
UART and 2-wire Interface Reconfiguration of the AT94K FPSLIC using an AT17 Series EEPROM

Features

- Use of the AVR External Interrupt Service C Routine to Initiate Data Transfer from the Graphic User Interface (GUI) of a Personal Computer
- Use of the AVR C Routine with XY-modem Protocol to Receive Configuration Data from the UART Port of the AT94K FPSLIC™
- Use of the AVR® C Routine to Program an AT17 Series EEPROM from the 2-wire Interface of the AT94K FPSLIC
- Demonstrate how to Reconfigure an AT94K FPSLIC from an AT17LV010 EEPROM

Introduction

Atmel's AT94K FPSLIC is a SRAM-based silicon device that can be designed to reconfigure itself in system from an AT17 Series EEPROM. This application note demonstrates how to reconfigure an AT94K FPSLIC device using its internal UART port, a 2-wire interface port and an external AT17LV010 EEPROM.

This application note assumes that the user is familiar with the information presented in the "XY-modem Protocol" application note, the "AT94K Series FPSLIC" datasheet, and the AT17 Series datasheets, and the "Programming Specification for Atmel's AT17 and AT17A Series FPGA Configuration EEPROMs". These documents are available on the Atmel web site, at <http://www.atmel.com>.

Design Description

The AT17LV010 EEPROM must be first programmed with the configuration data, which contains the external hardware interrupt service routine instruction for the embedded AVR microcontroller core of AT94K FPSLIC. Then the EEPROM will receive the reconfiguration data from the UART port and the EEPROM will be programmed through the 2-wire interface.

While the FPSLIC device is running, an external hardware interrupt signal can be triggered to initiate the update of the reconfiguration data from the serial port of a personal computer to the UART of the FPSLIC. The embedded microcontroller will execute its external hardware interrupt service routine instruction to receive the configuration data from its UART port and program the data to an external EEPROM through the 2-wire interface of the FPSLIC. Since there will not be enough data memory within the FPSLIC to store the maximum size of the reconfiguration data for the 1-Mbit EEPROM, the transferred data will be buffered and then programmed to the AT17LV010 EEPROM in a 128-byte length at a time. After all the reconfiguration data is programmed to the EEPROM, resetting the FPSLIC device will start reconfiguration of the new design. The design flow diagram and block diagram are shown in Figure 1 and Figure 2, respectively.



**Programmable
SLI
AT94K**

**Application
Note**

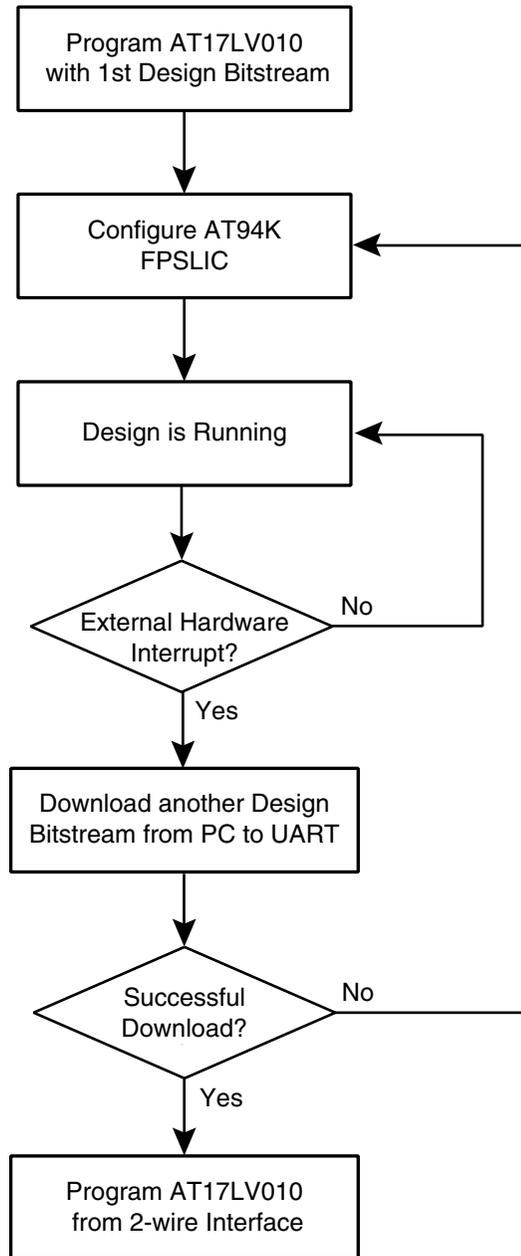
Rev. 3012A-FPSLI-01/02



The C routine for programming the EEPROM is written specifically for the 1-Mbit device. The code can easily be modified and recompiled for other densities of the AT17 Series EEPROMs.

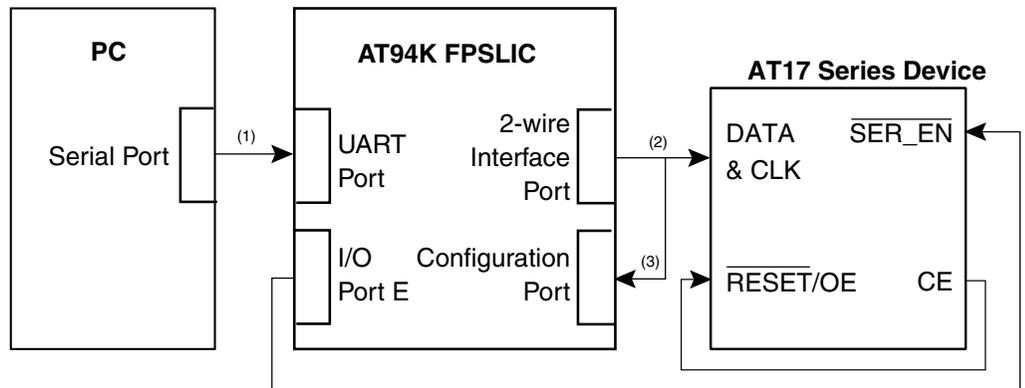
This reference design must use the 208-pin package of any density of the AT94K FPSLIC devices. It is not recommended for other smaller packages of the AT94K FPSLIC device because the 2-wire interface core is not bonded to the external I/O port due to the pin limitation of the small package size.

Figure 1. Design Flow Diagram



UART and 2-wire Interface Reconfiguration

Figure 2. Design Block Diagram



- Notes:
1. Path 1: the configuration data will be downloaded from the serial port of the PC to the UART port of the AT94K FPSLIC.
 2. Path 2: the configuration data will be programmed from the 2-wire interface port of the AT94K FPSLIC to the AT17LV010 EEPROM.
 3. Path 3: the configuration data will load from the AT17LV010 EEPROM to the configuration port of the AT94K FPSLIC to

Software and Hardware Tools

Atmel's ATSTK94 Starter Kit includes the CPS software, the ATDH2225 ISP direct download cable, the XY-modem software (GUI), and REV 3 or higher of the ATSTK94 Starter Kit board. In addition, a personal computer and a serial port cable are needed. See Table 1 for a list of the software and hardware used for this reference design.

Table 1. Software and Hardware Tools

Software	Hardware
ImageCraft C compiler – Version 6.1 G or above	ATDH2225 ISP direct download cable (Included in the ATST94K Starter Kit)
System Designer™ – Version 2.0 or above	ATSTK94 Starter Kit Board Rev 3 or above (Included in the ATSTK94 Starter Kit)
Atmel AT17 Configurator Programming System (CPS) – Version 7.06 or above	Serial-port Cable
XY-modem Software (GUI) (Provided)	Personal Computer

The source files may be found on the Atmel web site, at <http://www.atmel.com/atmel/products/prod320.htm>, under the **doc3012.zip** archive. The source files for the designs 1 to 3 are shown in Table 2.

Table 2. Source Files

Design	File	Description
Design 1	Design Files	
	AT17.H	C header file for design 1
	AT17.C	C routines (design functions) for design 1. The external hardware interrupt service routine is included.
	MAIN.C	Main program of design 1
	Output Programming Bitstream Files	
	DESIGN1.BST	Generated by System Designer for design 1
	DESIGN1X.BIN ⁽¹⁾	Absolute binary file for design 1. It is used for the XY-modem software.
Design 2	Design Files	
	AT17.H	C header file for design 2
	AT17.C	C routines (design functions) for design 2. The external hardware interrupt service routine is included.
	MAIN.C	Main program of design 2
	Output Programming Bitstream Files	
	DESIGN2.BST	Generated by System Designer for design 2
	DESIGN2X.BIN ⁽¹⁾	Absolute binary file for design 2. It is used for the XY-modem software.
Design 3	Design Files	
	AT17.H	C header file for design 3
	AT17.C	C routines (design functions) for design 1. The external hardware interrupt service routine is included.
	MAIN.C	Main program of design 3
	Output Programming Bitstream Files	
	DESIGN3.BST	Generated by System Designer for design 3
	DESIGN3X.BIN ⁽¹⁾	Absolute binary file for design 3. It is used for the XY-modem software.

Note: 1. The file conversion software can convert this file from *.bst to *.bin.

Design1.bst, **design1x.bin**, **design2x.bin** and **design3x.bin** are examples used for this demo. For details about the bitstream files, please review the Readme file included in the **demo** folder of **doc3012.zip**.

UART and 2-wire Interface Reconfiguration

XY-modem Software Setup

- Extract **doc3012.zip** to your local drive (**c:** or **d:**).
- Install the XY-modem software⁽¹⁾ to your PC.
 - Navigate to the folder where you extracted the zip file and open the **XY-modem** folder.
 - Double-click on the **setup.exe** file, the wizard will guide you through the software installation.

Note: 1. If you have problems using the XY-modem, change the interrupt number for the serial port.

- Download Atmel's AT17 Configuration Programming System software (CPS) from the Atmel web site, at <http://www.atmel.com/atmel/products/prod185.htm>
- Double-click on the **cpsinstall.exe** file, the wizard will guide you through the software installation.

ATSTK94 Board Setup

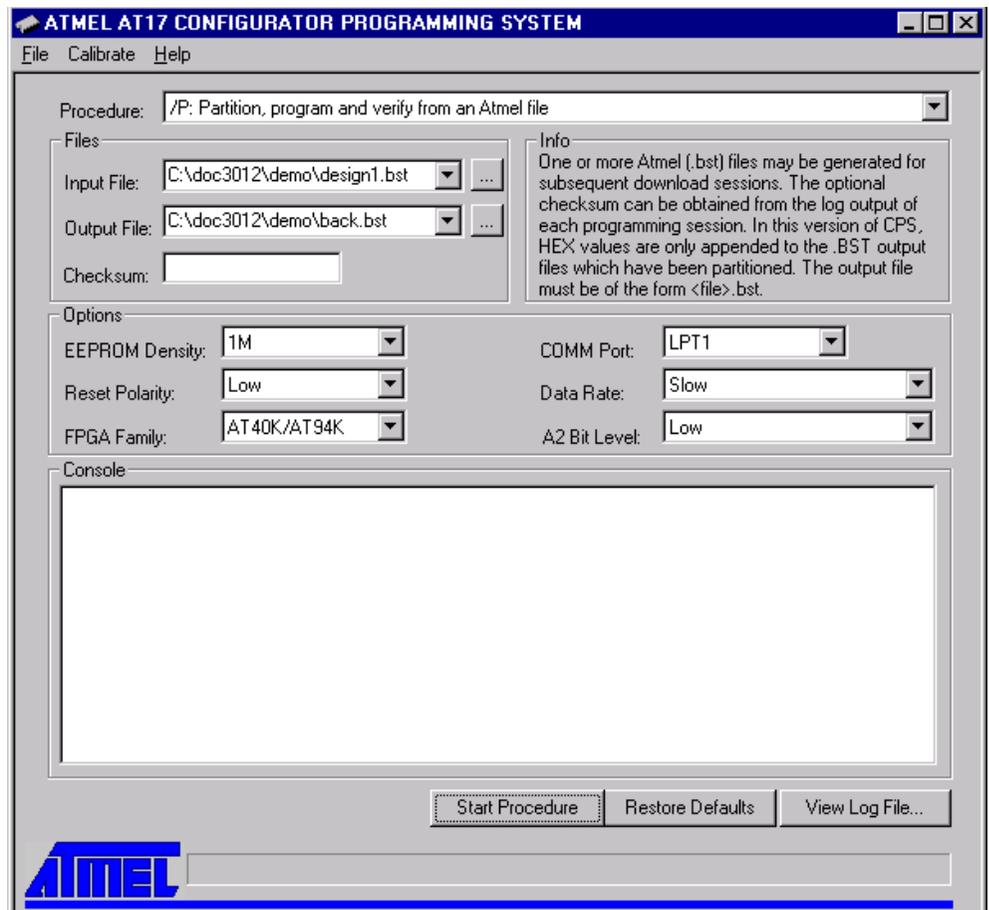
- Connect the serial port cable from the PC to the UART0 of the ATSTK94 Starter Kit board.
- Set all PORTD jumpers to the "A" side to allow the AVR's PORTD to be connected to the LEDs.
- Make sure the JP17 jumper is set toward to the oscillator "Y1" for setting the AVR System Clock to 4 MHz.
- Set the JP20 jumper to allow bit 7 of the AT94K PortE (PE7) to be connected to the SER_EN pin of the EEPROM in order to select the operation between the Programming mode or Configuration mode of the EEPROM.
- Connect the power supply to the board.

EEPROM Programming

- Program the EEPROM with the **design1.bst** file using the ATDH2225 ISP direct download cable and the CPS software.

This step is only required once if the updated designs have added the external hardware Interrupt C routine for the UART download procedure. For this design demo, both **design1x.bin** and **design2x.bin** have this feature.
- Connect the parallel cable from the PC to the dongle of the ATDH2225 ISP direct download cable.
- Connect the 10-pin ribbon cable from the dongle of the direct download cable to the male header of the starter kit board.
- Turn on (SW14) the power of the starter kit board and set another switch (SW10) to the **Program** position.
- Open CPS and select the options as they appear in Figure 3.

Figure 3. Atmel CPS Programming Setup



- Press the **Start Procedure** button to program the **design1.bst** file to the AT17LV010 EEPROM.
- After the data is programmed to the EEPROM, remove the 10-pin ribbon cable from the male header and turn the board switch (SW10) to “Run:”.
- Press the **restart** button to start the configuration. The binary counter value is displayed on the LEDs.

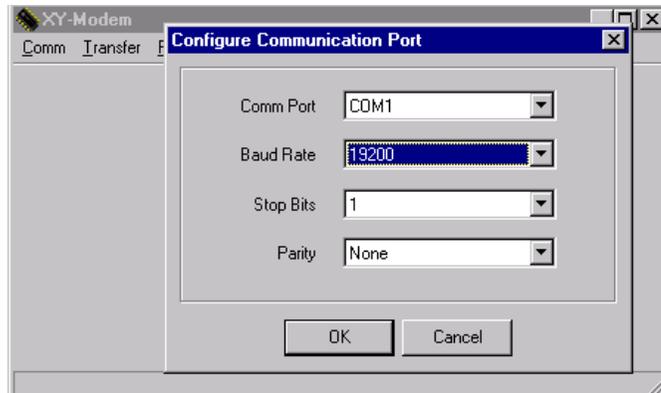
New Design Download

Download the new design file (**design2x.bin**) to the FPSLIC using the Graphic User Interface (XY-modem software):

- Open the XY-modem software.
- Go to the **Comm** menu and choose **Ports**. The **Configure Communication Port** window appears.
- Set up the baud rate as shown in Figure 4.

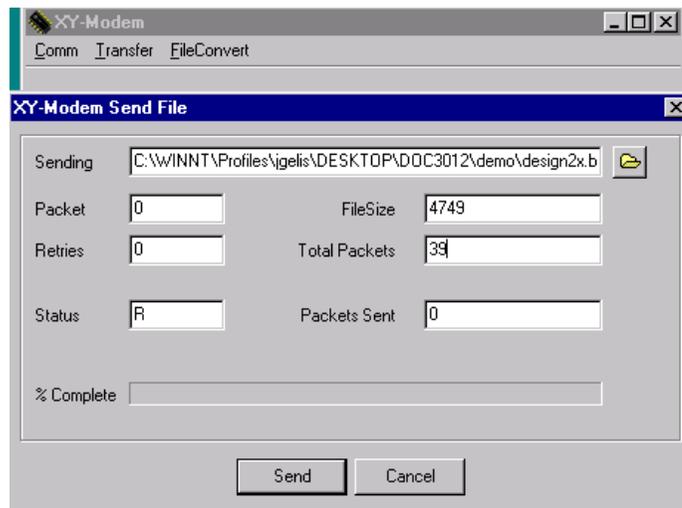
UART and 2-wire Interface Reconfiguration

Figure 4. Baud Rate Settings Dialog Box



- Press the **OK** button.
- Go to the **Transfer** menu and choose **Send File**, the **XY-Modem Send File** dialog box appears.
- Use the browse file button to open the **design2X.bin** from the demo **folder**. The fields in the dialog box are filled out automatically, see Figure 5.

Figure 5. XY-Modem Send File Dialog Box



- Press the **Send** button.
- Press the **SW1** button from the starter kit board to trigger the external interrupt service C routine for data download.
- Press the **Reset** button from the AT94K Starter kit board to start reconfiguration. The AT94K FPSLIC will be reconfigured with the **design2x.bin** file, which is converted from **design2.hex** file. The LCD and LED will display “FPSLIC STATER KIT” to show the design changes. You can also modify the C code to trigger the reset pin of the FPSLIC to start reconfiguration immediately, without pressing the reset button after the design 2 bitstream is downloaded to the chip.

- Repeat the design download procedure, this time use the **design1x.bin** file. You can also try **design3x.bin** file. However, notice that **design1.bst** and **design1x.bin** contain the same configuration bitstream for design1, except that they are written in different format. The different file format is also applied to design2 and design3. Since this XY-modem software is only written to accept the absolute binary file format, you can only import the file that has file extension ***.bin**.

References

- “AT17LV512/010/512/010” datasheet, <http://www.atmel.com/atmel/acrobat/doc0944.pdf>.
- “AT94K Series FPSLIC” datasheet, <http://www.atmel.com/atmel/acrobat/doc1138.pdf>.
- “C Code for Interfacing the FPSLIC AVR Core to AT17 Series Configuration Memories”, <http://www.atmel.com/atmel/acrobat/doc2289.pdf>.
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- “AVR350: XmodemCRC Receive Utility for AVR”, <http://www.atmel.com/atmel/acrobat/doc1472.pdf>.
- “Implementing the Scrolling Design on the ATSTK94 FPSLIC Starter Kit”, <http://www.atmel.com/atmel/acrobat/doc2316.pdf>.
- “Programming Specification for Atmel's AT17 and AT17A Series FPGA Configuration EEPROMs”, <http://www.atmel.com/atmel/acrobat/doc0437.pdf>.
- “Theory of XY-modem Protocol”, <http://www.atmel.com/atmel/acrobat/doc3019.pdf>.



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