



Silicon Storage Technology, Inc.

SST89C5x
SST89E/V5x4Rx
SST89E/V5xRDx
SoftICE
User's Guide



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1.0 OVERVIEW

1.1 Introduction

SoftICE stands for Software In-Circuit Emulator. It is an in-circuit development tool for SST customers to debug their applications in SST89C5x, SST89E/V5x4Rx, and SST89E/V5xRDx MCUs.

The purpose of this document is to provide a hands-on reference guide for users of the SoftICE software utility tool. It also lists SoftICE features and shows the users how to install SoftICE in their system.

1.1.1 Scope

The scope of this document is limited to discussing SoftICE features, target hardware requirements, installing and using SoftICE, and user code restrictions.

1.1.2 References

TABLE 1-1: FILE AND SOFTWARE REFERENCES

Title	Location
1. KEIL 8051/251 Evaluation Kit	
Setup software	CD-ROM\Keil\setup.exe
Getting Started with μ Vision 2	CD-ROM\Keil\Keil\C51\Hlp\Gs51.pdf
2. IAP demo program ¹	
demoIAP_5x	CD-ROM\SST89C5x\SoftICE\demoIAP_5x
demoIAP_554	CD-ROM\SST89x554\SoftICE\demoIAP_554
demoIAP_564	CD-ROM\SST89x564\SoftICE\demoIAP_564
3. SST Boot-Strap Loader User's Guide	CD-ROM\User's Guides\Boot-Strap Loader User's Guide
4. SST89C5x SoftICE	
SoftICE54.hex	CD-ROM\SST89C5x\SoftICE\ SoftICE54.hex
SoftICE58.hex	CD-ROM\SST89C5x\SoftICE\ SoftICE58.hex
5. SST89E/V554RC SoftICE	
SoftICE554.hex	CD-ROM\SST89x554\SoftICE\ SoftICE554.hex
6. SST89E/V564RD SoftICE	
SoftICE564.hex	CD-ROM\SST89x564\SoftICE\ SoftICE564.hex
7. SST89E/V54RD2 SoftICE	
SoftICE54RD2.hex	CD-ROM\SST89x54RD2\SoftICE\ SoftICE54RD2.hex
8. SST89E/V58RD2 SoftICE	
SoftICE58RD2.hex	CD-ROM\SST89x58RD2\SoftICE\ SoftICE58RD2.hex

T1-1.1 4003

1. These demoIAP programs are only for SST89C5x and SST89E/V5x4Rx.

1.1.3 Software/Documentation Updates

For the latest SST software and documentation updates, visit the SST web site at www.SST.com or www.Super-Flash.com.

For the latest Keil software and documentation updates, visit Keil's web site at www.keil.com.



2.0 SOFTICE FEATURES

SST89C5x / SST89E/V5x4Rx / SST89E/V5xRDx SoftICE communicates with the KEIL μ Vision2 Debugger using one of the PC's COM ports. It helps debug the target programs in real-time, thus provides engineers using SST89C5x / SST89E/V5x4Rx / SST89E/V5xRDx with an in-circuit development tool, which is simple, effective and easy to use. Small and compact though, SoftICE has most of the features of sophisticated hardware emulators. The features supported by SoftICE together with KEIL μ Vision2 Debugger are as follows:

- Download Intel HEX files.
- Source code debugging supporting both assembler and C51 high level language.
- Disassemble the code area into 8051 mnemonics.
- In-line Assembler.
- STEP
- STEP OVER
- Set/Remove Break Point (up to 10 fixed and 1 temporary Break Point)
- GO to Break Point/Cursor
- Read/Write Data memory
- Read/Write Code memory
- Read/Write SFRs
- Read/Write Ports
- SST-specific In-Application Programming (IAP)

3.0 TARGET HARDWARE REQUIREMENTS

SST89C5x / SST89E/V5x4Rx / SST89E/V5xRDx SoftICE requires the following hardware components:

- Serial interface with timer 2 as baud rate generator.
- 8 byte stack space
- 5 KByte code memory is used by SoftICE firmware.

For SST89C58: 1 KByte in Block1, from F000h to F3FFh.

4 KByte in Block0, from 7000h to 7FFFh.

For SST89C54: 1 KByte in Block1, from F000h to F3FFh.

4 KByte in Block0, from 3000h to 3FFFh.

For SST89E/V554RC: 4 KByte in Block1, from 0000h to 0FFFh.

1 KByte in Block0, from 7C00h to 7FFFh.

For SST89E/V564RD: 4 KByte in Block1, from 0000h to 0FFFh.

1 KByte in Block0, from FC00h to FFFFh.

For SST89E/V54RDx: 1 KByte in Block1, from E000h to EFFFh.

4 KByte in Block0, from 3C00h to 3FFFh.

For SST89E/V58RDx: 1 KByte in Block1, from E000h to EFFFh.

4 KByte in Block0, from 7C00h to 7FFFh.

All other on-chip resources can be used by the application.



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A typical connection between SoftICE and KEIL μ Vision2 Debugger is shown in Figure 3-1.

Make sure the device is in Internal Mode, that is, EA# (pin 31) is at a logic "high".

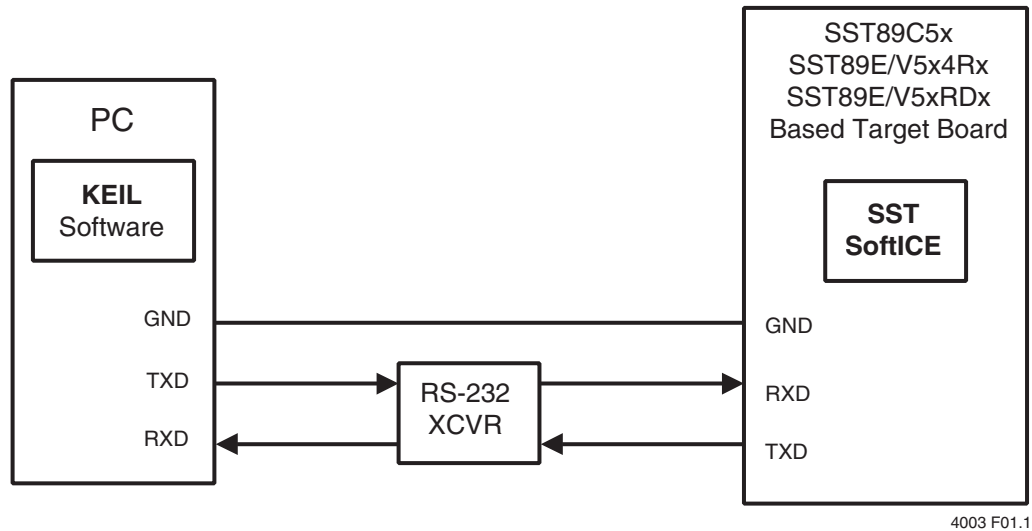


FIGURE 3-1: HARDWARE CONNECTION

The connection between SST BSL Demo Board v2.0 and PC is shown in Figure 3-2. Use the SoftICE adapter between the cable and the demo board.

Make sure switches 1 and 2 are OFF and switch 8 is ON.

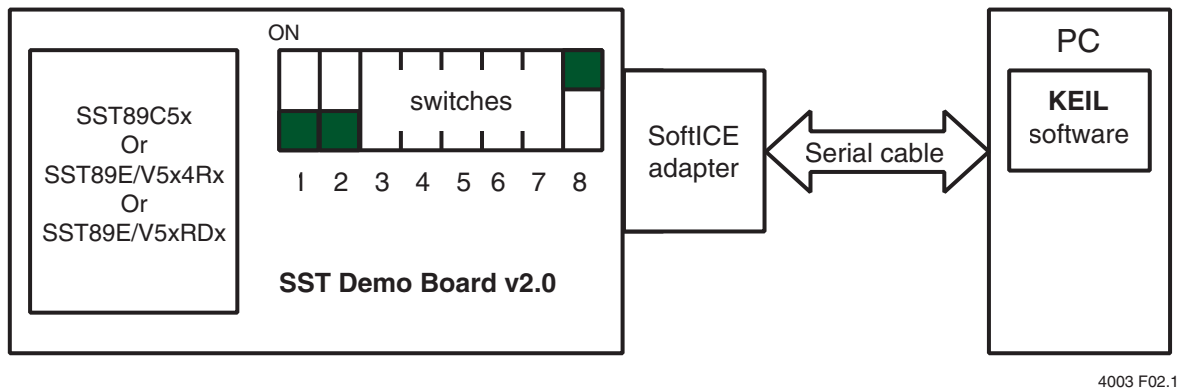


FIGURE 3-2: CONNECT SST DEMO BOARD AND PC



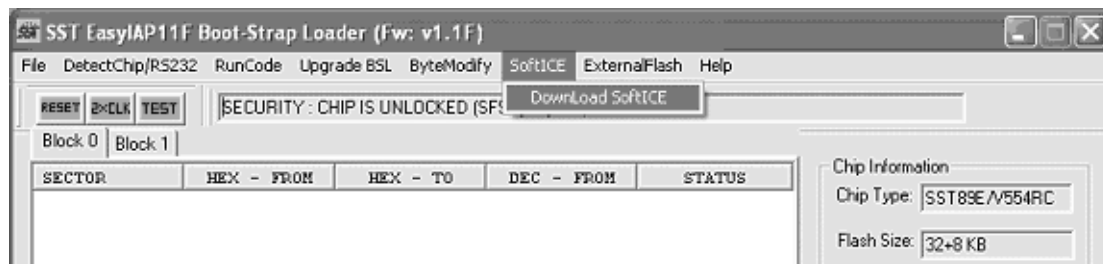
4.0 INSTALLING SOFTICE

4.1 Install SoftICE from SST Boot-Strap Loader

SoftICE firmware can be loaded into MCU directly from the SST Boot-Strap Loader.

After the device type is detected in Internal Memory Mode, SoftICE firmware can be downloaded by clicking on "Download SoftICE" in the SoftICE menu. SST Boot-Strap Loader will download the specific SoftICE for the device detected. Be aware that once the SoftICE firmware is downloaded, the SST Boot-Strap Loader located in block 1 will be replaced by SoftICE firmware.

For detailed information on how to use the SST Boot-Strap Loader, please refer to the *SST Boot-Strap Loader User's Guide* (Reference 3).



4.2 Install SoftICE by programmer

SoftICE firmware can also be loaded into the MCU by a 3rd party programmer.

- For SST89C54: Load SoftICE54.hex (Reference 4) to SST89C54, and remap 1k.
- For SST89C58: Load SoftICE58.hex (Reference 4) to SST89C58, and remap 1k.
- For SST89E/V554RC: Load SoftICE554.hex (Reference 5) to SST89E/V554RC, block 1. Do not program SC0 (Prog-SC0) or SC1 (Prog-SC1) bits, so that after reset, the MCU will always start to execute SoftICE.
- For SST89E/V564RD: Load SoftICE564.hex (Reference 6) to SST89E/V564RD, block 1. Do not program SC0 (Prog-SC0) bit, so that after reset, the MCU will always start to execute SoftICE.
- For SST89E/V54RDx: Load SoftICE54RD2.hex (Reference 7) to SST89E/V54RDx, block 1. Do not program SC0 (Prog-SC0) or SC1 (Prog-SC1) bits, so that after reset, the MCU will always start to execute SoftICE.
- For SST89E/V58RDx: Load SoftICE58RD2.hex (Reference 8) to SST89E/V58RDx, block 1. Do not program SC0 (Prog-SC0) or SC1 (Prog-SC1) bits, so that after reset, the MCU will always start to execute SoftICE.

After SoftICE firmware is loaded into MCU and Keil software installed (Reference 1, setup software), connect the target board with PC as shown in Figure 3-1. When power-on or reset, the SoftICE is ready to communicate with Keil software to debug the user program. Note that when using Keil software demo version, user code size is limited to 2 KByte.

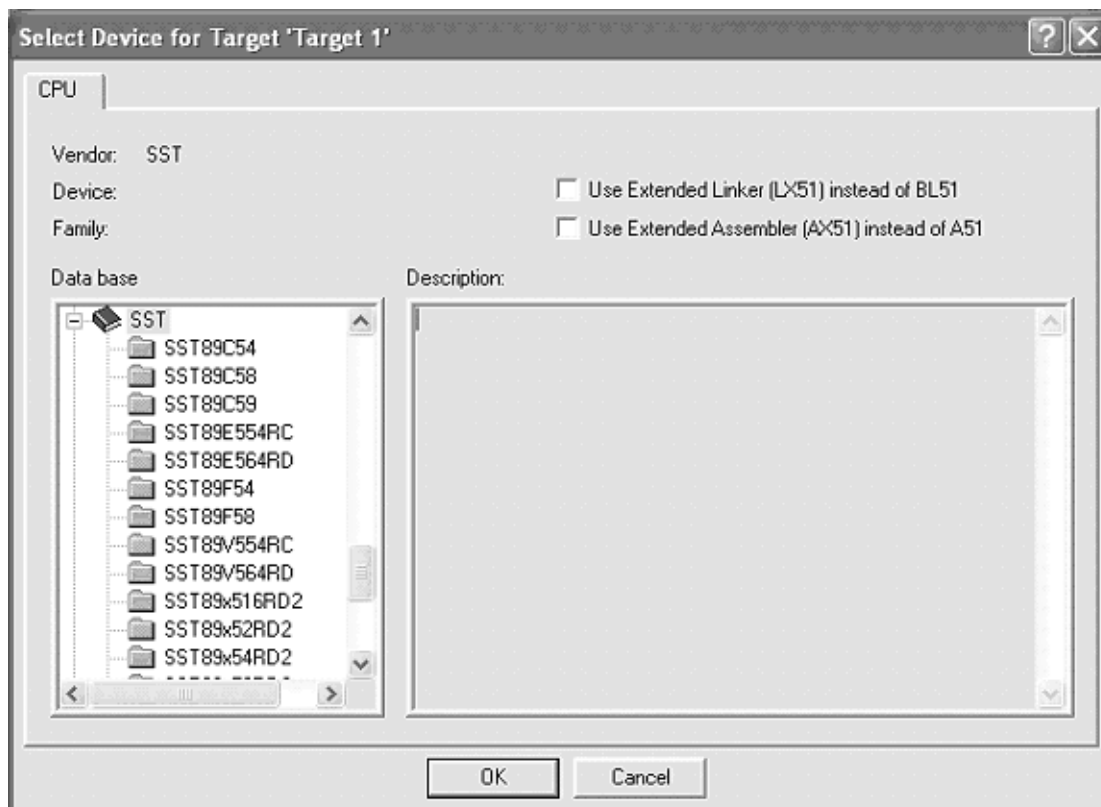


5.0 HOW TO USE SOFTICE

Step 1. Create project and compile user program

Create project and compile user program. For detailed instructions on how to create a project and compile a user program, please refer to *Getting Started with μ Vision2* (Reference 1).

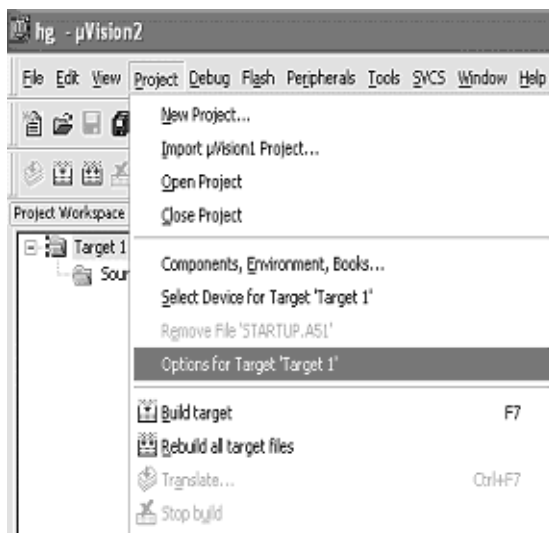
Select one of the SST MCUs (e.g. SST89C5x, SST8989E/V5x4Rx, or SST89E/V5xRDx) as the target device.



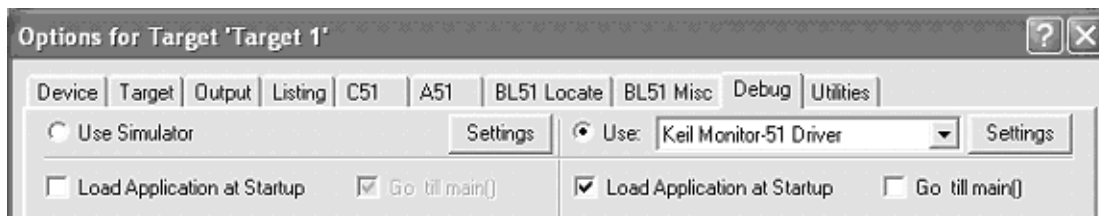


Step 2. Configurations

Select Options for Target 'Target 1' From KEIL user interface.

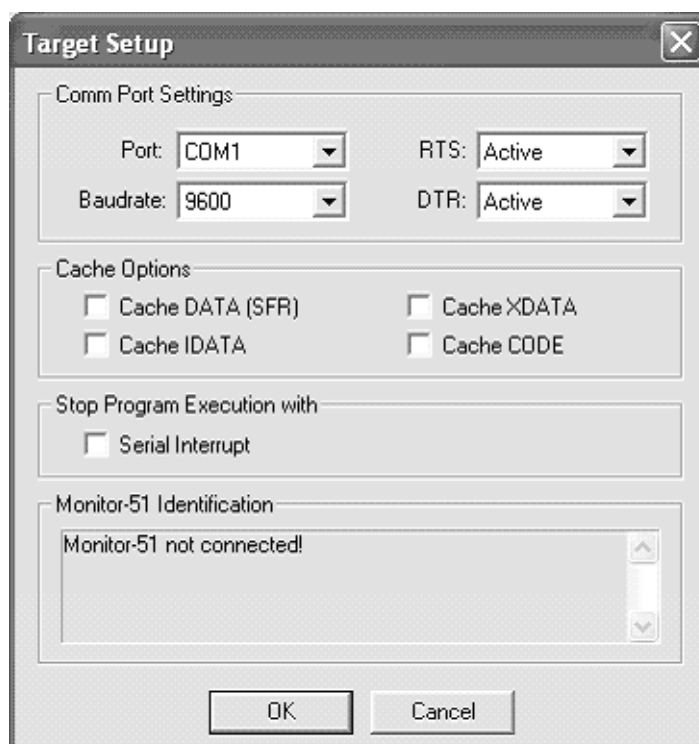


In the Options for Target 'target 1' window, select Use Keil Monitor-51 Driver in Debug tag. Note that the user's code area will be erased each time when the target board is reset. So Load Application at Startup should be selected also, if the user program needs to be loaded into the target board at startup.





Click the Settings button, and the Target Setup window pops up for configuration. Select the PC serial interface (COM1-COM4) and the baud rate for the PC to be able to communicate with the target board. Don't select Cache Options if real time displaying of the memory window is needed. Note that if Stop Program Execution with Serial Interrupt is selected, SoftICE will modify three bytes at the serial port interrupt vector location c:0023h. Be sure that the user program does not use these code locations (c:0023-0025h).



The above setup can also be modified during the user code debugging process. The Configuration dialog box can be accessed by selecting Target Settings, from the Peripherals menu.

Step 3. Start Debugging Session

Start the debugging session by clicking the Start/Stop Debug Session in the Debug menu.



For detailed instructions on how to use KEIL μVision2 Debugger, please refer to *Getting Started with μVision2* (Reference 1).



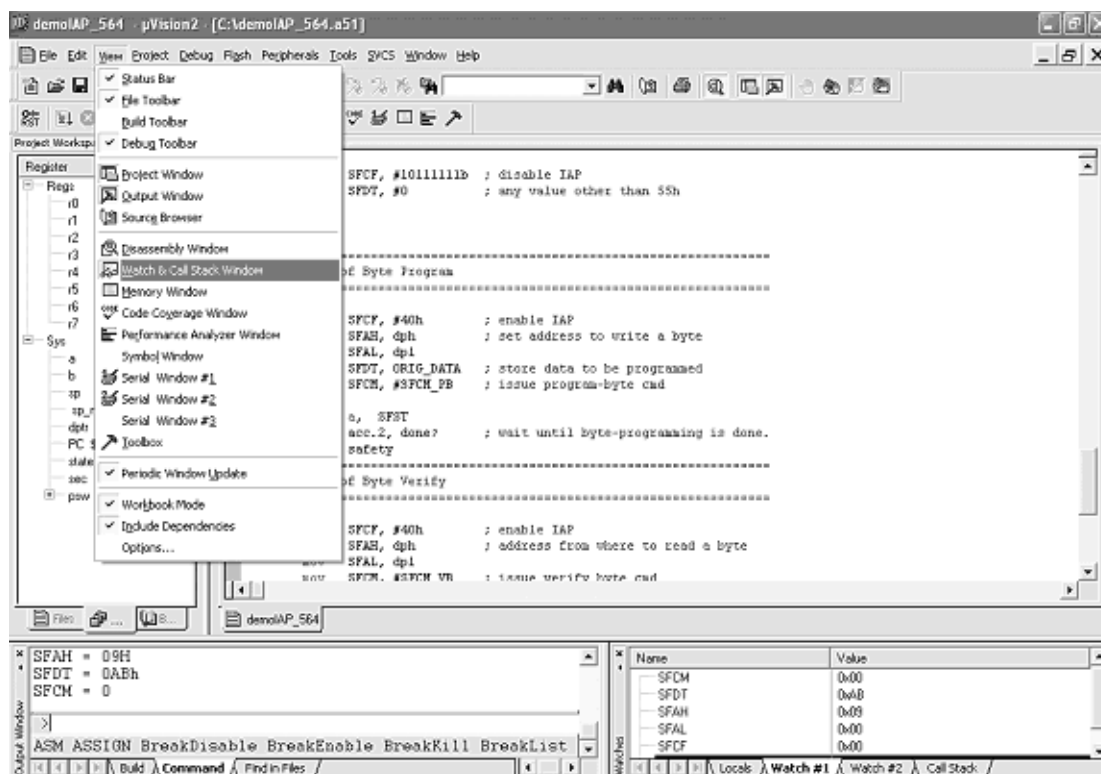
5.1 Tips for Debugging SST-specific In-Application Programming

5.1.1 Read/Write SST-specific SFRs

To display SST-specific SFRs, just type in the SFR name in the Watch Window. The Watch Window can be activated by clicking Watch & Call Stack Window from the View menu, and the current value of the SST-special SFRs will appear.

SST-specific SFRs can be modified through Output Window (Command Window in earlier version of Keil) in the View menu. See the screen image below.

Note: The SST-specific SFRs should be defined properly in the user program.



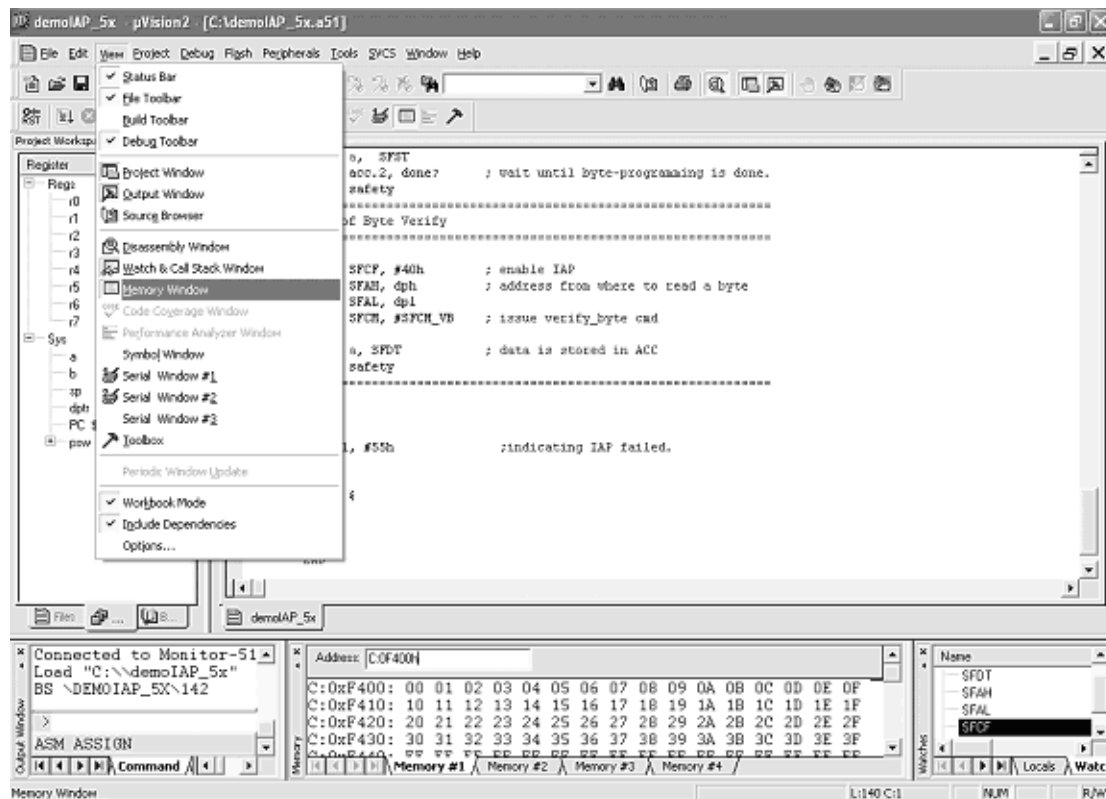


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5.1.2 Monitor the IAP procedure.

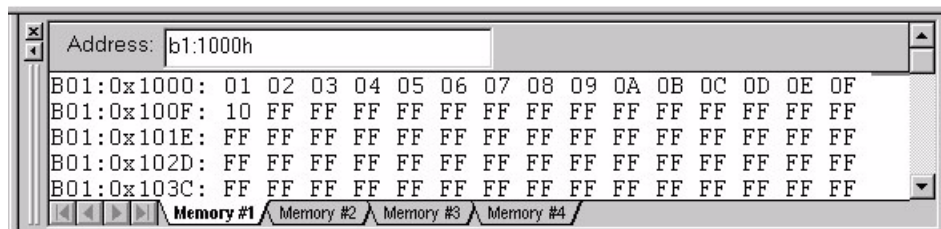
To view the effects of an IAP command procedure executing in block 0 on flash memory in block 1, open the Memory Window by clicking the Memory Window in View menu. Type the target address of IAP in the Memory Window. The result will be shown in the Memory Window immediately.

Note: Make sure Cache Options in the Target Setup window (See page 9) are not checked for real time display.



For SST89C5x SoftICE, the flash memory available for IAP is starting from C:0F400h.

For SST89x564RD SoftICE, C: (or B0:) is used to display code memory in block 0. B1: is used to display code memory in block 1. And the code memory available for IAP is starting from B1: 1000h.



For SST89E/V554RC or SST89E/V5xRDx SoftICE, both C: and B0/B1: can be used to display code memory. Either B0: or C:0000h – C:7FFFh can be used to display code memory in block 0. Either B1: or C:0E000h – C:0FFFFh can be used to display code memory in block 1. The code memory available for IAP is starting from B1:1000h or C:0F000h.



Note: If there is problem writing "00h" or "0FFh" to the Memory Window, please try the following technique:

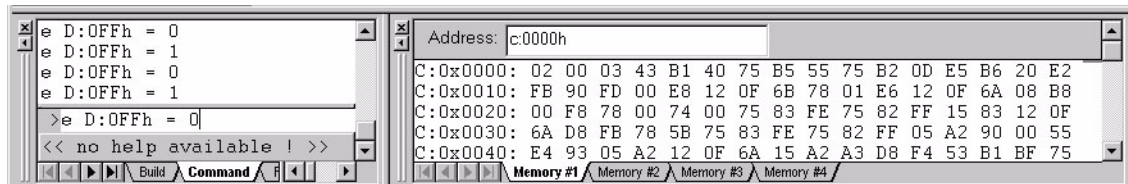
- **To Read/Write to code memory in block 1:**

Type in e D:0FFh = 1 in Output window (select Output window in View menu). Type in the starting address of the code memory to be displayed in the Memory Window. Any modifications to block 1 can now be made through the Memory Window.

- **To Read/Write to code memory in block 0:**

Type in e D:0FFh = 0 in Output window. Type in the starting address of the code memory to be displayed in the Memory Window. Any modifications to block 0 can now be made through the Memory Window.

The default setting is select code memory in block 0.





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6.0 IAP DEMO PROGRAM (FOR SST89C5x AND SST89E/V5x4Rx)

There are two IAP Demo programs to demonstrate Sector-Erase, Byte-Program, and Byte-Verify programming routines using SST-specific IAP. The programs are clearly-structured and well-documented for user understanding.

- DemolAP_5X, is for SST89C5x devices. (See Reference 2)
- DemolAP_564 is for SST89E564RD / SST89V564RD devices. (See Reference 2)
- DemolAP_554 is for SST89E554RC / SST89V554RC devices. (See Reference 2)

These sample programs are for user reference only. SST does not guarantee the functionality or the usefulness of this sample code.

7.0 SOFTICE USER CODE RESTRICTIONS

- KEIL MON51.DLL does not support the following KEIL debugger features:
Memory Map/Performance analyzer/Call stack analyzer/Code coverage.
Trace is not supported by SoftICE because of its tremendous memory usage.
- For SST89C5x, the VIS bit (SFCF.7) should always be 1. For SST89E/V5x4Rx or SST89E/V5xRDx, neither SC0 or SC1 should be programmed by user program.
- SST-specific WatchDog Timer and Soft Reset are not supported.
- User code should be within 0000h-6FFFh for SST89C58, 0000h-2FFFh for SST89C54, 0000h-FBFFh in block 0 for SST89E/V564RD, 0000h-7BFFh in block 0 for SST89x554RC, 0000h-3BFFh in block 0 for SST89E/V54RDx, 0000h-7BFFh in block 0 for SST89E/V58RDx.
- No breakpoint should be set on a one-byte instruction, if a label (jump target) is right after this instruction (within two bytes).
- Timer 2 can be used as a timer/counter only during a GO command. TR2 (T2CON.2, start timer 2) can only be set to 1 after the point where GO is issued, and should be cleared before the GO command reaches a break point.
- When selecting the "Stop Program Execution with Serial Interrupt" option, SoftICE will modify three bytes beginning at the serial port interrupt vector location 0023h. Make sure that the user program does not use these code locations. The continuous hand shaking signals between PC and MCU will make the execution of the user program slower during a GO. And Timer 2 can not be used as a timer/counter even during a GO command. This function should not be selected if a real-time GO is desired.
- User cannot Step Into an interrupt service routine (ISR) from the main program. When Stepping ISR is needed, user can set a break point at the beginning of the ISR, then Step through the remainder of the ISR code after the reaching the break point.