ROW2	-609.8	-1047.3	-609.8	-1271.3	-609.8	-1494.2
10	ROW1	-435.6	-1047.3	-435.6	-1271.3	-435.6	-1494.2
11	OUT1	-288.9	-1047.3	-288.9	-1271.3	-288.9	-1494.2
12	VDD	-122.0	-1047.3	-122.0	-1271.3	-122.0	-1494.2
13	OUT2	149.5	-1016.4	149.5	-1240.4	149.5	-1463.4
14	GND	296.4	-1016.4	296.4	-1240.4	296.4	-1463.4
15	GND1	376.4	-1016.4	376.4	-1240.4	376.4	-1463.4
16	OUT3	523.3	-1016.4	523.3	-1240.4	523.3	-1463.4
17	TEST	641.4	1047.3	641.4	1271.3	641.4	1494.2
18	MODE/STS4	494.6	1047.3	494.6	1271.3	494.6	1494.2