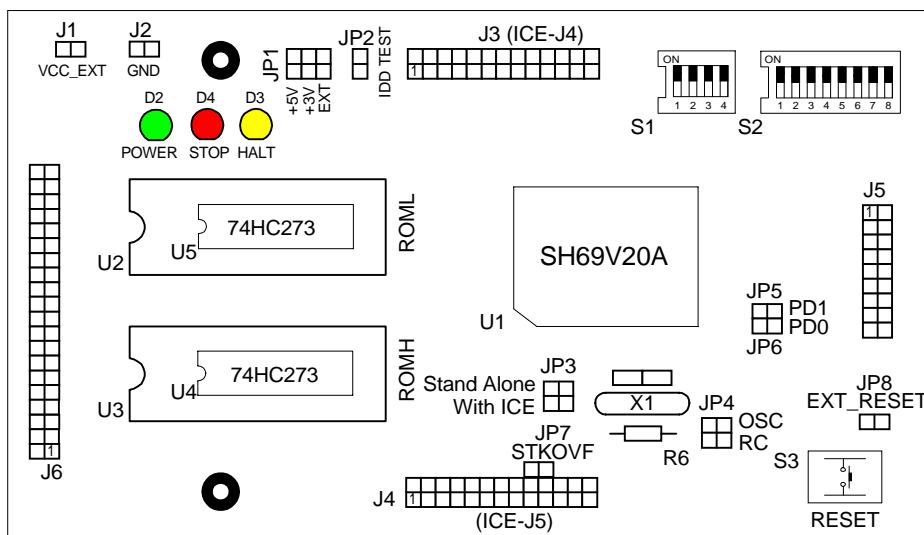# SINO WEALTH

SH69K20A EVB

## Application Notice for SH69K20A EVB

SH69K20A EVB

The SH69K20A EVB is used to evaluate the SH69K20A chip's function for the development of application program. It contains of a SH69V20A chip to evaluate the functions of SH69K20A. The following figure shows the placement diagram of SH69K20A EVB.

There are two configurations of SH69K20A EVB in application development: ICE mode and stand-alone mode.
In the ICE mode, the SH66xx ICE (motherboard) is connected to the SH69K20A EVB by the ICE interface.
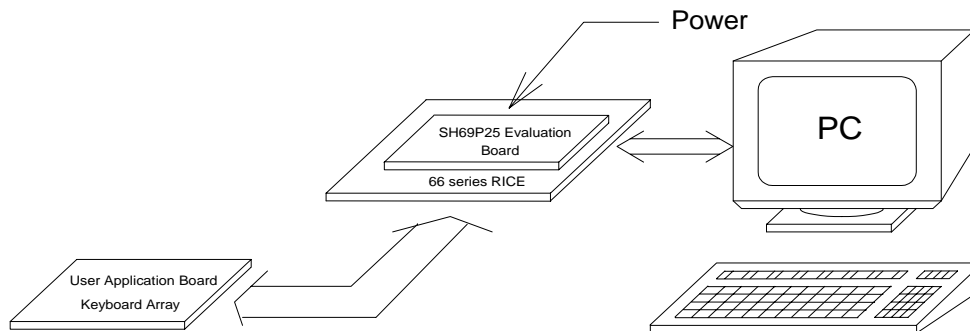
(a) ICE mode

In the stand-alone mode, the SH69K20A EVB is no longer connected to the motherboard. But the EPROM board must be connected to the SH69K20A EVB by the EPROM interface. The EPROMs which may be the 27512 or 27256 store the application program;
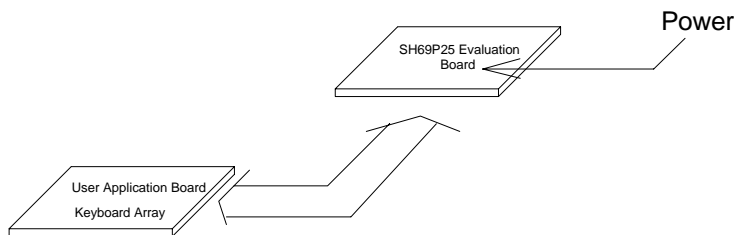
(b) Stand-alone mode

The process of your program's evaluation on SH69K20A EVB

Uasm66.exe: assemble the program, and get binary (*.obj) file and the other files.
Depart the one 16 bits obj file to the two 8 bits files by convert.exe.

Usage example (for example: aaa.asm):
    1.Run the SH66 series assemble program:
     C: >uasm66 aaa.asm ; to produce the obj file: aaa.obj
    2. Depart the aaa.obj to two 8 bits files aaah.obj and aaal.obj, for example:
     C: > convert
        Input the 16 bits (.obj) file aaa.obj
        Then aaah.obj and aaal.obj will be created.
    3. Write the aaah.obj to EPROM (ROMH)
     Write the aaal.obj to EPROM (ROML)
    4. Put the two EPROMs (ROML and ROMH) on the EV board U3,U2.

SH69K20A EVB Programming Notices:

1. Clear data RAM and initialize all system registers at the beginning.
2. Do not perform logical operation with I/O ports. Especially when the I/O ports have external connections.
3. Do not perform arithmetic operation with those registers only have 1, 2 or 3 bits. This kind of operation may not get the result you expected.
4. Never use reserved registers.
5. If "IE" instruction (interrupt enable) is set outside the interrupt processing program and there is "HALT" or "STOP" instruction, this two instructions should be followed "IE" instruction closely.
6. After CPU responding to an interrupt, IRQ should be cleared before resetting IE in order to avoid many responses to one interrupt.
7. Interrupt Enable instruction will be automatically cleared after entering interrupt-processing program. If setting IE too early, there is a possibility of re-entry the interrupt. So the Interrupt Enable instruction should be placed at the end and followed closely by two instructions include "RTNI".
8. During the two successive instruction cycles next to Interrupt Enable instruction, CPU will not respond to any interrupts.
9. After CPU responding to interrupts, each bit of IE will be cleared by hardware while IRQ should be cleared by software.
10. It is necessary to add NOP before or after the HALT instruction, else the CPU will execute error instruction when it wakes up from the HALT.
    ```
    .
    . .
    NOP
    HALT
    NOP
    .
    . .
    ```
11. It is wise to set Interrupt Enable flag before you return from subroutine in two instruction.
    ```
    .
    . .
    LDI    IE, 04H;      Enable timer0 interrupt
    LDA    Temp,0
    RTNI
    ```
12. When you set Interrupt Enable flag as the following and your subroutine do not set Interrupt Enable flag, then your system will never wake up if an interrupt entered between the NOPs.
    Sample: incorrect use!
    ```
    . .
    LDI    IE, 1111B;  IE = Interrupt enable flag
    NOP
    NOP
    NOP
    HALT
    .
    . .
    ```
13. To add "p=69K20A" and "romsize=1024" at the beginning of a program. If any problem is found in compiling the program, check if the SH6566.dev is located at the program directory.
14. When setting Timer Counter, first fill T0L, then T0H.
15. After setting TM0, T0L, T0H, it is unnecessary to reset them after interrupt each time. If TM0, T0L, T0H are reset after each TIMER interrupt, interrupt interval time will not equal because the interrupt timing is not successive.
16. Any instruction containing writing to or reading from memory, it should not be used to operate with I/O Port. It is best to avoid using those instructions such as "SUB, ADD " which do not contain Write operation with I/O Port but have computation operation.
17. When the internal pull-up resistor is on, "1" must be written to I/O Port before Reading. And when the internal pull-low resistor is on, "0" must be written to I/O Port before Reading.
18. Don't let any I/O port at floating state before entering "STOP" mode, or the stop current will exceed the specification defined.
19. Directly reading PORT states ensure the count is correct.
20. Interrupt activating from STOP at the first time can save power.
21. When the Compiler of old version compiles program, the last line will be read twice. So, if the last line is an instruction, two same operations will be occurred. If there is Label in the last line, compiler will give an error named 'repeated definition' . This will happen in main program or included files and it is recommended that the last line should be a blank line or END.
22. The stack has four layers, if an interrupt is enabled, there only have three layers can be used. Otherwise, if an interrupt comes, the stack will be overflowed that will cause CPU Reset or other errors.

23. Key De-bounce time is recommended to be 50ms. If a user use Rubber Key, it is best to test Rubber Key's De-bounce time.
24. Index register DPH and DPM both have three bits only, so pay attention to the referred address when using them.
25. It takes about 0.3 second to wake up from STOP when using 32768Hz crystal. So, if the system is waked up by key pressing, the key may have been released when the program begins to read Key value. Please pay more attention to this problem.
26. The "NOP" instruction should be added at the beginning of the program to ensure the IC is stability.
27. SH69K20A EV board is designed for SH69K20A.

SH69K20A EVB interface connector: (TOP View from EVB)

J1, J2 (VCC_EXT, GND):

- External Power input for Stand-Alone mode. The voltage of VCC_EXT must be 5V±5%.

J5 (User's interface):

PORTA.2	1	PORTA.1
EX1/PORTA.3		PORTA.0/EX0
T0/PORTD.2		OSCI/PORTD.1
$\overline{RESET}$/PORTD.3		OSCO/PORTD.0
GND		VDD_EXT
PORTB.0		PORTC.3
PORTB.1		PORTC.2
PORTB.2		PORTC.1
PORTB.3		PORTC.0

J3, J4 (With ICE interface):

- Connect with RICE66.

J6 (With ICE interface):

- Connect with RICE66 (user can connect RICE66 with J3&J4 or with J6).

Jumper setting:

JP1 (EVB power select):

- Short the +5V position(Default), the voltage (+5V) of SH69V20A is internal source.
- Short the +3V position, the voltage (+3V) of SH69V20A is internal source.
- Short the EXT position, the external power (2.0~5.5V, refer to SH69K20A spec) of SH69V20A is input from EXT pin of J5.

JP2 (SH69K20A current test):

- This jumper must be connected(Default).
- If you want to get the operating current (for reference only), remove the jumper and link a current-meter(the upper point is positive; the down point is negative).

JP3 (SH69K20A EVB With ICE/Stand Alone mode select):

- If short the "With ICE" position (Default), the clock of SH69K20A EVB is fed from the ICE. This is only for ICE mode.
- If short the "Stand Alone" position, the system clock of SH69V20A is provided from its oscillator(refer to SH69K20A spec). This is only for stand-alone mode.

JP4 (SH69K20A EVB RC Oscillator or Crystal/Ceramic Oscillator select, Stand-alone mode only):

- If short the "OSC" position, then oscillator type (S1) select crystal or ceramic, the clock of SH69V20A is provided from crystal or ceramic resonator. User must put a crystal or ceramic resonator to X1 position and two capacity to C2/C3 position on board.
- If short the "RC" position, then oscillator type (S1) select external RC resonator, the clock of SH69V20A is provided from external RC resonator. User must put a RC resistor (R_{OSC}=47K/Fosc=8MHz, for reference only) to R6 position on board.

JP5, JP6 (SH69K20A PortD0/PortD1 function select):

- If the OSCO pin shared as PortD.0, JP6 should be shortened or JP6 should be removed.
- If the OSCI pin shared as PortD.1, JP5 should be shortened or JP5 should be removed.

JP7 (SH69K20A EVB Stack overflow function enable/disable select, available in ICE-mode):

- If short this jumper (Default), then the Stack overflow function is enabled in ICE mode.
- If remove this jumper, then the Stack overflow function is disabled in ICE mode.

JP8 (SH69K20A External Reset circuit select):

- If short this jumper (Default), then external reset circuit (R13, C13, S3) is selected.
- If remove this jumper, then external reset circuit is disabled, and user must set bit6 of S2 to use internal reset function(Reset pin shared as PortD.3).

Switch setting:

S1:

1. OSC2, OSC1, OSC0:

Off,	off,	off	select 32.768K Crystal resonator;
Off,	off,	on	select 400K~8MHz Crystal resonator;
Off,	on,	off	select 400K~8MHz Ceramic resonator;
Off,	on,	on	select External RC resonator;
On,	off,	off	select 6MHz Internal RC resonator;
On,	off,	on	select 4MHz Internal RC resonator;
On,	on,	off	select 2MHz Internal RC resonator;
On,	on,	on	select External Clock from OSCI;

2. If you turn on bit 4 (OSC3), then select high frequency clock (1MHz~8MHz); else select low frequency clock (32K~1MHz).
3. When select External/Internal RC resonator or External Clock source, then the OSCO pin shared as PortD.0.
4. When select Internal RC resonator, then the OSCI pin shared as PortD.1.

S2:

1. To use the function of SH69K20A, you must turn on bit 1 of this switch, or the EVB will work improperly.
2. If turn on bit 2 of this switch, then **enable the Watch Dog function**, else **disable the Watch Dog function**.

3. If turn on bit 3 of this switch, then **enable the LVR function**, else **disable the LVR function**.
4. If turn on bit 4 of this switch, then **select LVR high voltage(3.6V~4.2V) function**, else **select LVR low voltage(1.4V~2.0V) function**.
5. If turn on bit 5 of this switch, then **select 5V operating voltage mode**; else **select 3V operating voltage mode**.
6. If turn on bit 6 of this switch, then **select Reset pin used as reset function**; else **select Reset pin shared as PortD3(input only)**.

S3:

Reset the whole system when push the button (Only when Reset pin used as reset function and external reset circuit is used).

LED declare:

Power indicate:
    D2 (Green LED) is lighted when power of the EVB is on.
HALT indicate:
    D3 (Yellow LED) is lighted when the system has gone into the HALT mode.
STOP indicate:
    D4 (Red LED) is lighted when the system has gone into the STOP mode.

Notice:
Evaluate your program with ICE indicate:
1. After enter to RICE66 and successfully download the user program, push the F5 (Reset) on PC keyboard before run your program when you evaluate your program with ICE. If there were abnormal response, the user should power off the ICE, quit RICE66 and wait for a few seconds before restart.
2. First time run RICE66, need to select an appropriate MCU type, clock frequency ... save the settings and restart RICE66 again.
3. Can't Step (F8) or Over (F9) a HALT and STOP instruction.
4. When you want to escape from HALT or STOP (in ICE mode), you should press the F5 key on PC keyboard twice.
5. The maximum current limit of the +3V power is 100mA, when the user uses internal +3V power to drive external device such as LED.