Silicon Storage Technology, Inc.

Boot-Strap Loader

MCU: v1.1F Firmware

User's Guide

S74006-00-000 9/04

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1.0 INTRODUCTION

The Boot-Strap Loader (BSL) software enables SST customers to download/upload their application software into/from the FlashFlex51 flash memory via In-Application Programming[1] (IAP) while the system is running. The PC executable, SSTEasyIAP.exe, is a Windows-based application and the MCU version 1.1F firmware is for 8051-family MCUs.

The purpose of this document is to provide a hands-on reference guide for the users. It also helps the users see a clear picture of the system connections and the EasyIAP11F Boot-Strap Loader features.

1.1 Scope

The scope of this document is limited to the features of the EasyIAP11F Boot-Strap Loader and target hardware requirements.

1.2 Software/Documentation Updates

The latest versions of the BSL firmware, the EasyIAP software and documentation are available for download from the SST web site at www.sst.com or www.SuperFlash.com.

- For the latest Keil software and documentation updates, visit Keil's web site at www.keil.com.
- For technical support via email, please contact the SST FlashFlex51 product Hot Line: Support@sst.com.

1.3 EasyIAP Features

Firmware features implemented in the BSL v1.1F include:

- Pre-programmed into SST89E/V5x4Rx and SST89E/V5xRDx MCUs
- Support for SST89C54/58 MCUs
- Read
- Download
- Sector Erase
- Run User Code
- Chip Erase
- Chip Remap
- Lock Chip
- File Compare
- File Save
- File Print
- Byte-Modify
- Auto-baud rate detection
- BSL upgrade capability
- Download SoftICE
- Selectable BSL v1.1E to v1.1F upgrade capability
- File download and upload capability from either internal or external memory
- Lock Chip in internal memory mode for SST89E/V5x4Rx and SST89E/V5xRDx
- Program SC0, SC1 bit for SST89E/V5x4Rx and SST89E/V5xRDx
- Double Clock function for SST89E/V5x4Rx and SST89E/V5xRDx
- PC controls EA# and RST with BSL demo board 2.0 and later versions

1. The Boot-Strap Loader Software Example is for the user's reference and convenience only. SST does not guarantee the functionality or the usefulness of the example bootstrap loader.

2.0 HARDWARE REQUIREMENTS

- RS-232 Serial Cable
- Down Loader Kit

2.1 Standard RS-232 Serial Cable

A standard RS-232 DTE-DCE cable is required to connect the host PC to the development platform. The female end of the cable connects to the PC (Data Terminal Equipment, DTE) and the male end connects to the development platform (Data Communication Equipment, DCE).

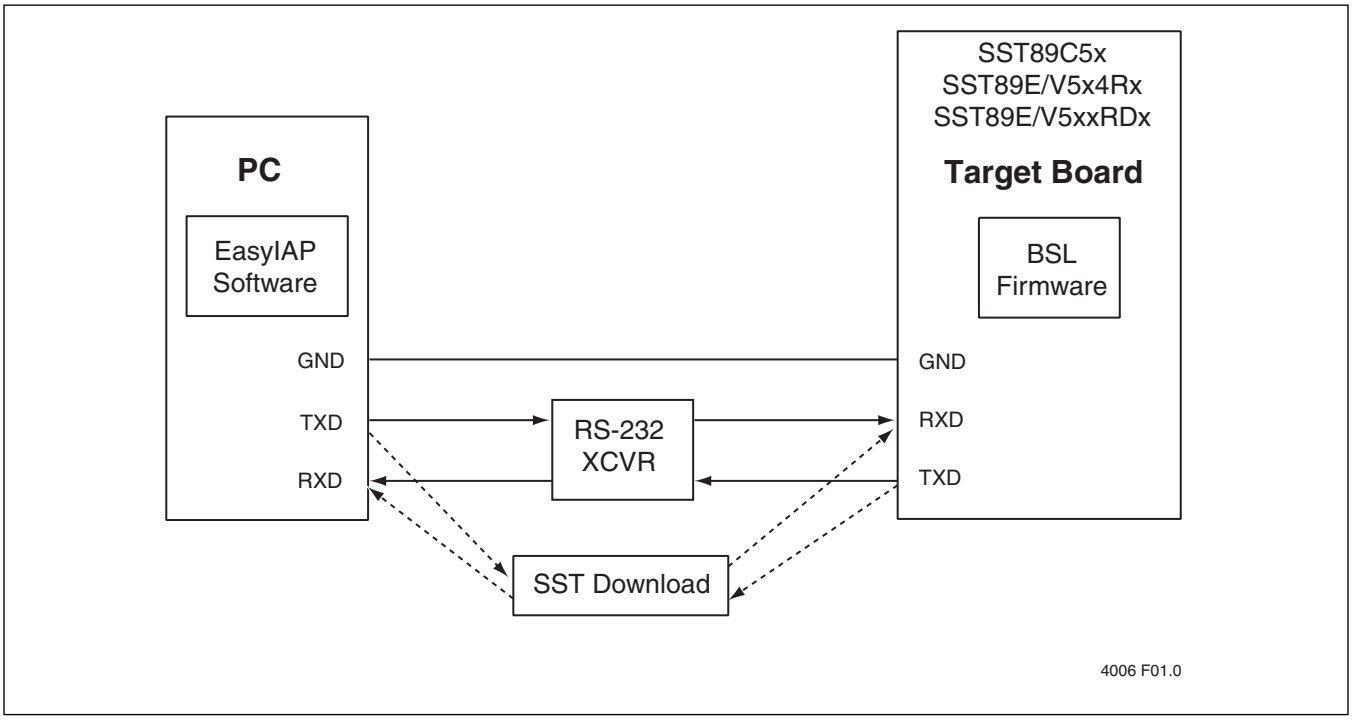
The serial cable connections are:

PC DB-9 plug (COM1 or COM2)			Development Platform	
RxD	Pin 2	to	TxD	Pin 2
TxD	Pin 3	to	RxD	Pin 3
DTR	Pin 4	to	DTR	Pin 4
GND	Pin 5	to	GND	Pin 5
RTS	Pin 7	to	RTS	Pin 7

No hardware handshake line is required to invoke communication between the host PC and the development platform as the firmware contains a transmission protocol to ensure fault-free data transmission between the PC and the development platform.

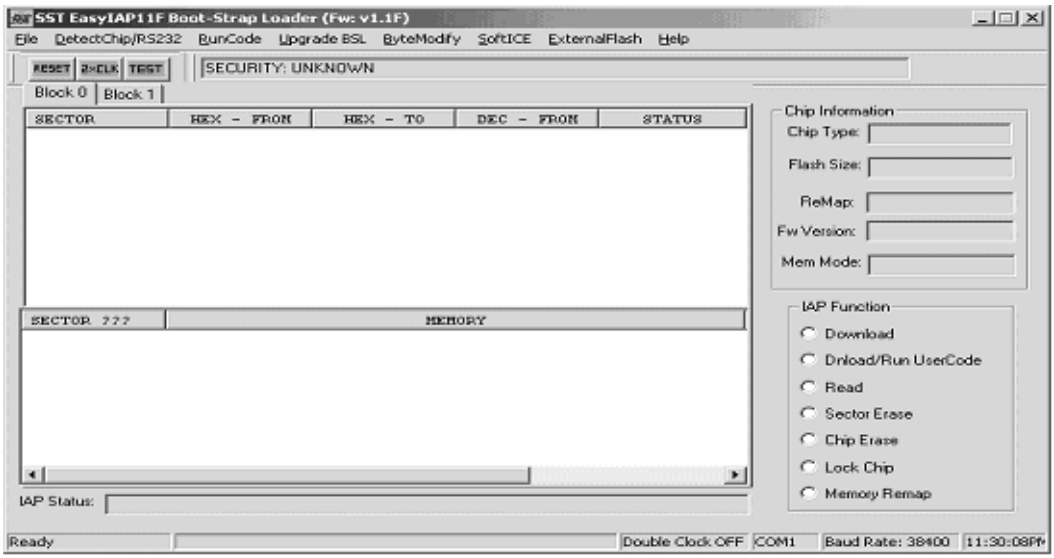
2.2 Hardware Connections

The PC should be connected to the target board through a standard RS-232 cable as shown in the figure below.



3.0 USING THE BOOT-STRAP LOADER

The following figure shows the entry window of the EasyIAP11F Boot-Strap Loader.



3.1 Self-detection of Serial Link

The software can detect whether the serial link is alive or not in about ten seconds. After either a disconnection of the serial link or an interruption of DC power, the software issues a warning message and clears the chip information on the screen.

3.2 Menus

3.2.1 File

From this option, user can select Compare, Save and Print options.

3.2.1.1 Compare

This option compares an Intel hex or a binary file with the contents in internal (block 0/1) or external (low/high 64K) flashes memory. Enter or select a filename, select the starting address (in Range list box), then click OK. The result of the comparison is shown in the dialog box (labeled as IAP Status) – the text of "File Compare OK!" is for a matched comparison or the text of "Unmatched data at memory address xxxxH: xxH(MCU) vs. xxH(File)" is for unmatched comparison.

3.2.1.2 Save Data into a File (Upload)

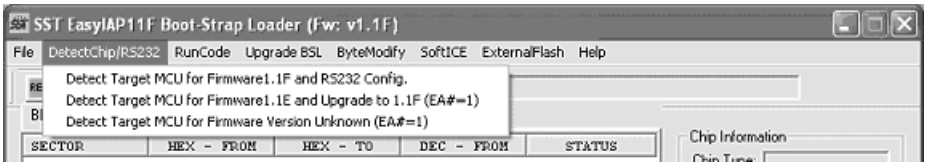
This option saves the contents of block 0/1 of internal flash or low/high 64K of external flash into a binary/text file. Enter a filename, choose the type of file (binary or text file), select the starting address and number of sectors (in Range list box), and then clicks OK. Click OK when the message "Save data has completed" appears.

3.2.1.3 Print Memory Contents

The Print option sends memory data from internal or external flash to a printer.

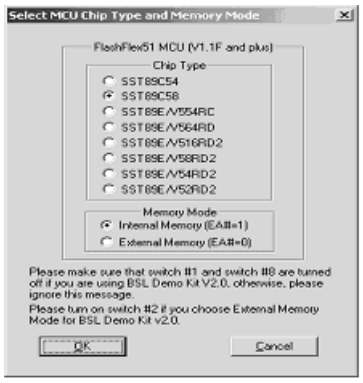
3.2.2 Detect Chip/RS-232 Menu

This option allows user to select firmware version. Click **Select Chip/RS-232** to display the firmware choices.

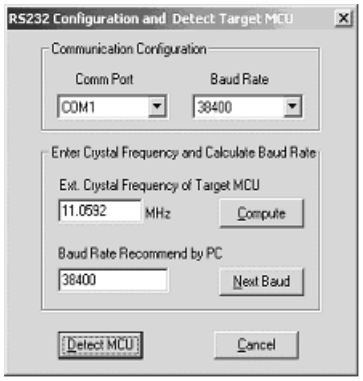


3.2.2.1 Detect Target MCU for Firmware1.1F and RS232 Config

Clicking this option selects the latest firmware version, 1.1F, and opens the following window. Choose the correct Chip Type and Memory Mode then click **OK**.

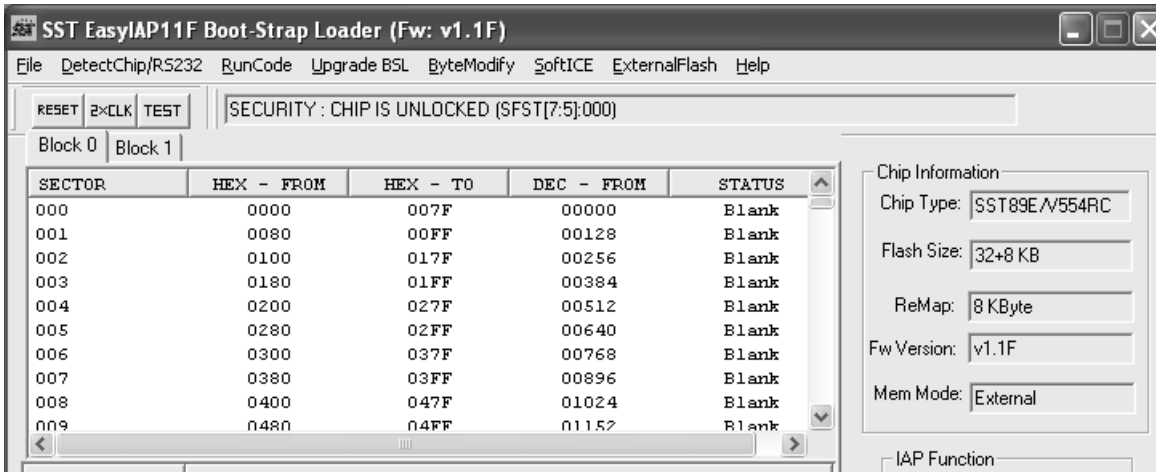


The next window displays the default values for the Comm Port and Baud Rate.



Select the COM# used to connect the serial cable to the PC. Then enter the crystal frequency of the target MCU and click **Compute** to calculate the "best" baud rate. Clicking **Next Baud** will calculate the 2nd, 3rd, 4th next-best baud rates. Then click **Detect MCU**.

Once the chip is detected successfully, the target MCU information will display in the upper right-hand corner. If an error message appears, please check the physical Comm Port connection and repeat the steps to detect the chip beginning in Section 3.2.2, "Detect Chip/RS-232 Menu" on page 6.



The RS-232 configuration is saved into a text file, SstBslComDft.txt, at the root directory of C drive. This saved configuration becomes the future default.

3.2.2.2 Detect Target MCU for Firmware1.1E and Upgrade to 1.1F (EA# =1)

Clicking this option causes the software to search for firmware version 1.1E in internal memory. If the software detects firmware version 1.1E it upgrades it to version 1.1F automatically without destroying the user's code in block 0. This function can only be used in Internal Memory Mode.

3.2.2.3 Detect Target MCU for firmware version is unknown (EA# =1)

Choose this option if the firmware version is unknown.

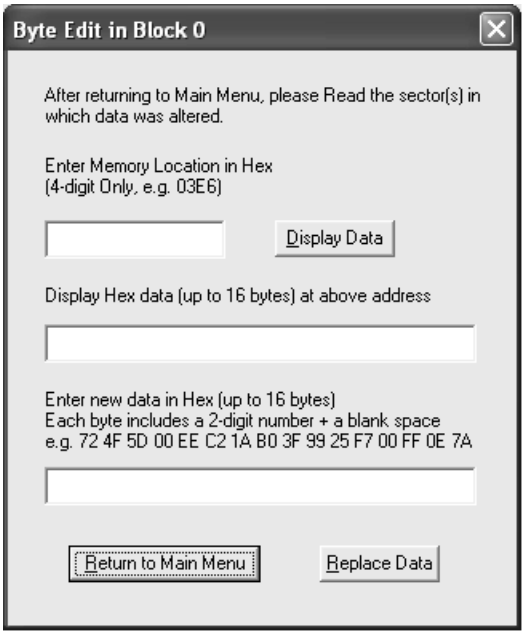
Clicking this option causes the software to search internal memory for firmware version 1.1F first, if that fails, it searches for version 1.1E. If version 1.1E is detected, it is automatically upgraded to version 1.1F without destroying the user's code in block 0. This function can only be used in Internal Memory Mode.

3.2.3 RunCode

This function executes user code at address 0000H in block 0 of the internal flash memory.

3.2.4 ByteModify

Click on Help and About Byte Modify to view a brief description of this option.



This option allows the contents of block 0 to be modified. To do this, enter a 4-digit memory location in hexadecimal format into the first field and click **Display Data.** The second field displays up to sixteen bytes of data starting from the address entered.

Enter up to sixteen bytes of new data into the lowest field. Separate each byte with a single space and click **Replace Data** to complete the data modification.

3.2.5 SoftICE

3.2.5.1 Download SoftICE

SoftICE (Software In-Circuit Emulator) is an in-circuit development tool used to debug applications for SST89C5x, SST89x5x4Rx, and SST89x5xxRDx MCUs. SoftICE will download to the first 1K in block 1 and the last 4K in block 0 (for SST89C5x), or the first 4K in block 1 and the last 1K in block 0 (for SST89x5x4Rx and SST89x5xRDx). **Please note that downloading SoftICE will erase the BSL loaded in block 1.**

Refer to the SoftICE User Guide for detailed information and instructions.

3.3 Toolbar Buttons

3.3.1 RESET - Reset Target MCU/Clear Chip Info

Clicking on the yellow RESET toolbar button erases the Chip Information on the screen and sends a RTS and DTR signal to the target MCU through the RS232 serial port.

The RTS/DTR signal provides a single level with standard RS232 signal amplitude (from -12 V to +12V). The duration of RTS signal is about 40 milliseconds before it rises from -12V to +12V. On the target MCU board, the user can optionally transform this RTS signal into a +5V signal and uses it to reset the target MCU.

3.3.2 2xCLK - Double Clock

This feature applies to SST89x5x4Rx and SST89x5xRDx only, the crystal frequency of the target board will be doubled by clicking this button.

3.4 IAP Functions

3.4.1 Download

User code can only be downloaded into block 0 of the MCUs internal flash or the low/high 64K of external flash. To start downloading, click **Download** under IAP Function, enter the appropriate File Name, e.g. BINCTR.HEX, and Starting Sector (e.g. 0000H), then click on **OK**.

Prior to downloading, the sectors in flash memory, which match the code size, are erased completely. Consequently, the program warns the user and asks whether the download is to proceed or not. Click **Yes** to proceed or **No** to quit. To search for the file, the user can click **Browse** located at the right side of File Name list box.

3.4.2 Download/Run User Code

This function combines Download and Run User Code into one. The Download/Run-User-Code command automatically runs user code after reprogramming block 0 of the flash memory.

3.4.3 Read

This function reads the code from either block 0 or block 1 flash memory, and then displays the contents in hex format.

The procedure is:

1. Click **Read**
2. Select the starting address and range of sectors
3. Click **OK**.

Sector status can be any one of three conditions – Blank, Not Blank or Unknown. The content of an unread sector which shows all 00s corresponds to the All Zeros status.

3.4.4 Sector Erase

This option enables the user to select the region of internal/external flash memory to be erased. The user enters the starting address and number of sectors (in Range list box) to be erased, then clicks **OK**. Click **OK** when the message "Sector erase completed!" appears.

3.4.5 Chip Erase

This option is only allowed in External Memory Mode.

3.4.6 Lock Chip

Most lock levels are allowed in External Memory Mode for C54/C58.

All lock levels are allowed in Internal Memory Mode for SST89E/V5x4Rx and SST89E/V5xRDx.

3.4.7 Memory Remap

This option is only allowed in External Memory Mode. Users can choose to remap to 1K, 2K, and 4K for SST89C5x. For SST89x564RD, user can program SC0, and for SST89x554RC and SST89x5xRDx, users can choose to program SC0 and SC1.

4.0 INSTALLING WINDOWS SOFTWARE

The BSL package includes a PC executable program and the MCU binary/Intel Hex code. The PC executable, SSTEasyIAP.EXE, is a Window-based application and runs directly under Windows 95/98/NT/2000/Me/XP operating systems. Two additional MFC library files provided in this package, MFC42.DLL and MSVCRT.DLL, are usually located in the Windows System or System32 folder. The user needs to copy these two library files into the same folder as SSTEasyIAP.EXE only if they don't exist or are not the latest revision codes.

The MCU binary/Intel Hex code can work with external crystal frequency range from 1 MHz through 33 MHz (40 MHz for SST89E5x4Rx and SST89E5xRDx), the PC pre-settings for serial communication are: 38.4K/19.2K/9600/4800/2400/1200/600 baud, 8 data bits, 1 stop bit, and no parity.

The MCU code, residing in block 1 flash, can be installed in three different ways:

1. by the factory,
2. by the user with SST Boot-Strap Loader (BSL) Demo Kit,
3. by the user with a universal programmer that supports the SST microcontroller.

Please visit the SST website for the information on the SST BSL Demo Kit, and the list of programmer vendors that support the FlashFlex51 family.

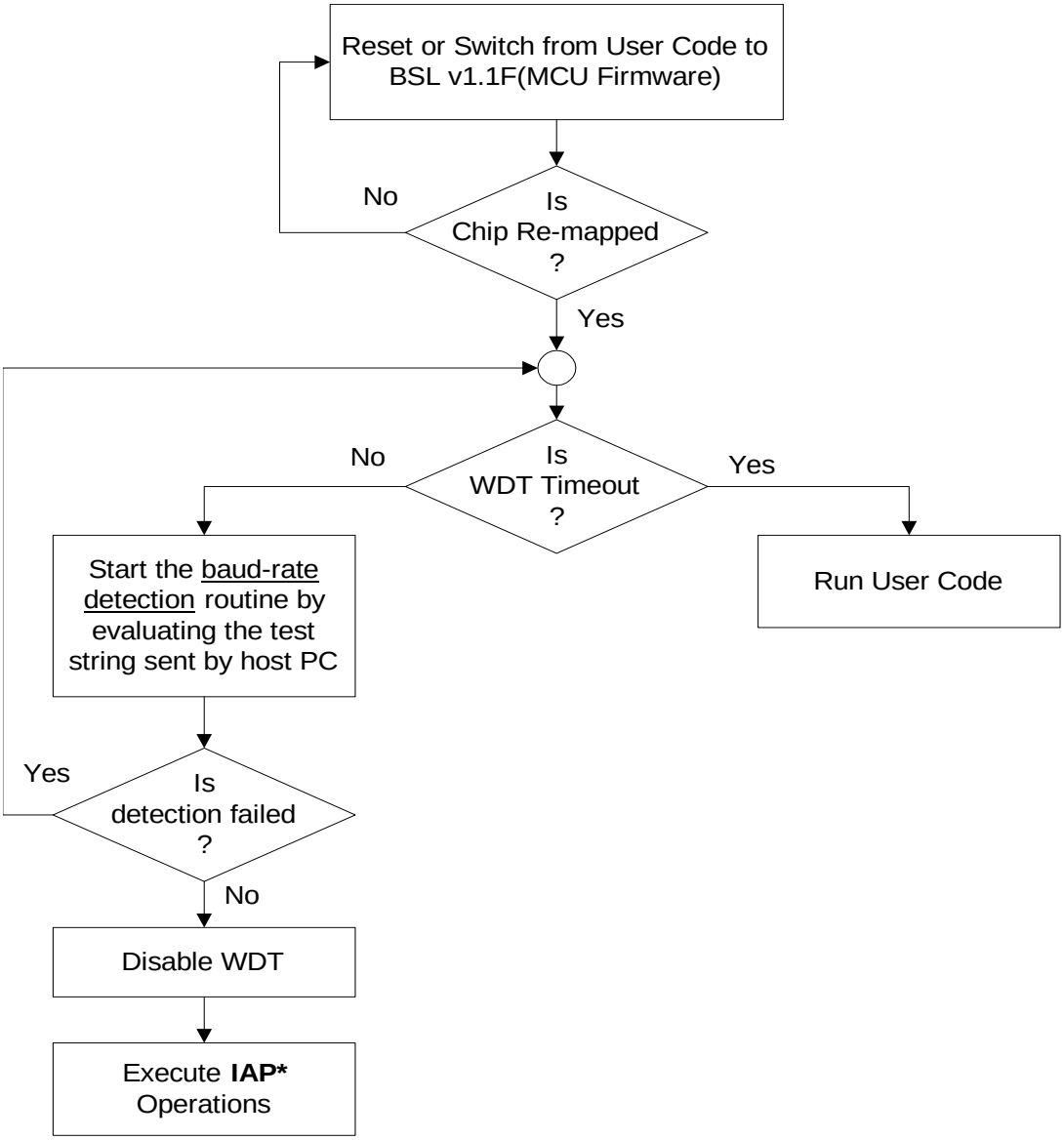


FIGURE 4-1: MCU FIRMWARE ARCHITECTURE OF BOOT-STRAP LOADER V1.1F

APPENDIX A. LIST OF SOURCE CODE

The BSL package consists of three parts:

- For the Windows 95/98/NT/2000/Me/XP-resident software, an executable file (SSTEasyIAP11.EXE) is supplied.
- For the MCU-resident code, an Intel hex file (.HEX) and a binary file (.BIN) are furnished.
- For the external memory-resident code, an Intel hex file (.HEX) is furnished.

Table A-1 lists the files that can be downloaded from the SST web site. Both Internal Memory Mode and External Memory Mode versions use MCU Timer 2 for baud rate generation for the serial port.

TABLE A-1: LIST OF EASYIAP11F (PC) / BSL V1.1F (MCU) / V1.1F (EXTERNAL MEMORY CHIP) FILES

Chip Type	Ext. Crystal Frequency	Baud Rate	PC Files	MCU/Ext. Memory Files
SST89C54/C58 (Internal Memory Mode)	1 – 33 MHz (5V) 1 – 12 MHz (2.7V)	38.4K/19.2K/9.6K/ 4.8K/2.4K/1.2K/600	SSTEasyIAP11F.exe	F51MBLI5.HEX[1] F51MBLI5.BIN[1]
SST89E/V554RC (Internal Memory Mode)	1 – 33 MHz (V554RC) 1 – 40 MHz (E554RC)	38.4K/19.2K/9.6K/ 4.8K/2.4K/1.2K/600	SSTEasyIAP11F.exe	F51MBLL5.BIN[1]
SST89E/V564RD (Internal Memory Mode)	1 – 33 MHz (V564RD) 1 – 40 MHz (E564RD)	38.4K/19.2K/9.6K/ 4.8K/2.4K/1.2K/600	SSTEasyIAP11F.exe	F51MBLL5.BIN[2]
SST89E/V58RD2 (Internal Memory Mode)	1 – 33 MHz (V58RD2) 1 – 40 MHz (E58RD2)	38.4K/19.2K/9.6K/ 4.8K/2.4K/1.2K/600	SSTEasyIAP11F.exe	F51MBLL5.BIN[1]
SST89E/V54RD2 (Internal Memory Mode)	1 – 33 MHz (V54RD2) 1 – 40 MHz (E54RD2)	38.4K/19.2K/9.6K/ 4.8K/2.4K/1.2K/600	SSTEasyIAP11F.exe	F51MBLL5.BIN[1]
SST89E/V516RD2 (Internal Memory Mode)	1 – 33 MHz (V516RD2) 1 – 40 MHz (E516RD2)	38.4K/19.2K/9.6K/ 4.8K/2.4K/1.2K/600	SSTEasyIAP11F.exe	F51MBLL5.BIN[2]
SST39SF010A MPF or equivalent Flash Memory (External Memory Mode)	N/A	38.4K/19.2K/9.6K/ 4.8K/2.4K/1.2K/600	SSTEasyIAP11F.exe	F51EBLK5.HEX

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1. Binary file should be downloaded into block 1 and starts at address F000H for SST89C5x and E000H for SST89x554RC and SST89x54/58RD2. The hex file needs to be downloaded into block 0 and starts at address 0000H.
2. Both binary file and hex file should be downloaded to address 0000H of block 1 for SST89x564RD and SST89x516RD2.

APPENDIX B. BSL DEMO BOARD VER.2.0 SWITCH FUNCTIONS

TABLE B-1: FUNCTIONS OF INDIVIDUAL SWITCHES ON BSL DEMO BOARD (V2.0)

Position	Function		
1	EA1	OFF=1 ON=0	See Table B-2 and Table B-3 below
2	CE#	OFF=1	Disable External Flash SST39SF010A
		ON=0	Enable on-board SST39SF010A
3	A16	OFF=1	Select upper 64K of SST39SF010A
		ON=0	Select lower 64K of SST39SF010A
4	P3.2	OFF=1	User definable switch's function
5	P3.3	ON=0	
6	P3.4		
7	P3.5		
8	RST1	OFF	RST is controlled by PC software
		ON	RST is controlled by MAX706 with Manual Reset button

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TABLE B-2: BSL DEMO BOARD RUNNING STAND-ALONE WITHOUT PC CONTROL:
NOTE: Disconnect cable between PC and Board v2.0

RST1 must be ON, MCU's RST is controlled by on board MAX706 with Manual Reset button			
EA1	**A16**	**CE#**	**Effects**
0	0	0	Run external lower 64K of SST39SF010A
0	1	0	Run external upper 64K of SST39SF010A
1	0	0	Run internally, lower 64K as data memory
1	1	0	Run internally, upper 64K as data memory
0	0	1	Illegal combination of settings
0	1	1	Illegal combination of settings
1	0	1	Run internally, no data memory, SST39SF010A is disabled
1	1	1	Run internally, no data memory, SST39SF010A is disabled

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TABLE B-3: BSL DEMO BOARD RUNNING UNDER CONTROL OF PC SOFTWARE:

Both RST1 and EA1 must be set OFF, MCU's RST and EA# is controlled by PC software				
RST2				
1	Reset MCU, don't care EA2, A16 or CE#.			
0	MCU is running, mode is determined by following chart:			
	EA2	**A16**	**CE#**	**Effects**
	0	0	0	Run external lower 64K of SST39SF010A
	0	1	0	Run external upper 64K of SST39SF010A
	1	0	0	Run internally, lower 64K as data memory
	1	1	0	Run internally, upper 64K as data memory
	0	0	1	Illegal combination of settings
	0	1	1	Illegal combination of settings
	1	0	1	Run internally, no data memory, SST39SF010A is disabled
	1	1	1	Run internally, no data memory, SST39SF010A is disabled

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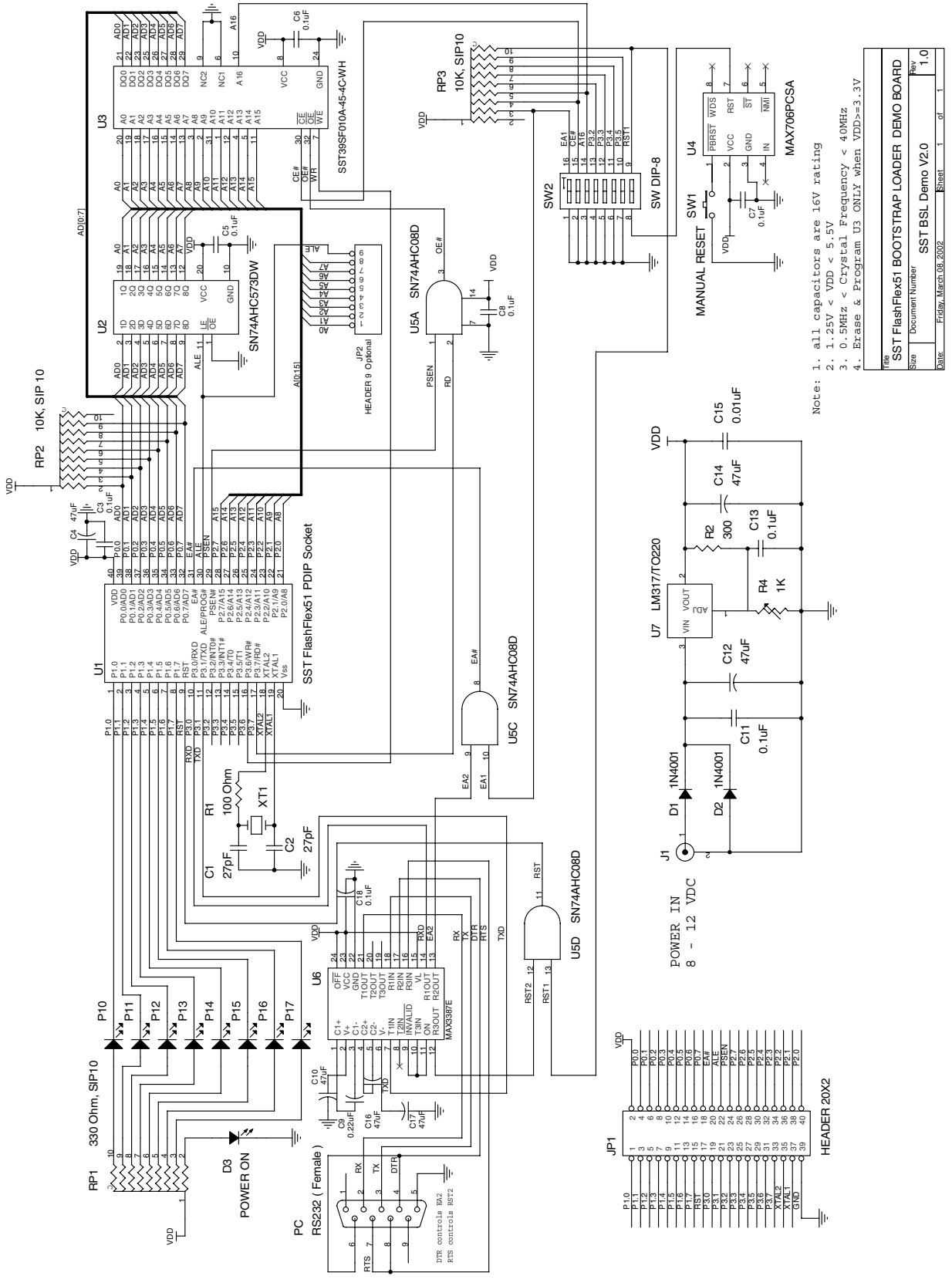
APPENDIX C. BSL DEMO BOARD VER.2.0 SCHEMATIC



APPENDIX D. SST STARTER KIT V3.0 SWITCH FUNCTION

FlashFlex51 Starter Kit

The FlashFlex51 Starter Kit (P/N: SST89CK78STR) is the latest developmental platform for the SST 89 series microcontrollers. It is designed to provide the beginning user with easy access to the SST microcontroller while providing the experienced developer with an able platform for development. Some key features are:

- RS-232 Interface
- ZIF socket
- Full 40-pin header mapping the 40-pin MCU connection
- 128 KByte of external flash on-board
- 8 LEDs mapped to Port 1 of the MCU
- Hardware reset switch
- Supports 3.3V or 5V operation
- Supports 1 MHz to 40MHz operating crystal frequency
- A spacious breadboard area for future developmental tasks

Tables D-1 and D-2 detail the switch settings for the FlashFlex51 Starter Kit:

TABLE D-1: STARTER KIT V3.0 DIP SWITCH SETTINGS

Switch Number	Down (OPEN) position	Up (CLOSE) position
1 (EA1)	Sets EA# to high if switch no. 4 is up. It is a don't-care if switch no. 4 is down.	Sets EA# to low if switch no. 4 is up. It is a don't-care if switch no. 4 is down.
2 (CE#)	39SF010A is disabled.	39SF010A is enabled.
3 (A16)	A16=1 selects high 64K of 39SF010A, where user can download and execute code.	A16=0 selects lower 64K of 39SF010A (default external BSL1.1F).
4 (Sel)	MCU's EA# and RST are under full control of PC software SSTEasyIAP. Switch no. 1 (EA1) and reset button have no effect at all.	MCU's EA# and RST are controlled by switch no.1 (EA1) and on-board reset button respectively.
5 (LED)	Power supply to all 8 LEDs is cut off.	Power supply to all 8 LEDs is on. LEDs are controlled by port P1.

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TABLE D-2: EXTERNAL FLASH MEMORY CONTROL

Memory Mode	Switch Combinations	Result
EA# = 0, MCU on-chip flash can be used to store data.	CE#=0, A16=0	MCU is running external BSL1.1F in lower 64K of SST39SF010A.
	CE#=0, A16=1	MCU is running user's code in high 64K of SST39SF010A.
	CE#=1, A16=x	External SST39SF010A is de-selected.
EA# = 1, MCU is running internally.	CE#=0, A16=0	External BSL1.1F in lower 64K of 39SF010A can be updated.
	CE#=0, A16=1	High 64K of 39SF010A can be used as data memory.
	CE#=1, A16=x	External 39SF010A is de-selected.

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JP1: When the jumper is on the left, board V_{DD} is approximately 3.3V. This is compatible with the SST89V5x4Rx, SST89V5xRDx, and SST89C54/58. When the jumper is on the right, board V_{DD} is approximately 5.0V and is compatible with the SST89E5x4Rx, SST89E5xRDx, and SST89C54/58.

J2: Any 6V to 12V AC/DC adapter can be used to power starter kit. Power can be input directly from connector J1 Pin 40(V_{DD}) and Pin 20(GND). It can also be input via connector J4 Pins 1 and 10(V_{DD}) and Pins 2 and 9(GND), which bypass the regulator U7 (LM317).