



A. HE82015 Introduction

HE82015 is a member of 8-bit Micro-controller series developed by King Billion Electronics Ltd. It is a power speech controller. The 7-bit current-type D/A converter and PWM device provide the complete speech output mechanism. The 128K ROM Size can be used in the storage of speech (40 seconds at 3Kbytes per second). In order to simplify IC function, this IC have not exit follow list circuit, **Slow Clock, Internal Power-ON Reset, TP automatic increase, Timer2 and Watch-dog Timer**. Please pay attention.

The instruction set of HE82015 are quite easy to learn and simple to use. Only about thirty instructions with four-type addressing mode are provided. Most of instructions take only 3 oscillator clocks (machine cycles). The processing power is enough to most of battery operation system.

B. HE82015 Features

- Operation Voltage : 2.4V – 5.5V
- System Clock : DC ~ 8MHz @ 5.0V
DC ~ 4MHz @ 2.4V
- Internal ROM : 128K Bytes(64K Program ROM, 64K Data ROM)
- Internal RAM : 128 Bytes.
- Single Clock System : Normal (Fast) clock : 32.768K ~ 8MHz
- Operation Mode : FAST、SLEEP Mode.
- 8 bit Bi-directional I/O port. Mask Option can select PUSH-PULL or OPEN DRAIN output mode for each I/O pin.
- One 7-bit current-type DAC output.
- PWM device.
- Two external interrupts and one internal timer interrupt.
- One 16-bit timer. (Clock Source reference by Fast Clock)
- Instruction set : 32 instructions, 4 addressing mode. **7-bit DATA POINTER** for RAM and **17-bit TABLE POINTER** for ROM.

C. Internal Block

I.F.C.	E.S.C.	I.P.R.	PROM	DROM	TP	TP+1	RAM	PP	DP	I/O	DTMF	WDT	Timer
—	—	⊙	64KB	64KB	17-bit	⊙	128B	—	7-bit	8	—	—	T1
VO	DAO	OP	PWM	LCD	COM*SEG	Bias	Rgr	ChrgPmp	LV2	LR	LVG	REC	S.R.
⊙	—	—	⊙	—	—	—	—	—	—	—	—	—	—



D. HE82015 Pin Description

Which version of IC decided by KB when customer gives order to KB. Please make sure which version will be used before you make a PCB!

Version A1:

Pin #	Pin name	I/O	Function	Description
4 3	FXI, FXO	B, O	External fast clock pin. Connecting to crystal or RC to generate 32.768 kHz ~ 8MHz frequency.	Mask option setting : MO_FXTAL=0 : R,C oscillator for Fast Clock 1 : Crystal oscillator for Fast Clock User can use OP1 and OP2 to change operation mode between Normal and Sleep.
2	RSTP_N	I	System Reset.	Level trigger, active low. For let system reset.
5	TSTP_P	I	Test Pin	Please bond this pin and add a test point on PCB for debugging. Leave this pin floating is OK
7..14	PRTD[7:0]	B	8-pin bi-directional I/O port. PRTD[7..2] as wake-up pin. PRTD[7..6] as external interrupt pin.	Mask options : MO_DPP[7..0]=1 ~ Push-pull. =0 ~ Open-drain. Output must be “1” before reading whenever use them as input (No tri-state structure).
16	PWM	O	The PWM output can drive speaker or buzzer directly.	Set the bit2 of VOC register as one to turn on PWM.
17	GND_PWM	P	Dedicated PWM Ground	
1	VO	O	DAC Voice Output	Set the bit1(DA=1) of VOC register to turn on DAC with VO output.
6	VDD	P	Positive Power Input	
15	GND	P	Power Ground Input	

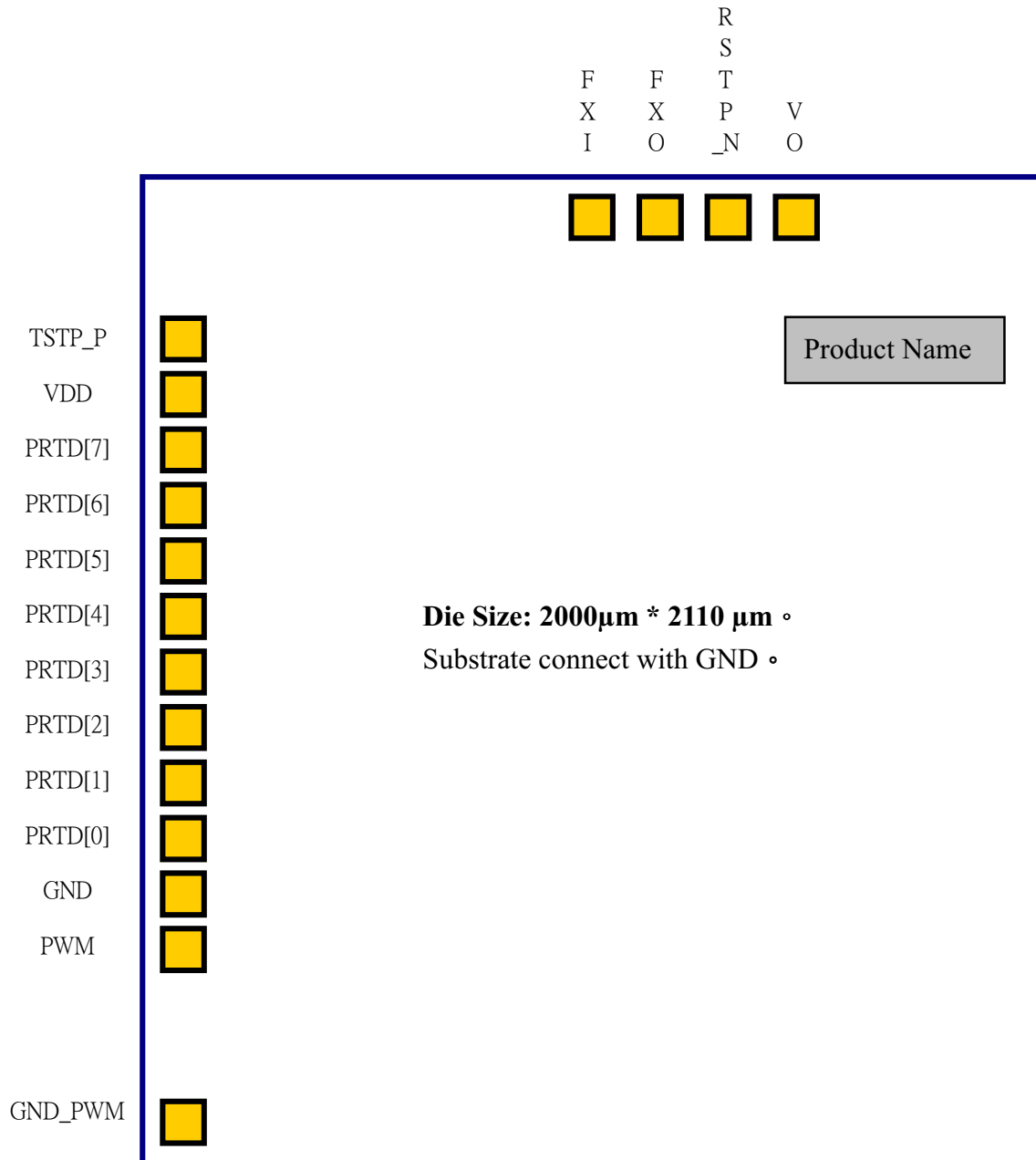
Version B1:

Pin #	Pin name	I/O	Function	Description
4 3	FXI, FXO	B, O	External fast clock pin. Connecting to crystal or RC to generate 32.768 kHz ~ 8MHz frequency.	Mask option setting : MO_FXTAL=0 : R,C oscillator for Fast Clock 1 : Crystal oscillator for Fast Clock User can use OP1 and OP2 to change operation mode between Normal and Sleep.
2	RSTP_N	I	System Reset.	Level trigger, active low. For let system reset.
5	TSTP_P	I	Test Pin	Please bond this pin and add a test point on PCB for debugging. Leave this pin floating is OK
7..14	PRTD[7:0]	B	8-pin bi-directional I/O port. PRTD[7..2] as wake-up pin. PRTD[7..6] as external interrupt pin.	Mask options : MO_DPP[7..0]=1 ~ Push-pull. =0 ~ Open-drain. Output must be “1” before reading whenever use them as input (No tri-state structure).
16	PWMP	O	The PWM positive output can drive speaker or buzzer directly.	Set the bit2 of VOC register as one to turn on PWM.
17	PWMN	O	The PWM negative output.	
1	VO	O	DAC Voice Output	Set the bit1(DA=1) of VOC register to turn on DAC with VO output.

6	VDD	P	Positive Power Input	
15	GND	P	Power Ground Input	

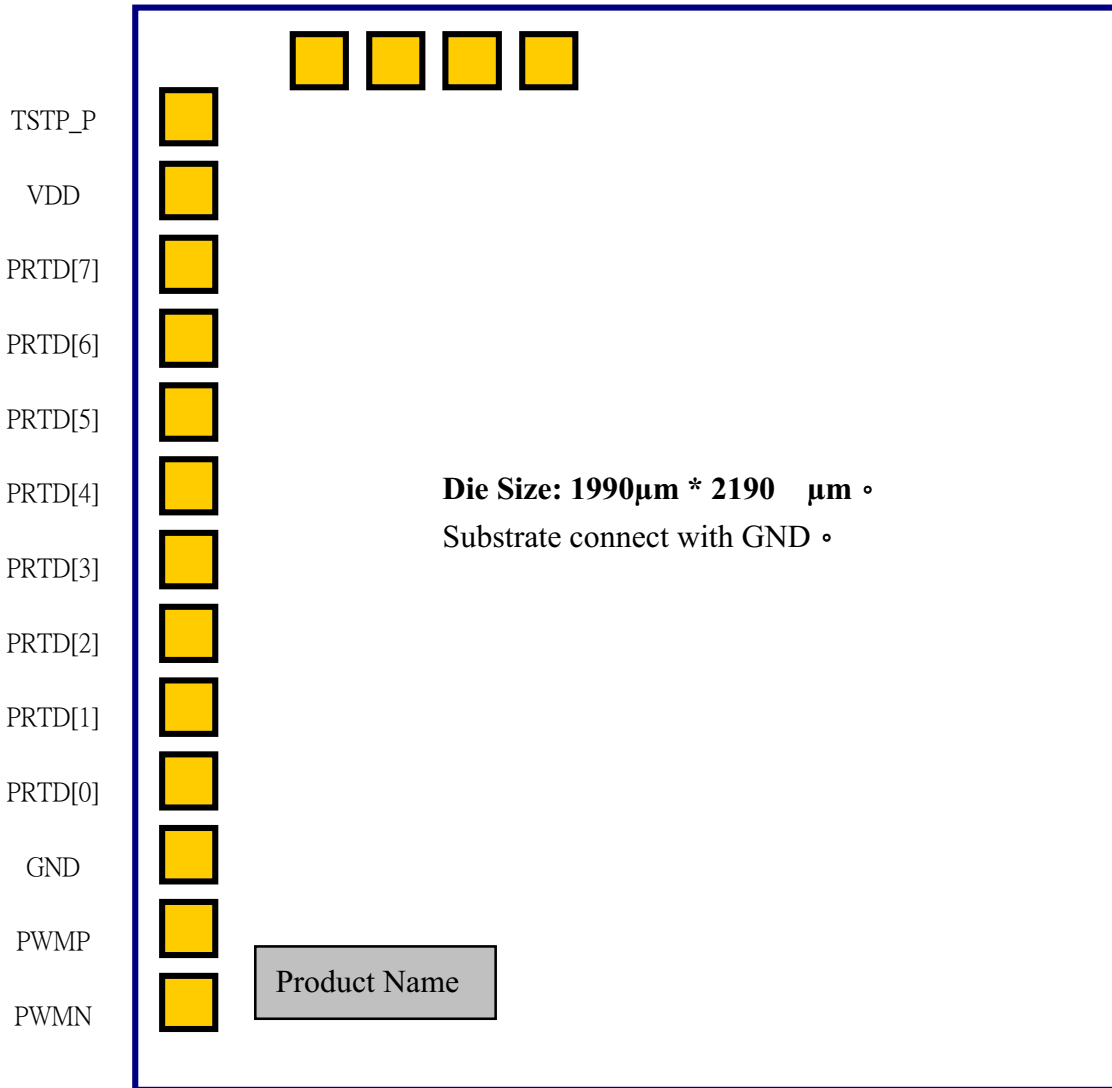
E. Pin Diagram

Version A1:



Version B1:

R
 S
 T
 F F P V
 X X _N O
 I O





F. Bonding Pad Location

Version A1:

PIN Number	PIN Name	X Coordinate	Y Coordinate
1	VO	X= 344.65	Y= 971.00
2	RSTP_N	X= 228.75	Y= 971.00
3	FXO	X= 112.85	Y= 971.00
4	FXI	X= -3.05	Y= 971.00
5	TSTP_P	X= -896.60	Y= 793.40
6	VDD	X= -896.60	Y= 677.50
7	PRTD[7]	X= -896.60	Y= 561.60
8	PRTD[6]	X= -896.60	Y= 445.70
9	PRTD[5]	X= -896.60	Y= 329.80
10	PRTD[4]	X= -896.60	Y= 213.90
11	PRTD[3]	X= -896.60	Y= 98.00
12	PRTD[2]	X= -896.60	Y= -17.90
13	PRTD[1]	X= -896.60	Y= -133.80
14	PRTD[0]	X= -896.60	Y= -249.70
15	GND	X= -896.60	Y= -365.60
16	PWM	X= -896.60	Y= -496.90
17	GND_PWM	X= -896.60	Y= -965.70

Version B1:

PIN Number	PIN Name	X Coordinate	Y Coordinate
1	VO	X= -252.65	Y= 902.60
2	RSTP_N	X= -389.60	Y= 902.60
3	FXO	X= -526.55	Y= 902.60
4	FXI	X= -663.50	Y= 902.60
5	TSTP_P	X= -1000.20	Y= 788.05
6	VDD	X= -1000.20	Y= 651.10
7	PRTD[7]	X= -1000.20	Y= 514.15
8	PRTD[6]	X= -1000.20	Y= 377.20
9	PRTD[5]	X= -1000.20	Y= 240.25
10	PRTD[4]	X= -1000.20	Y= 103.30
11	PRTD[3]	X= -1000.20	Y= -33.65
12	PRTD[2]	X= -1000.20	Y= -170.60



13	PRTD[1]	X= -1000.20	Y= -307.55
14	PRTD[0]	X= -1000.20	Y= -444.50
15	GND	X= -1000.20	Y= -581.45
16	PWMP	X= -1000.20	Y= -731.20
17	PWMN	X= -1000.20	Y= -894.55

G. DC/AC Characteristics

Absolute Maximum Rating

Item	Sym.	Rating	Condition
Supply Voltage	V _{dd}	-0.5V ~ 8V	
Input Voltage	V _{in}	-0.5V ~ V _{dd} +0.5V	
Output Voltage	V _o	-0.5V ~ V _{dd} +0.5V	
Operating Temperature	T _{op}	0 ⁰ C ~ 70 ⁰ C	
Storage Temperature	T _{st}	-50 ⁰ C ~ 100 ⁰ C	

Recommended Operating Conditions

Item	Sym.	Rating	Condition
Supply Voltage	V _{dd}	2.4V ~ 5.5V	
Input Voltage	V _{ih}	0.9 V _{dd} ~ V _{dd}	
	V _{il}	0.0V ~ 0.1V _{dd}	
Operating Frequency	F _{max}	8MHz	V _{dd} =5.0V
		4MHz	V _{dd} =2.4V
Operating Temperature	T _{op}	0 ⁰ C ~ 70 ⁰ C	
Storage Temperature	T _{st}	-50 ⁰ C ~ 100 ⁰ C	



測試條件:TEMP=25°C, VDD=3V+/-10%, GND=0V

	PARAMETER		CONDITION	MIN	TYP	MAX	UNIT
I_{Fast}	NORMAL Mode Current	System	2M ext. R/C		0.75	1	mA
I_{Sleep}	Sleep Mode Current	System				1	μA
I_{oHPWM}	PWM Output Drive Current	PWMP, PWMN*2	V _{DD} =3V; V _{oh} =2V	12	15		mA
I_{oLPWM}	PWM Output Sink Current	PWMP, PWMN*2	V _{DD} =3V; V _{oL} =1V	33	40		mA
I_{oVO}	DAC Output Current	VO	V _{DD} =3V; VO=0~2V, Data=7F	2.5	3		mA
V_{iH}	Input High Voltage	I/O pins		0.8 V _{DD}			V
V_{iL}	Input Low Voltage	I/O pins				0.2 V _{DD}	V
V_{hys}	Input Hysteresis Width	I/O, RSTP_N	Threshold=2/3V _{DD} (input from low to high) Threshold=1/3V _{DD} (input from high to low)		1/3 V _{DD}		V
I_{oH}	Output Drive Current	I/O pull-high*1	V _{oL} =2.0V	50			μA
I_{oL_1}	Output Sink Current	I/O pull-low*1	V _{oL} =0.4V	1.0			mA
I_{iL_1}	Input Low Current	RSTP_N	V _{iL} =GND, pull high Internally		20		μA
I_{iL_2}	Input Low Current	I/O	V _{iL} =GND, if pull high Internally by user		100		μA

Note: *1: Drive Current Spec. for Push-Pull I/O port only

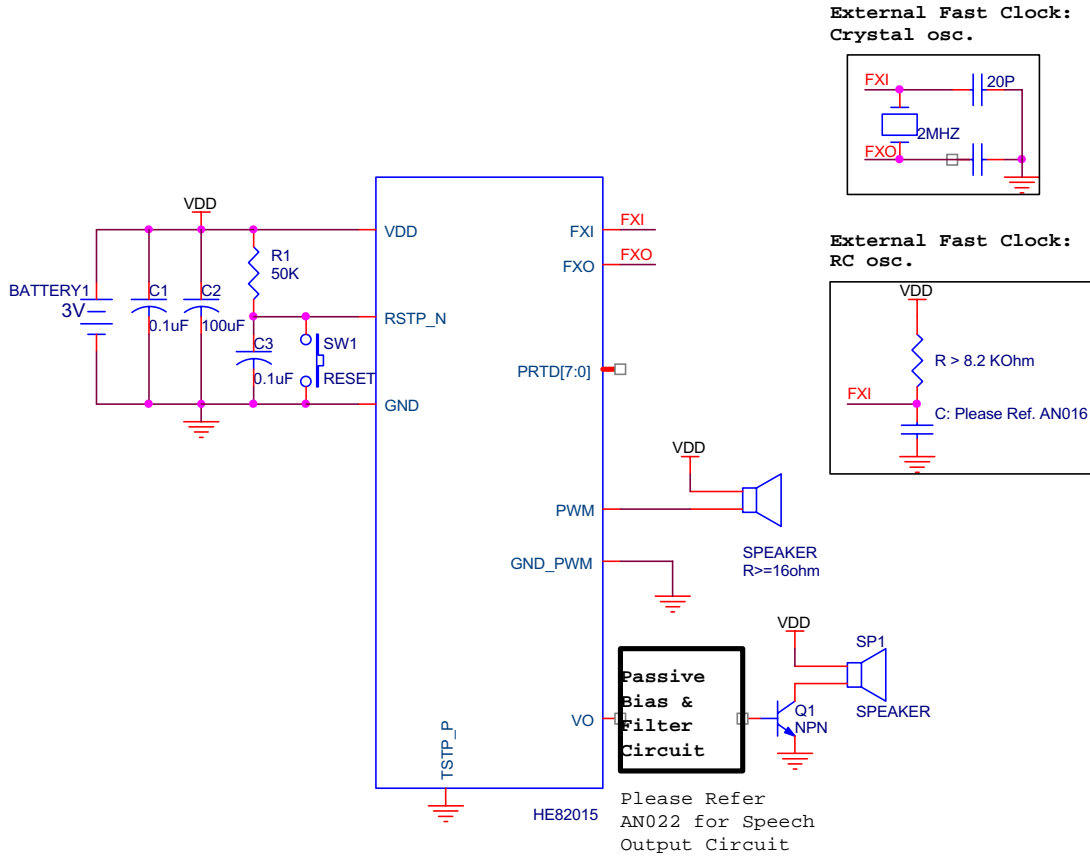
Sink Current Spec. for both Push-Pull and Open-Drain I/O port.

*2: This Spec. base on one driver only. There are five build-in driver, so user just multiply the number of driver he used to one driver current to get the total amount of current.

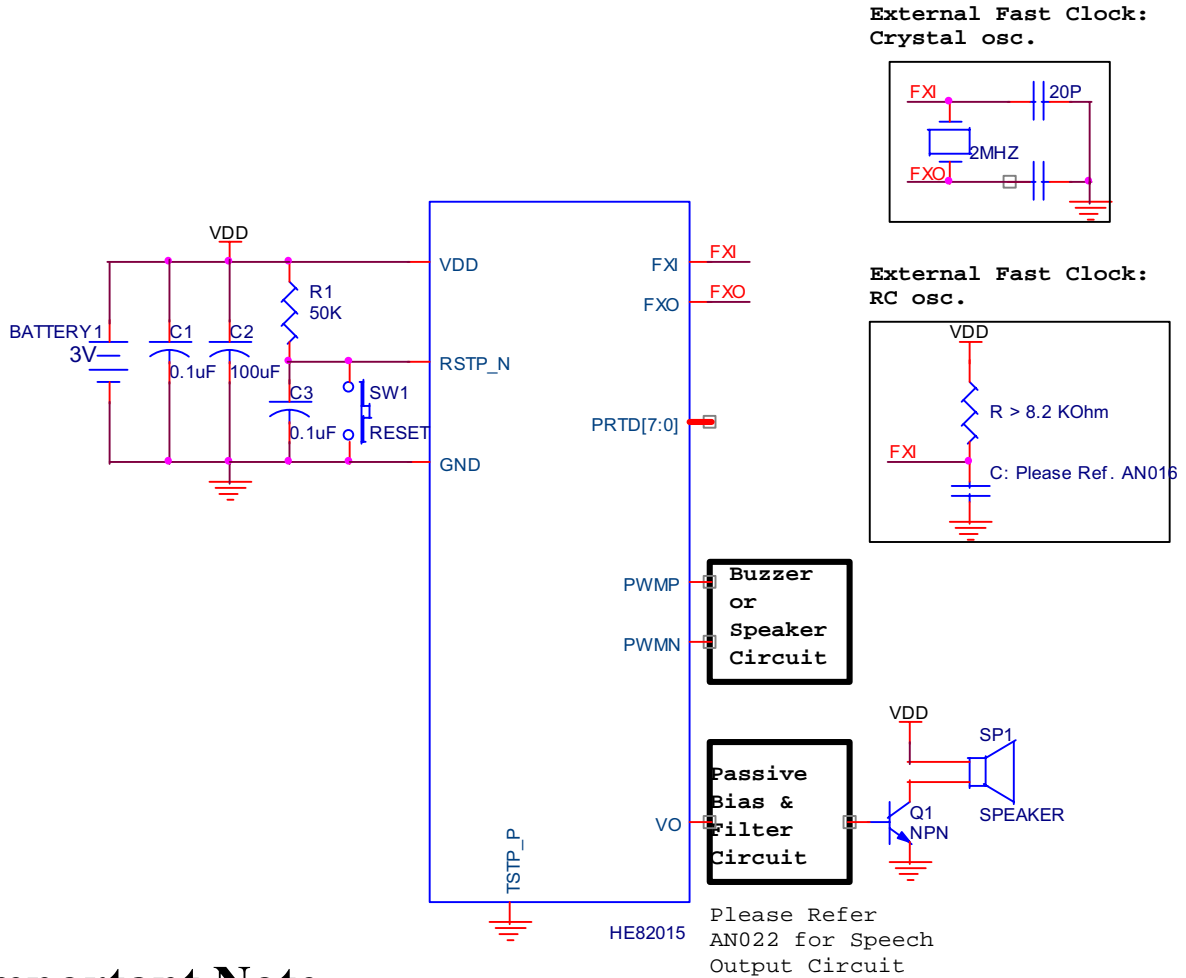
(I_{oHPWM}、I_{oLPWM} * N; N=0,1,2,3,4,5)

H. Application Circuit

Version A1:

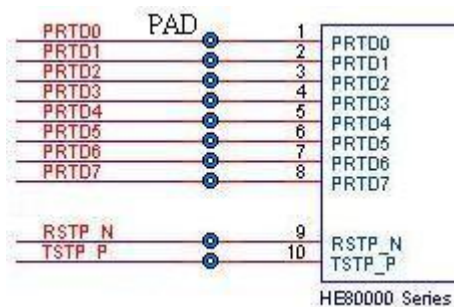


Version B1:



I. Important Note

1. Please bonds the TSTP_P, RSTP_N and PRTD[7:0] with test point on PCB (can be soldered and probed) as you can, then KB can do some IC testing job on PCB. Neither VDD nor GND connection is necessary for TSTP_P. The following figure is an example (Testing point with through hole).



J. Updated Record

Version	Date	Section	Original Content	New Content
V3.3	Nov 20, 2001	B, G I, J	2.2V (VDD operation voltage)	2.4V New Section