



A. HE80170S Introduction

HE80170S is a member of Jess Tech HE8000 series 8-bit CMOS micro-controller. This chip is a Power Speech Controller. It built-in one internal Op-Amp, one 7-bit D/A converter and one PWM output module to provide a speech output interface. Use the built-in 512K ROM can store around 170 seconds of speech data (8KHz sampling rate ADPCM). Use external SRAM or Flash RAM for recording function.

The HE80170S provides a very simple and effective instruction set, each instruction byte occupies only 1.5 clock cycle time, therefore, it is suitable to apply in the high performance systems.

B. HE80170S Features

- Operating Voltage: 2.4V ~ 5.2V
- Operation frequency Range: DC ~ 8MHz @ 5.0V
DC ~ 4MHz @ 2.4V
- ROM size: 512K Bytes
- RAM size: 128 Bytes
- Dual Clock: Normal(Fast) clock: 32.768K ~ 8MHz
Slow clock: 32.768KHz
- Operating Mode: DUAL , FAST , SLOW , IDLE , SLEEP
- Built-in WATCH DOG TIMER
- 24 bi-directional I/O pins, PUSH-PULL or OPEN DRAIN output selected by mask option
- Built-in an internal Op-Amp
- Built-in one D/A Converter
- Built-in a PWM output circuit
- Provides two internal and two external interrupt
- Provides two 16-bit timer (no time base)
- Instruction Set : 32 Instructions, 4 types of Addressing Mode, 2 individual Pointer for ROM (24-bit) and RAM (8-bit) table access.
- Multi-channel voice function.

C. HE80170S Application

- Power Speech Controller provides around 170 seconds of speech time
- Interface to Light, Sound, Temperature and Humidity sensor for controlling application.
- Use external SRAM or Flash RAM for recording function.



D. Pin Assignment

| Pin | Pin Name | I/O | Function | Description |
|------------|---------------------------|---------|---|--|
| 15 14 | FXI, FXO | B, O | External Fast Clock pin. Connecting to crystal or RC to generate 32.768KHz ~ 8MHz frequency. | Mask Option settings : MO_FCK/SCKN=00 : Slow Clock only 01 : Illegal 10 : Dual Clock 11 : Fast Clock only MO_FOSCE=0 : Internal fast oscillation 1 : External fast oscillation |
| 18 17 | SXI, SXO | I, O | External Slow Clock pin. Connecting with 32768Hz crystal or resistor as slow clock and providing clock source for LCD display, TIMER1, Time-Base and other internal blocks. | MO_FXTAL=0 : RC osc. for Fast Clock 1 : X'tal osc. for Fast Clock MO_SXTAL=0 : RC for 32768Hz Clock 1 : X'tal for 32768Hz 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 32768Hz clock is for LCD and Timer 1 only. |
| 13 | RSTP_N | I | System reset signal | 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 |
| 16 | TSTP_P | I | Test Pin. | Please bond this pin and add a test point on PCB for debugging. Leave this pin floating is OK. |
| 20.. 27 | 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 Option 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). |
| 36 | PWMP | O | PWM positive output can drive speaker or buzzer directly. | Set the bit-2 of VOC register (PWM =1) to turn on the PWM |
| 37 | PWMN | O | PWM negative output can drive speaker or buzzer directly. | Set the bit-2 of VOC register (PWM =1) to turn on the PWM. |
| 8 | VO | O | D/A voice output | Set the bit-1 of VOC register (VO =1) to turn on the VO. |
| 9 | DAO | O | D/A output, for OP use | Set the bit-0 of VOC register (DAO =1) to turn on the DAO. |
| 10 | OPIN | I | Negative input of OP comparator | Individual internal Op-Amp. |
| 11 | OPIP | I | Positive input of OP comparator | |
| 12 | OPO | O | Output of OP comparator | |
| 19 | VDD | P | Positive Power Input | Adding 0.1mF capacitor as by-pass capacitor is between VDD and GND is necessary |
| 38 | GND | P | Power Ground Input | |

F. Bonding Pad Location

| PIN Number | PIN Name | X Coordinate | Y Coordinate | PIN Number | PIN Name | X Coordinate | Y Coordinate |
|------------|----------|--------------|--------------|------------|----------|--------------|--------------|
| 1 | NC | X= -544.55 | Y= 1562.60 | 21 | PRTD[6] | X= 1375.50 | Y= 254.15 |
| 2 | NC | X= -681.50 | Y= 1562.60 | 22 | PRTD[5] | X= 1375.50 | Y= 391.10 |
| 3 | NC | X= -818.45 | Y= 1562.60 | 23 | PRTD[4] | X= 1375.50 | Y= 528.05 |
| 4 | NC | X= -955.40 | Y= 1562.60 | 24 | PRTD[3] | X= 1375.50 | Y= 665.00 |
| 5 | NC | X= -1092.35 | Y= 1562.60 | 25 | PRTD[2] | X= 1375.50 | Y= 801.95 |
| 6 | NC | X= -1229.30 | Y= 1562.60 | 26 | PRTD[1] | X= 1375.50 | Y= 938.90 |
| 7 | NC | X= -1366.25 | Y= 1562.60 | 27 | PRTD[0] | X= 1298.20 | Y= 1562.60 |
| 8 | VO | X= 1375.50 | Y= -1540.20 | 28 | NC | X= 1161.25 | Y= 1562.60 |
| 9 | DAO | X= 1375.50 | Y= -1388.40 | 29 | NC | X= 1014.70 | Y= 1562.60 |
| 10 | OPIN | X= 1375.50 | Y= -1252.30 | 30 | NC | X= 877.75 | Y= 1562.60 |
| 11 | OPIP | X= 1375.50 | Y= -1115.35 | 31 | NC | X= 740.80 | Y= 1562.60 |
| 12 | OPO | X= 1375.50 | Y= -978.40 | 32 | NC | X= 603.85 | Y= 1562.60 |
| 13 | RSTP_N | X= 1375.50 | Y= -841.45 | 33 | NC | X= 466.90 | Y= 1562.60 |
| 14 | FXO | X= 1375.50 | Y= -704.50 | 34 | NC | X= 329.95 | Y= 1562.60 |
| 15 | FXI | X= 1375.50 | Y= -567.55 | 35 | NC | X= 193.00 | Y= 1562.60 |
| 16 | TSTP_P | X= 1375.50 | Y= -421.60 | 36 | PWMP | X= 43.25 | Y= 1562.60 |
| 17 | SXO | X= 1375.50 | Y= -293.65 | 37 | PWMN | X= -120.10 | Y= 1562.60 |
| 18 | SXI | X= 1375.50 | Y= -156.70 | 38 | GND | X= -270.65 | Y= 1562.60 |
| 19 | VDD | X= 1375.50 | Y= -19.75 | 39 | NC | X= -407.60 | Y= 1562.60 |
| 20 | PRTD[7] | X= 1375.50 | Y= 117.20 | | | | |



G. Electrical 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°C ~ 70°C | |
| Storage Temperature | T_{st} | -50°C ~ 100°C | |

Recommended Operating Conditions

| Item | Sym. | Rating | Condition |
|-----------------------|----------|-------------------------|---------------|
| Supply Voltage | V_{dd} | 2.4V ~ 5.2V | |
| Input Voltage | V_{ih} | $0.9V_{dd} \sim V_{dd}$ | |
| | V_{il} | $0.0V \sim 0.1V_{dd}$ | |
| Operating Frequency | Fmax | 8MHz | $V_{dd}=5.0V$ |
| | | 4MHz | $V_{dd}=2.4V$ |
| Operating Temperature | T_{op} | 0°C ~ 70°C | |
| Storage Temperature | T_{st} | -50°C ~ 100°C | |



Test condition: 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_{Slow} | SLOW Mode Current | System | 32.768K X'tal | | 6 | 9 | μA |
| I_{Idle} | IDLE Mode Current | System | 32.769K X'tal | | 4 | 7 | μA |
| I_{Sleep} | Sleep Mode Current | System | | | | 1 | μA |
| I_{oHPW} | PWM Output Drive Current | PWMP, PWMN*2 | $V_{DD}=3V; V_{oh}=2V$ | 12 | 15 | | mA |
| I_{oLPW} | PWM Output Sink Current | PWMP, PWMN*2 | $V_{DD}=3V; V_{ol}=1V$ | 33 | 40 | | mA |
| I_{oVO} | DAC Output Current | VO, DAO | $V_{DD}=3V; VO=0\sim 2V, Data=7F$ | 2.5 | 3 | | mA |
| V_{iH} | Input High Voltage | I/O pins | | 0.8 | | | V |
| | | | | V_{DD} | | | |
| V_{iL} | Input Low Voltage | I/O pins | | | | 0.2 | V |
| | | | | | | V_{DD} | |
| V_{hys} | Input Hysteresis Width | I/O, RSTP_N | Threshold=2/3 V_{DD} (input from low to high) Threshold=1/3 V_{DD} (input from high to low) | | 1/3 | | V |
| | | | | | V_{DD} | | |
| I_{oH} | Output Drive Current | I/O pull-high*1 | $V_{ol}=2.0V$ | 50 | | | μA |
| I_{oL1} | Output Sink Current | I/O pull-low*1 | $V_{ol}=0.4V$ | 1.0 | | | mA |
| I_{iL1} | Input Low Current | RSTP_N | $V_{iL}=GND$, pull high Internally | | 20 | | μA |
| I_{iL2} | Input Low Current | I/O | $V_{iL}=GND$, if pull high Internally by user | | 100 | | μA |

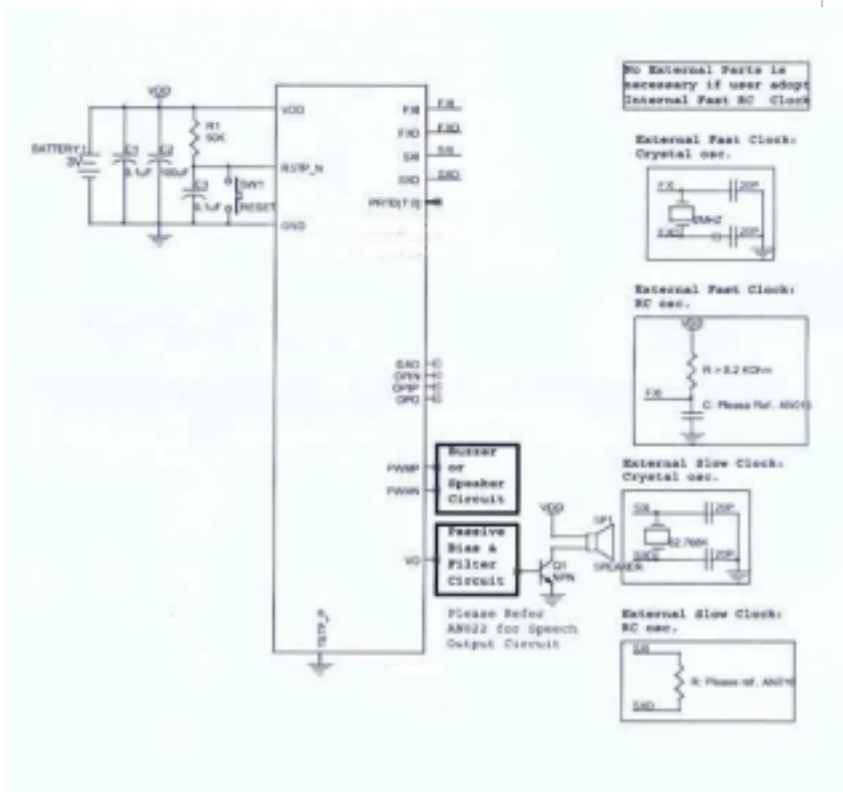
Note: *1: Drive Current Spec. for Push-Pull I/O port only

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. ($I_{oHPWM} \cdot I_{oLPWM} * N$; N=0,1,2,3,4,5)

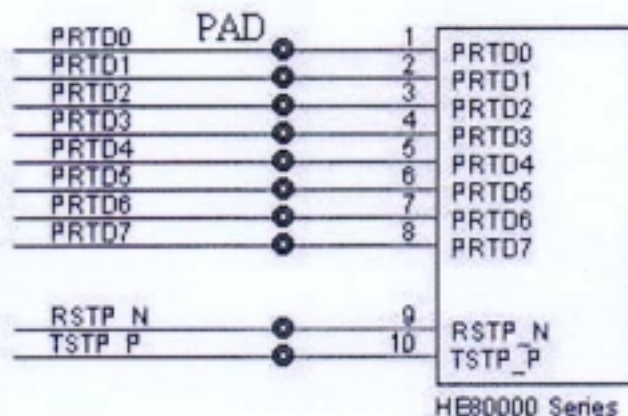
H. Application Circuit



I. Important Note

For accessing any address large than 64KB, users must update TPP first, TPH then TPL. Only by this order, the pre-charge circuit of ROM will work correctly. 5us waiting is necessary before LDV instruction is executed since Data ROM is a low speed ROM. Users can not emulate this accessing process in ICE. So 5us delay should be added by firmware.

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 JESS 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.)



SUPPLEMENTARY SPECIFICATION: HE80 Series PWM application

Description:

For HE80 PWM application, the following points must be bare in mind.

1. The PWM output can direct drive buzzer.
2. For direct drive speaker, it must use 32Ω or above speaker.
3. For speaker application, it must add capacitors between IC's VDD ground and its PWM output, see below figure.

Note: the 1uF capacitor must be connected near IC's

