A. HE83760 Introduction

HE83760 is a member of 8-bit Micro-controller series developed by King Billion Electronics Ltd. This IC build-in 3072-dot LCD driver, and also have 32-bit I/O port. Also built-in OP comparator can be used with (light、voice、temperature、humility) sensor and used as battery low detection. The 7-bit current-type D/A converter and PWM device provide the complete speech output mechanism. The 2M byte ROM and 16K byte RAM can be used in the storage of speech、graphic、text etc.. The built-in DTMF generator can generate the PSTN dialing tone directly.

HE83760 can be used in Translator、Data Bank、Pocket Dialer、Educational Toy、Digital Voice Recording System etc.

The instruction set of HE83760 are quite easy to learn and simple to use. Only about thirty instructions with four-type addressing mode are provided. Most of instructions take 3 oscillator clocks (machine cycles). The processing power is enough to most of battery operation system.

B. HE83760 Features

- Operation Voltage： 2.4V – 5.5V
- System Clock： DC ~ 8MHz @ 5.0V
  DC ~ 4MHz @ 2.4V
- Internal ROM： 2M Bytes(64K Program ROM+1984K Data ROM)
- Internal RAM： 16K Bytes
- Dual Clock System ： Normal (Fast) clock： 32.768K ~ 8MHz
  Slow clock： 32.768KHz
- Operation Mode： DUAL、FAST、SLOW、IDLE、SLEEP Mode.
- With WDT (WATCH DOG TIMER) to prevent deadlock condition.
- 32 bit Bi-directional I/O port. Mask Option can select PUSH-PULL or OPEN DRAIN output mode for each I/O pin.
- One built-in OP comparator.
- 3072 dots LCD driver (A、B TYPE selectable).
- One 7-bit current-type DAC output.
- PWM device.
- Built-in DTMF Generator.
- Two external interrupts and three internal timer interrupts.
- Two 16-bit timers and one Time-Base timer.
- Instruction set： 32 instructions, 4 addressing mode. 14-bit DATA POINTER for RAM and 21-bit TABLE POINTER for ROM.

C. Internal Block

Please always take in mind that ICE is different from IC. ICE is the whole set of HE80000 series IC, but each IC is a subset of ICE. Never use any hardware resource that real IC didn't have, especially RAM and register. KBIDS and compiler cannot prevent user to use some hardware resource that didn't exist. Please check the following table and refer the abbreviation in HE80000 user's manual.

I.F.C.	E.S.C.	I.P.R	PROM	DROM	TP	TP+1	RAM	PP	DP	I/O	DTMF	WDT	Timer
◎	◎	◎	64KB	1984KB	21-bit	◎	16KB	6-bit	8-bit	32	◎	◎	T1,T2,TB

VO	DAO	OP	PWM	LCD	COM*SEG	Bias	Rgr	ChrgPmp	LV2	LR	LVG	REC	S.R.
◎	◎	◎	◎	3072	32*96	1/7	—	1,3/2,2,3	◎	4:0	◎	E/I	I/D

D. Pin Description

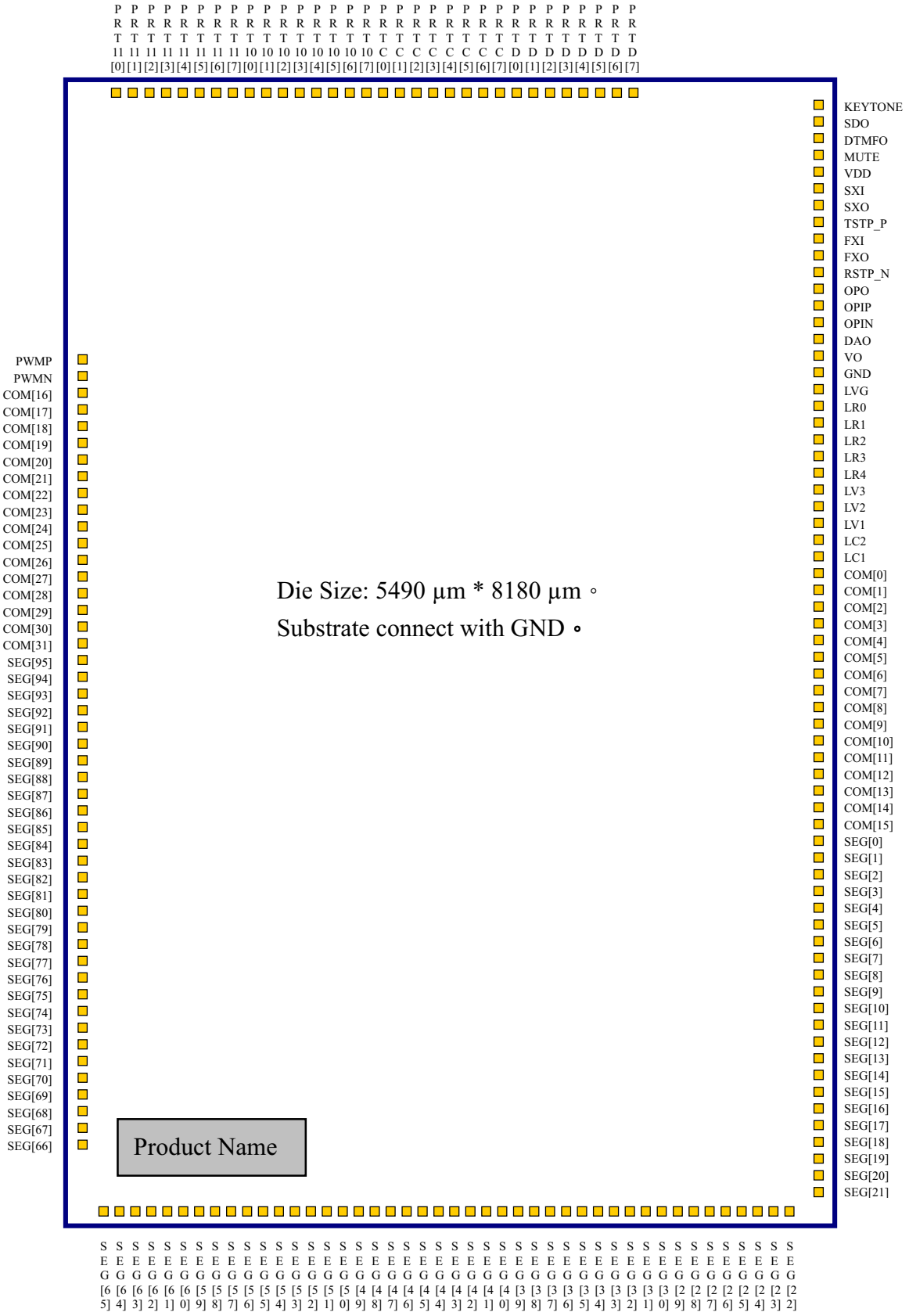
Pin #	Pin name	I/O	Function	Description
150 149	**FXI,** **FXO**	B, O	External fast clock pin. Connecting to crystal or RC to generate 32.768 kHz ~ 8MHz frequency.	Mask option setting： MO_FCK/SCKN= 00：Slow Clock only 01：Illegal 10：Dual Clock 11：Fast Clock only MO_FOSCE= 0： Internal fast osc. = 1：External fast osc. MO_FXTAL= 0：RC osc. for fast clock = 1：X'tal osc. for fast clock MO_SXTAL= 0：RC for 32768 Hz clock = 1：X'tal for 32768 Hz clock Use OP1 and OP2 to switch among different operation mode (NORMAL, SLOW, IDEL and SLEEP). In Dual Clock mode, the main system clock is still the Fast Clock. The 32768 Hz clock is for LCD and Timer 1 only.
153 152	**SXI,** **SXO**	I, O	External slow clock pin. Connecting with 32768 Hz crystal or resistor as slow clock and providing clock source for LCD display, TIMER1, Time-Base and other internal blocks.	
148	**RSTP_N**	I	System Reset.	Level trigger, active low. Except for using this pin, using mask option (MO_PORE=1) could enable IC build-in power-on reset circuit. Besides, MO_WDTE can set Watch Dog Timer： MO_WDTE=0：Disable Watch Dog Timer =1：Enable Watch Dog Timer
151	**TSTP_P**	I	Test Pin	Please bond this pin and add a test point on PCB for debugging. Leave this pin floating is OK.
167.. 174	**PRTC[7:0]**	B	8-pin bi-directional I/O port.	Mask options： MO_CPP[7..0]=1 ~ Push-pull. =0 ~ Open-drain. Output must be "1" before reading whenever use them as input (No tri-state structure).
159.. 166	**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).
175.. 182	**PRT10[7:0]**	B	8-pin bi-directional I/O port.	Mask options： MO_10PP[7..0]=1 ~ Push-pull. =0 ~ Open-drain. Output must be "1" before reading whenever use them as input (No tri-state structure).
183.. 190	**PRT11[7..0]**	B	8-pin bi-directional I/O port.	Mask options： MO_11PP[7..0]=1 ~ Push-pull. =0 ~ Open-drain. Output must be "1" before reading whenever use them as input (No tri-state structure).

Pin #	Pin name	I/O	Function	Description
18..3 115..130	**COM[31:0]**	O	LCD COMmon Output	LCD Data filled from page1, please refer the LCD RAM map.
19..114	**SEG[95:0]**	O	LCD SEGment Output	
132	**LC2**	B	Charge Pump Switch 2	Add one 0.1 μF capacitor between LC1 and LC2. Please refer the application circuit.
131	**LC1**	B	Charge Pump Switch 1	
135	**L V3**	B	Highest Charge pump Voltage	LV3>LV2>LV1 Please refer the application circuit.
134	**L V2**	B	Charge Pump V2	
133	**L V1**	B	Charge Pump V1	
136..140	**LR[4..0]**	B	LCD Resister level 4 ~ 0	Please refer the application circuit.
141	**L VG**	I	LCD Virtual Ground	Please refer the application circuit.
1	**PWMP**	O	The PWM positive output can drive speaker or buzzer directly.	Set the bit2 of VOC register as one to turn on PWM.
2	**PWMN**	O	The PWM negative output.	
143	**VO**	O	DAC Voice Output	Set the bit1(DA=1) of VOC register to turn on DAC with VO output.
144	**DAO**	O	Alternative Output of DAC	Set the bit0(OP=1) of VOC register to turn on DAC with VO output and also turn OP comparator on.
145	**OPIN**	I	Negative input of OP comparator	Set the bit0(OP=1) of VOC register to turn on OP comparator.
146	**OPIP**	I	Positive input of OP comparator	
147	**OPO**	O	Output of OP comparator	
156	**DTMFO**	O	DTMF Output	Through PRT12 we can turn on/off DTMF and write data. Using Mask Option MO_DTMFSCK set the clock source of DTMF block. MO_DTMFSCK=0；Clock Source=3.579545 MHz =1；Clock Source=32768 Hz
155	**MUTE**	O	MUTE Output for Dialer	User can turn on/off MUTE pin by port12.
157	**SDO**	O	Serial Data Output	We can turn on/off SDO block or write data by port12.
158	**KEYTONE**	O	1024-Hz 50% duty square wave	User can turn on/off key tone by port12.
154	**VDD**	P	Positive Power Input	Adding 0.1 μF capacitor as by-pass capacitor is between VDD and GND is necessary.
142	**GND**	P	Power Ground Input	

E. LCD RAM Map

Page 1	SEG [7:0]	SEG [15:8]	SEG [23:16]	SEG [31:24]	SEG [39:32]	SEG [47:40]	SEG [55:48]	SEG [63:56]	Page 2	SEG [71:64]	SEG [79:72]	SEG [87:80]	SEG [95:88]
COM0	00H	20H	40H	60H	80H	A0H	C0H	E0H	COM0	00H	20H	40H	60H
COM1	01H	21H	41H	61H	81H	A1H	C1H	E1H	COM1	01H	21H	41H	61H
COM2	02H	22H	42H	62H	82H	A2H	C2H	E2H	COM2	02H	22H	42H	62H
:	:	:	:	:	:	:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:	:	:	:	:	:	:
COM29	1DH	3DH	5DH	7DH	9DH	BDH	DDH	FDH	COM29	1DH	3DH	5DH	7DH
COM32	1EH	3EH	5EH	7EH	9EH	BEH	DEH	FEH	COM32	1EH	3EH	5EH	7EH
COM31	1FH	3FH	5FH	7FH	9FH	BFH	DFH	FFH	COM31	1FH	3FH	5FH	7FH

F. Pin Diagram



F . Bonding Pad Location

PIN Number	PIN Name	X Coordinate	Y Coordinate	PIN Number	PIN Name	X Coordinate	Y Coordinate
1	PWMP	X= -2671.45	Y= 1798.70	96	SEG[18]	X= 2671.10	Y= -3330.30
2	PWMN	X= -2671.45	Y= 1635.35	97	SEG[17]	X= 2671.10	Y= -3214.80
3	COM[16]	X= -2671.45	Y= 1496.25	98	SEG[16]	X= 2671.10	Y= -3099.30
4	COM[17]	X= -2671.45	Y= 1380.75	99	SEG[15]	X= 2671.10	Y= -2983.80
5	COM[18]	X= -2671.45	Y= 1265.25	100	SEG[14]	X= 2671.10	Y= -2868.30
6	COM[19]	X= -2671.45	Y= 1149.75	101	SEG[13]	X= 2671.10	Y= -2752.80
7	COM[20]	X= -2671.45	Y= 1034.25	102	SEG[12]	X= 2671.10	Y= -2637.30
8	COM[21]	X= -2671.45	Y= 918.75	103	SEG[11]	X= 2671.10	Y= -2521.80
9	COM[22]	X= -2671.45	Y= 803.25	104	SEG[10]	X= 2671.10	Y= -2406.30
10	COM[23]	X= -2671.45	Y= 687.75	105	SEG[9]	X= 2671.10	Y= -2290.80
11	COM[24]	X= -2671.45	Y= 572.25	106	SEG[8]	X= 2671.10	Y= -2175.30
12	COM[25]	X= -2671.45	Y= 456.75	107	SEG[7]	X= 2671.10	Y= -2059.80
13	COM[26]	X= -2671.45	Y= 341.25	108	SEG[6]	X= 2671.10	Y= -1944.30
14	COM[27]	X= -2671.45	Y= 225.75	109	SEG[5]	X= 2671.10	Y= -1828.80
15	COM[28]	X= -2671.45	Y= 110.25	110	SEG[4]	X= 2671.10	Y= -1713.30
16	COM[29]	X= -2671.45	Y= -5.25	111	SEG[3]	X= 2671.10	Y= -1597.80
17	COM[30]	X= -2671.45	Y= -120.75	112	SEG[2]	X= 2671.10	Y= -1482.30
18	COM[31]	X= -2671.45	Y= -236.25	113	SEG[1]	X= 2671.10	Y= -1366.80
19	SEG[95]	X= -2671.45	Y= -351.75	114	SEG[0]	X= 2671.10	Y= -1251.30
20	SEG[94]	X= -2671.45	Y= -467.25	115	COM[15]	X= 2671.10	Y= -1135.80
21	SEG[93]	X= -2671.45	Y= -582.75	116	COM[14]	X= 2671.10	Y= -1020.30
22	SEG[92]	X= -2671.45	Y= -698.25	117	COM[13]	X= 2671.10	Y= -904.80
23	SEG[91]	X= -2671.45	Y= -813.75	118	COM[12]	X= 2671.10	Y= -789.30
24	SEG[90]	X= -2671.45	Y= -929.25	119	COM[11]	X= 2671.10	Y= -673.80
25	SEG[89]	X= -2671.45	Y= -1044.75	120	COM[10]	X= 2671.10	Y= -558.30
26	SEG[88]	X= -2671.45	Y= -1160.25	121	COM[9]	X= 2671.10	Y= -442.80
27	SEG[87]	X= -2671.45	Y= -1275.75	122	COM[8]	X= 2671.10	Y= -327.30
28	SEG[86]	X= -2671.45	Y= -1391.25	123	COM[7]	X= 2671.10	Y= -211.80
29	SEG[85]	X= -2671.45	Y= -1506.75	124	COM[6]	X= 2671.10	Y= -96.30
30	SEG[84]	X= -2671.45	Y= -1622.25	125	COM[5]	X= 2671.10	Y= 19.20
31	SEG[83]	X= -2671.45	Y= -1737.75	126	COM[4]	X= 2671.10	Y= 134.70
32	SEG[82]	X= -2671.45	Y= -1853.25	127	COM[3]	X= 2671.10	Y= 250.20
33	SEG[81]	X= -2671.45	Y= -1968.75	128	COM[2]	X= 2671.10	Y= 365.70
34	SEG[80]	X= -2671.45	Y= -2084.25	129	COM[1]	X= 2671.10	Y= 481.20
35	SEG[79]	X= -2671.45	Y= -2199.75	130	COM[0]	X= 2671.10	Y= 596.70
36	SEG[78]	X= -2671.45	Y= -2315.25	131	LC1	X= 2671.10	Y= 712.20
37	SEG[77]	X= -2671.45	Y= -2430.75	132	LC2	X= 2671.10	Y= 827.70
38	SEG[76]	X= -2671.45	Y= -2546.25	133	LV1	X= 2671.10	Y= 943.20

PIN Number	PIN Name	X Coordinate	Y Coordinate	PIN Number	PIN Name	X Coordinate	Y Coordinate
39	SEG[75]	X= -2671.45	Y= -2661.75	134	LV2	X= 2671.10	Y= 1058.70
40	SEG[74]	X= -2671.45	Y= -2777.25	135	LV3	X= 2671.10	Y= 1174.20
41	SEG[73]	X= -2671.45	Y= -2892.75	136	LR4	X= 2671.10	Y= 1289.70
42	SEG[72]	X= -2671.45	Y= -3008.25	137	LR3	X= 2671.10	Y= 1405.20
43	SEG[71]	X= -2671.45	Y= -3123.75	138	LR2	X= 2671.10	Y= 1520.70
44	SEG[70]	X= -2671.45	Y= -3239.25	139	LR1	X= 2671.10	Y= 1636.20
45	SEG[69]	X= -2671.45	Y= -3354.75	140	LR0	X= 2671.10	Y= 1751.70
46	SEG[68]	X= -2671.45	Y= -3470.25	141	LVG	X= 2671.10	Y= 1867.20
47	SEG[67]	X= -2671.45	Y= -3585.75	142	GND	X= 2671.10	Y= 1982.70
48	SEG[66]	X= -2671.45	Y= -3701.25	143	VO	X= 2671.10	Y= 2116.35
49	SEG[65]	X= -2524.65	Y= -4016.95	144	DAO	X= 2671.10	Y= 2268.15
50	SEG[64]	X= -2409.15	Y= -4016.95	145	OPIN	X= 2671.10	Y= 2401.80
51	SEG[63]	X= -2293.65	Y= -4016.95	146	OPIP	X= 2671.10	Y= 2517.30
52	SEG[62]	X= -2178.15	Y= -4016.95	147	OPO	X= 2671.10	Y= 2632.80
53	SEG[61]	X= -2062.65	Y= -4016.95	148	RSTP_N	X= 2671.10	Y= 2748.30
54	SEG[60]	X= -1947.15	Y= -4016.95	149	FXO	X= 2671.10	Y= 2863.80
55	SEG[59]	X= -1831.65	Y= -4016.95	150	FXI	X= 2671.10	Y= 2979.30
56	SEG[58]	X= -1716.15	Y= -4016.95	151	TSTP_P	X= 2671.10	Y= 3094.80
57	SEG[57]	X= -1600.65	Y= -4016.95	152	SXO	X= 2671.10	Y= 3210.30
58	SEG[56]	X= -1485.15	Y= -4016.95	153	SXI	X= 2671.10	Y= 3325.80
59	SEG[55]	X= -1369.65	Y= -4016.95	154	VDD	X= 2671.10	Y= 3441.30
60	SEG[54]	X= -1254.15	Y= -4016.95	155	MUTE	X= 2671.10	Y= 3556.80
61	SEG[53]	X= -1138.65	Y= -4016.95	156	DTMFO	X= 2671.10	Y= 3672.30
62	SEG[52]	X= -1023.15	Y= -4016.95	157	SDO	X= 2671.10	Y= 3787.80
63	SEG[51]	X= -907.65	Y= -4016.95	158	KEYTONE	X= 2671.10	Y= 3916.20
64	SEG[50]	X= -792.15	Y= -4016.95	159	PRTD[7]	X= 1169.30	Y= 4014.10
65	SEG[49]	X= -676.65	Y= -4016.95	160	PRTD[6]	X= 1053.80	Y= 4014.10
66	SEG[48]	X= -561.15	Y= -4016.95	161	PRTD[5]	X= 938.30	Y= 4014.10
67	SEG[47]	X= -445.65	Y= -4016.95	162	PRTD[4]	X= 822.80	Y= 4014.10
68	SEG[46]	X= -330.15	Y= -4016.95	163	PRTD[3]	X= 707.30	Y= 4014.10
69	SEG[45]	X= -214.65	Y= -4016.95	164	PRTD[2]	X= 591.80	Y= 4014.10
70	SEG[44]	X= -99.15	Y= -4016.95	165	PRTD[1]	X= 476.30	Y= 4014.10
71	SEG[43]	X= 16.35	Y= -4016.95	166	PRTD[0]	X= 360.80	Y= 4014.10
72	SEG[42]	X= 131.85	Y= -4016.95	167	PRTC[7]	X= 245.30	Y= 4014.10
73	SEG[41]	X= 247.35	Y= -4016.95	168	PRTC[6]	X= 129.80	Y= 4014.10
74	SEG[40]	X= 362.85	Y= -4016.95	169	PRTC[5]	X= 14.30	Y= 4014.10
75	SEG[39]	X= 478.35	Y= -4016.95	170	PRTC[4]	X= -101.20	Y= 4014.10
76	SEG[38]	X= 593.85	Y= -4016.95	171	PRTC[3]	X= -216.70	Y= 4014.10
77	SEG[37]	X= 709.35	Y= -4016.95	172	PRTC[2]	X= -332.20	Y= 4014.10
78	SEG[36]	X= 824.85	Y= -4016.95	173	PRTC[1]	X= -447.70	Y= 4014.10
79	SEG[35]	X= 940.35	Y= -4016.95	174	PRTC[0]	X= -563.20	Y= 4014.10
80	SEG[34]	X= 1055.85	Y= -4016.95	175	PRT10[7]	X= -678.70	Y= 4014.10

PIN Number	PIN Name	X Coordinate	Y Coordinate	PIN Number	PIN Name	X Coordinate	Y Coordinate
81	SEG[33]	X= 1171.35	Y= -4016.95	176	PRT10[6]	X= -794.20	Y= 4014.10
82	SEG[32]	X= 1286.85	Y= -4016.95	177	PRT10[5]	X= -909.70	Y= 4014.10
83	SEG[31]	X= 1402.35	Y= -4016.95	178	PRT10[4]	X= -1025.20	Y= 4014.10
84	SEG[30]	X= 1517.85	Y= -4016.95	179	PRT10[3]	X= -1140.70	Y= 4014.10
85	SEG[29]	X= 1633.35	Y= -4016.95	180	PRT10[2]	X= -1256.20	Y= 4014.10
86	SEG[28]	X= 1748.85	Y= -4016.95	181	PRT10[1]	X= -1371.70	Y= 4014.10
87	SEG[27]	X= 1864.35	Y= -4016.95	182	PRT10[0]	X= -1487.20	Y= 4014.10
88	SEG[26]	X= 1979.85	Y= -4016.95	183	PRT11[7]	X= -1602.70	Y= 4014.10
89	SEG[25]	X= 2095.35	Y= -4016.95	184	PRT11[6]	X= -1718.20	Y= 4014.10
90	SEG[24]	X= 2210.85	Y= -4016.95	185	PRT11[5]	X= -1833.70	Y= 4014.10
91	SEG[23]	X= 2326.35	Y= -4016.95	186	PRT11[4]	X= -1949.20	Y= 4014.10
92	SEG[22]	X= 2441.85	Y= -4016.95	187	PRT11[3]	X= -2064.70	Y= 4014.10
93	SEG[21]	X= 2671.10	Y= -3676.80	188	PRT11[2]	X= -2180.20	Y= 4014.10
94	SEG[20]	X= 2671.10	Y= -3561.30	189	PRT11[1]	X= -2295.70	Y= 4014.10
95	SEG[19]	X= 2671.10	Y= -3445.80	190	PRT11[0]	X= -2411.20	Y= 4014.10

H. 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}	0^0C ~ 70^0C	
Storage Temperature	T_{st}	-50^0C ~ 100^0C	

Recommended Operating Conditions

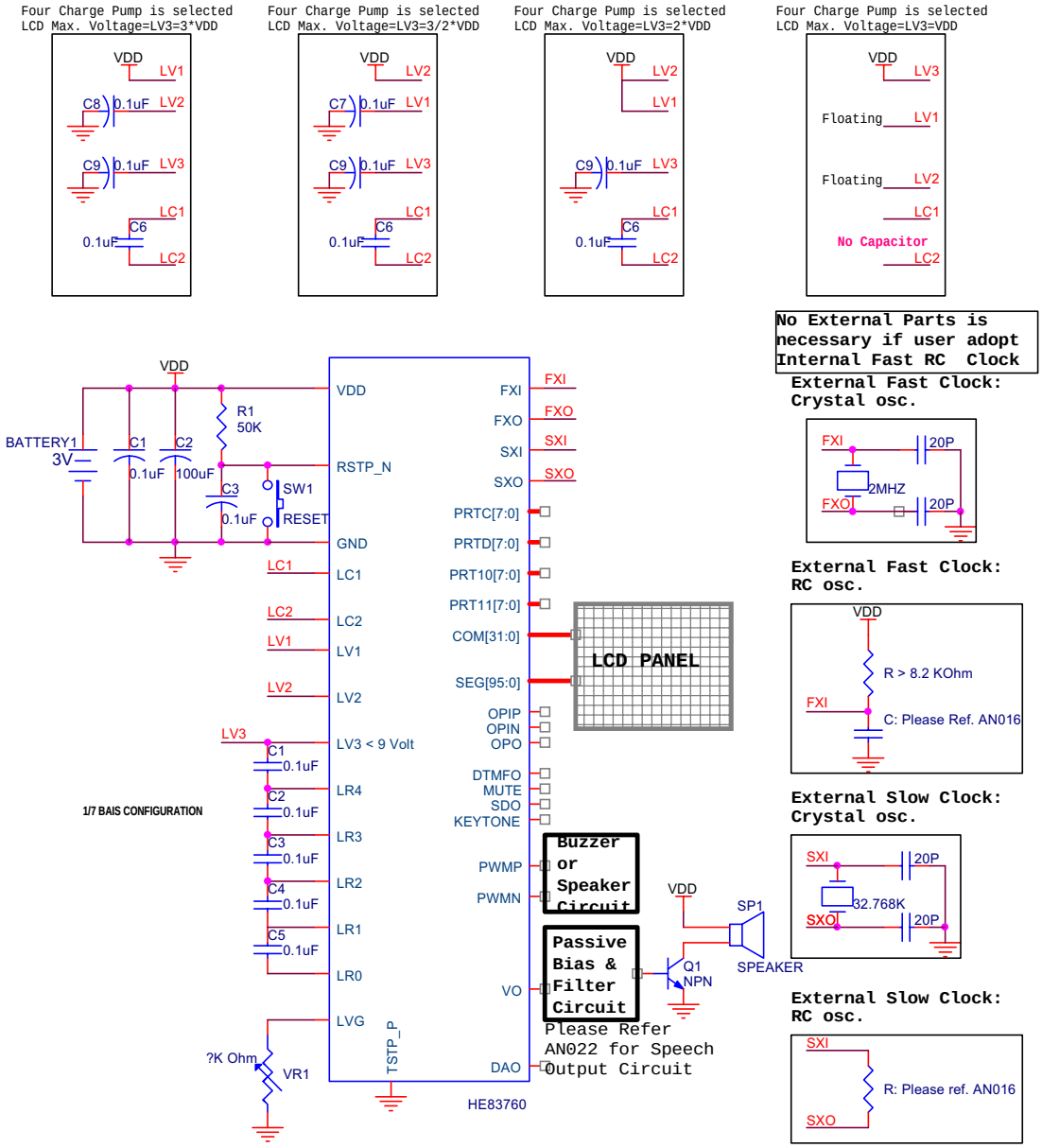
Item	Sym.	Rating	Condition
Supply Voltage	V_{dd}	2.4V ~ 5.5V	
Input Voltage	V_{ih}	0.9 V_{dd} ~ V_{dd}	
	V_{il}	0.0V ~ 0.1V_{dd}	
Operating Frequency	Fmax	8MHz	V_{dd} =5.0V
		4MHz	V_{dd} =2.4V
Operating Temperature	T_{op}	0^0C ~ 70^0C	
Storage Temperature	T_{st}	-50^0C ~ 100^0C	

Test Condition: TEMP=25℃, VDD=3V+/-10%, GND=0V

	PARAMETER		CONDITION	MIN	TYP	MAX	UNIT
I_{Fast}	NORMAL Mode Current	System	2M ext. R/C		1	1.5	mA
I_{Slow}	SLOW Mode Current	System	32.768K X'tal LCD Disable		15	25	μA
I_{Idle}	IDLE Mode Current	System	32.769K X'tal LCD Disable		10	20	μA
I_{LCD}	Extra Current if LCD ON	System	LCD Enable, LCD option=300Kohm Voltage-doubler OFF		20	30	μA
			LCD Enable, LCD option=30Kohm, Voltage-doubler ON		110	160	
I_{Sleep}	Sleep Mode Current	System				1	μA
I_{PWM}	PWM Output Current	PWMP, PWMN*2	With 32Ω Loading	10	14		mA
			With 64Ω Loading	6	8		mA
			With 100Ω Loading	4	5		mA
I_{oVO}	DAC Output Current	VO, DAO	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

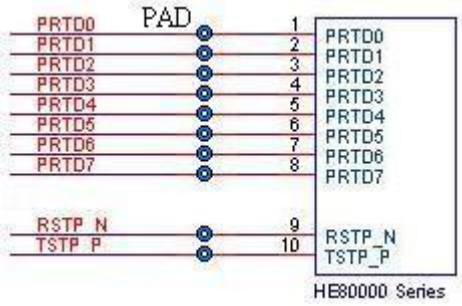
Note: *1: Drive Current Spec. for Push-Pull I/O port only
Sink Current Spec. for both Push-Pull and Open-Drain I/O port.
*2: This Spec. base on one driver only. There are five build-in driver, so user just multiply the number of driver he used to one driver current to get the total amount of current. (I_{PWM} * N; N=0,1,2,3,4,5)

I. Application Circuit



J. Important Note

1. Please always take in mind that ICE is different from IC. ICE is the whole set of HE80000 series IC, but each IC is a subset of ICE. Never use any hardware resource that real IC didn't have, especially RAM and register. KBIDS and compiler cannot prevent user to use some hardware resource that didn't exist. Please check the following table and refer the abbreviation in HE80000 user's manual.
2. LCD driving circuit must be turn off before IC goes into sleep mode.
3. 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).



4. LV3 must small than 9.0 Volt. Otherwise IC may breakdown.

K. Updated Record

Version	Date	Section	Original Content	New Content
V3.1	Jan 11, 2002	B, H	2.2V (VDD operation voltage)	2.4V
		I	1/5 Bias Configuration	1/7 Bias Configuration
		J, K		New Section