DG0636
Demo Guide
Implementing Auto Update and Programming Recovery Features (Using Ethernet Interface) for SmartFusion2 Devices

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1 Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

1.1 Revision 6.0

Replaced broken link “www.microsemi.com/soc/documents/CDM_2.08.24_WHQL_Certified.zip” with “http://soc.microsemi.com/download/rsc/?f=CDM_2.08.24_WHQL_Certified” in the Setting Up the Demo Design, page 13.

1.2 Revision 5.0

The following is a summary of the changes made in this revision.

- Updated the document for Libero SoC v2021.1.
- Removed the references to Libero version numbers.

1.3 Revision 4.0

This document is updated for Libero SoC v11.8 SP1 release changes.

1.4 Revision 3.0

Updated the document for Libero SoC v11.8 software release.

1.5 Revision 2.0

The following was a summary of the changes in revision 2.0 of this document.

- Updated the document for Libero v11.7SP1 software release (SAR 80381).
- Updated the document for Libero v11.7 software release (SAR 77891).
- Updated the document with MSS SPI0 enhancement to support Auto Update while sharing SPI0 pins with SPI Controller in Fabric (SAR 74734).

1.6 Revision 1.0

The first publication of this document.

2 Implementing Auto Update and Programming Recovery Features (Using Ethernet Interface) for SmartFusion2 Devices

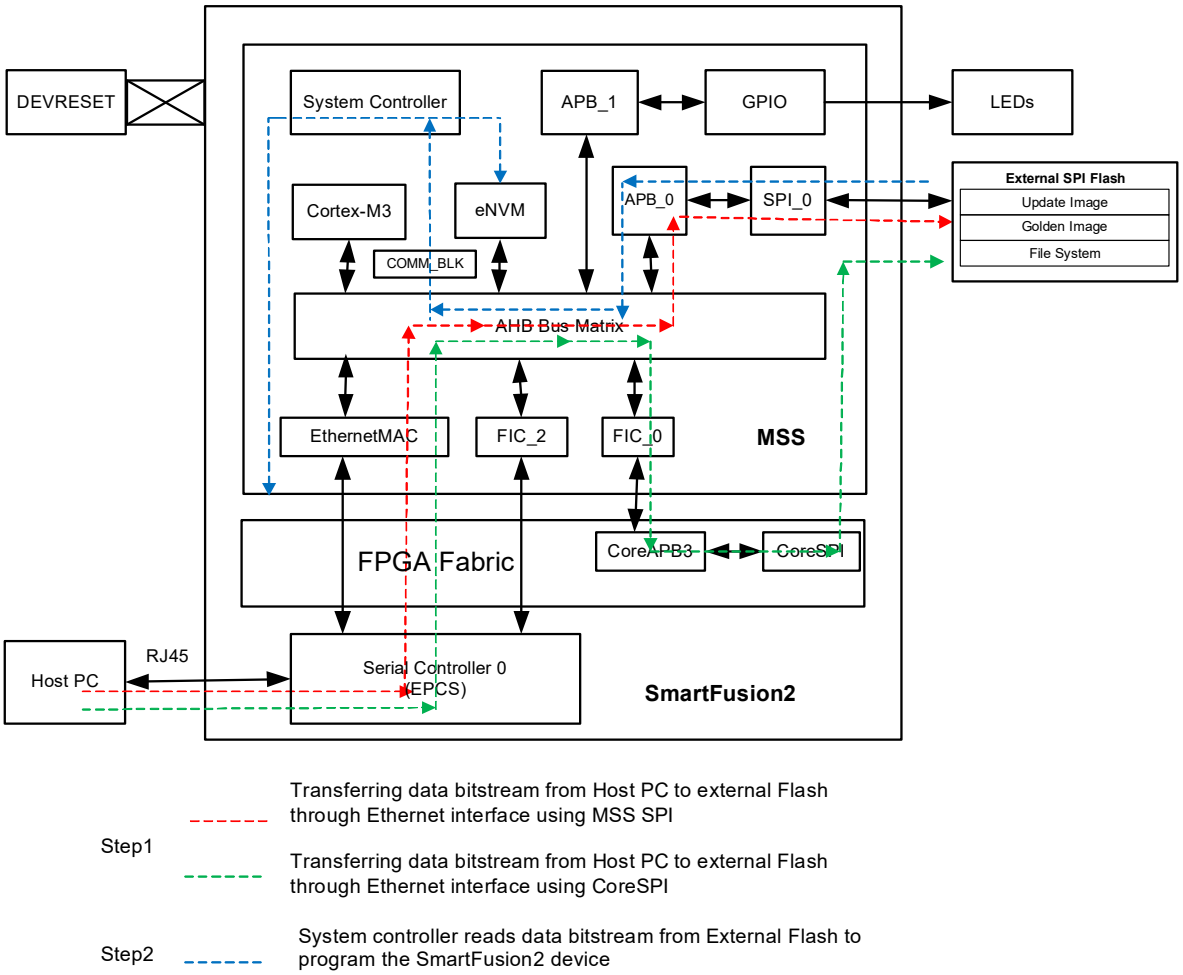
This demo design explains how to implement the Auto Update and Programming Recovery features of the SmartFusion2 device. Auto Update is a programming feature where a pre-programmed device is an auto programmed with an Update Image on power-up or assertion of the DEVRST_N pin. The Update Image is typically stored in an on-board external flash memory and its design version is greater than the image design version that is already programmed in the device. Programming Recovery feature allows the device to automatically recover from a power failure during a programming operation. When the Programming Recovery option is enabled, the device is programmed with the Golden Image that is stored in the external flash memory.

To transfer the Update and Golden images from Host PC to on-board external SPI flash, you can use different interfaces. For example, SmartFusion2® supported MSS peripherals such as UART, USB, PCIe, and Ethernet interfaces are used to load the images to the SPI flash memory. In this demo, the TFTP/Ethernet interface is used for loading SPI flash memory. The SPI flash memory can be programmed using the MSS SPI0 or Fabric CoreSPI controller.

The MSS SPI0 controller is configured to share the SPI0 pins with a CoreSPI controller implemented in the FPGA fabric. To share the SPI0 port a multiplexer logic is implemented in the FPGA fabric to switch the SPI0 pins between MSS SPI0 and the Fabric CoreSPI controller.

The following figure shows the data flow of the design. The arrows that are highlighted in red show the data flow between the Host PC and on-board external SPI flash memory using the MSS SPI and Ethernet Interfaces. The arrows that are highlighted in green show the data flow between the Host PC and on-board external SPI flash memory using the CoreSPI and Ethernet interfaces. The ARM® Cortex®-M3 processor copies the programming data from the Host PC to the SPI flash using the Ethernet interface. The arrows that are highlighted in blue show the System Controller reading the data from external SPI flash memory to program the SmartFusion2 device. In this demo design, the SPI flash images contain information to program both eNVM and FPGA fabric.

Figure 1 • **SmartFusion2 Demo Design**



For more information about Programming Recovery and Auto Update features of SmartFusion2, refer to *UG0451- IGLOO2 and SmartFusion2 Programming User Guide*.

For more information about SPI and Ethernet Interfaces, refer to *UG0331- SmartFusion2 Microcontroller Subsystem User Guide*.

2.1 Design Requirements

The following table lists the hardware and software design requirements for running this demo design.

Table 1 • **Design Requirements**

Requirement	Version
Operating System	64 bit Windows 7 and 10
Hardware	
SmartFusion2 Security Evaluation Kit: • FlashPro4 programmer • 12 V adapter • USB A to Mini-B cable	Rev E or later
RJ45 Cable (not provided with the kit)	
Software	
FlashPro Express	**Note:** Refer to the `readme.txt` file provided in the design files for the software versions used with this reference design.
Libero® System-on-Chip (SoC) for viewing the design files	
SoftConsole	
Host PC Drivers	USB to UART drivers
One of the following serial terminal emulation programs: • HyperTerminal • TeraTerm • PuTTY	

Note: Libero SmartDesign and configuration screen shots shown in this guide are for illustration purpose only. Open the Libero design to see the latest updates.

2.2 Prerequisites

Before you begin:

Download and install Libero SoC (as indicated in the website for this design) on the host PC from the following location.

https://www.microsemi.com/product-directory/design-resources/1750-libero-soc

2.3 Demo Design

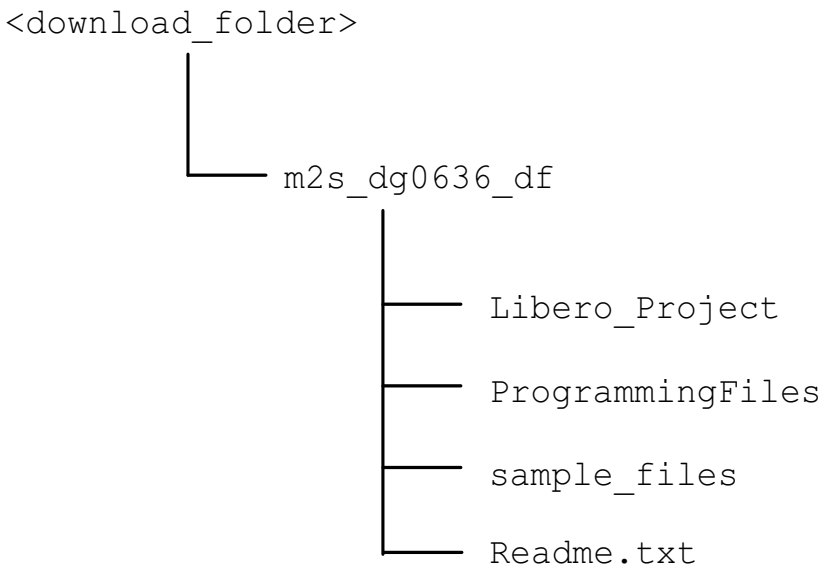
The demo design files are available for download from the following path in the Microsemi website:
http://soc.microsemi.com/download/rsc/?f=m2s_dg0636_df

Design files include:

- Libero_Project
- Sample files
- Programming files
- Readme.txt file

The following figure shows the top-level structure of the design files. Refer to `readme.txt` file for the complete directory structure.

Figure 2 • **Directory Structure**



2.3.1 Demo Design Features Summary

The following are the demo design features:

- Program Recovery is enabled, and to demonstrate this feature, only Golden Image is loaded into the SPI flash memory. When a power failure scenario is created, the demo design programs the device with the Golden Image after a power failure during a programming operation.
- Auto Update is enabled and both Golden and Update images (with a higher version) are loaded into the flash memory. When the device is reset, the demo design programs the device with a higher design version image, that is, Update Image to demonstrate the Auto Update feature.
- Transfer of programming files from the Host PC to an external SPI flash is done through Ethernet Interface using the TFTP application.
- External SPI flash can be programmed using MSS SPI0 or CoreSPI controller in fabric.
- Both eNVM and FPGA Fabric are programmed during Programming Recovery and Auto Update.
- LED blinking patterns and Serial Terminal messages are different for Golden and Update images to indicate Programming Recovery and Auto Update are applied correctly.

2.3.2 Demo Design Description

The demo design comprises of the following features:

- Programming Recovery
- Auto Update
- TFTP Server Application

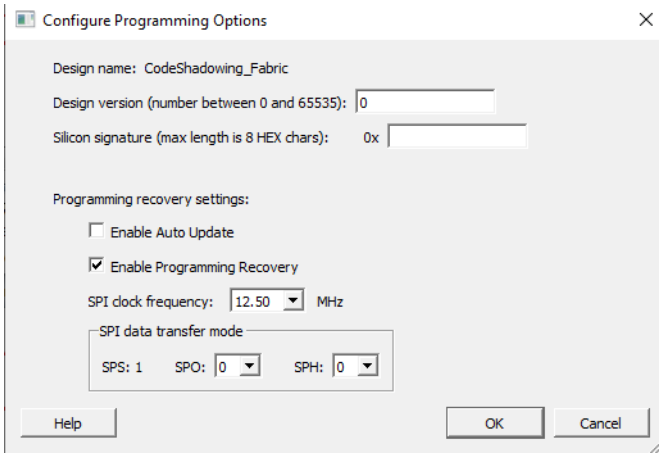
2.3.2.1 Programming Recovery

Programming recovery, if enabled, automatically recovers from a power failure during a programming operation. The Programming Recovery option is enabled using the Libero SoC software. To enable the Programming Recovery feature, open the Libero Project, and select **Configure Programming Recovery** option in the **Design Flow** window.

Programming recovery can be enabled in two ways:

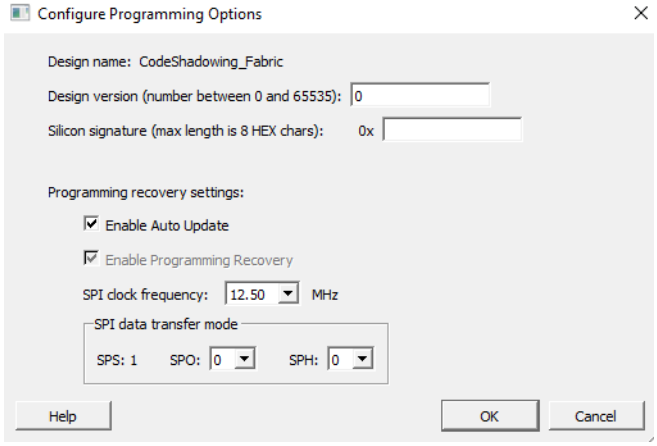
1. In the **Configure Program Recovery** window, select **Enable Programming Recovery** check box, as shown in the following figure.

Figure 3 • **Configure Programming Recovery - Enable Programming Recovery**



2. In the **Configure Program Recovery** window, enabling the Auto Update option enables the Programming Recovery, as shown in the following figure. This configuration is used in this demo.

Figure 4 • **Configure Programming Recovery - Enable Auto Update**



Based on the content provided in the Recovery programming file, three types of programming are possible:

- **eNVM programming:** This file has only eNVM content.
- **FPGA Fabric programming:** This file has only the FPGA fabric content.
- **eNVM and FPGA Fabric programming:** This file has both the FPGA fabric and eNVM content.

Program Recovery Image provided with Design files in this demo has both eNVM and Fabric content.

The Programming Recovery option requires an external SPI flash to be connected to MSS SPI_0. External SPI flash needs to be loaded with an SPI directory, Golden Image, and Update Image. The SPI directory provides the address of the Golden or Update images and their design versions, as shown in the following table.

Note: When only the Programming Recovery option is enabled, Update Image address and version are not required while creating the SPI directory. This demo demonstrates both Programming Recovery and Auto Update features.

Table 2 • **SPI Flash Directory**

Offset	Name	Size (Bytes)	Description
0	GOLDEN_IMAGE_ADDRESS	[3:0]	Address where the golden image starts.
4	GOLDEN_IMAGE_DESIGNVER	[1:0]	Design version of the golden image.
6	UPDATE_IMAGE_ADDRESS	[3:0]	Address where the update image starts.
10	UPDATE_IMAGE_DESIGNVER	[1:0]	Design version of the update image.

Create a directory in the SPI flash to provide the address for Auto Update Image, Golden Image, and their design versions. On the SmartFusion2 Security Evaluation Kit board, the flash memory size is 8 MB. Depending on the size of the programming file, the SPI flash memory is configured in the SoftConsole Project as follows:

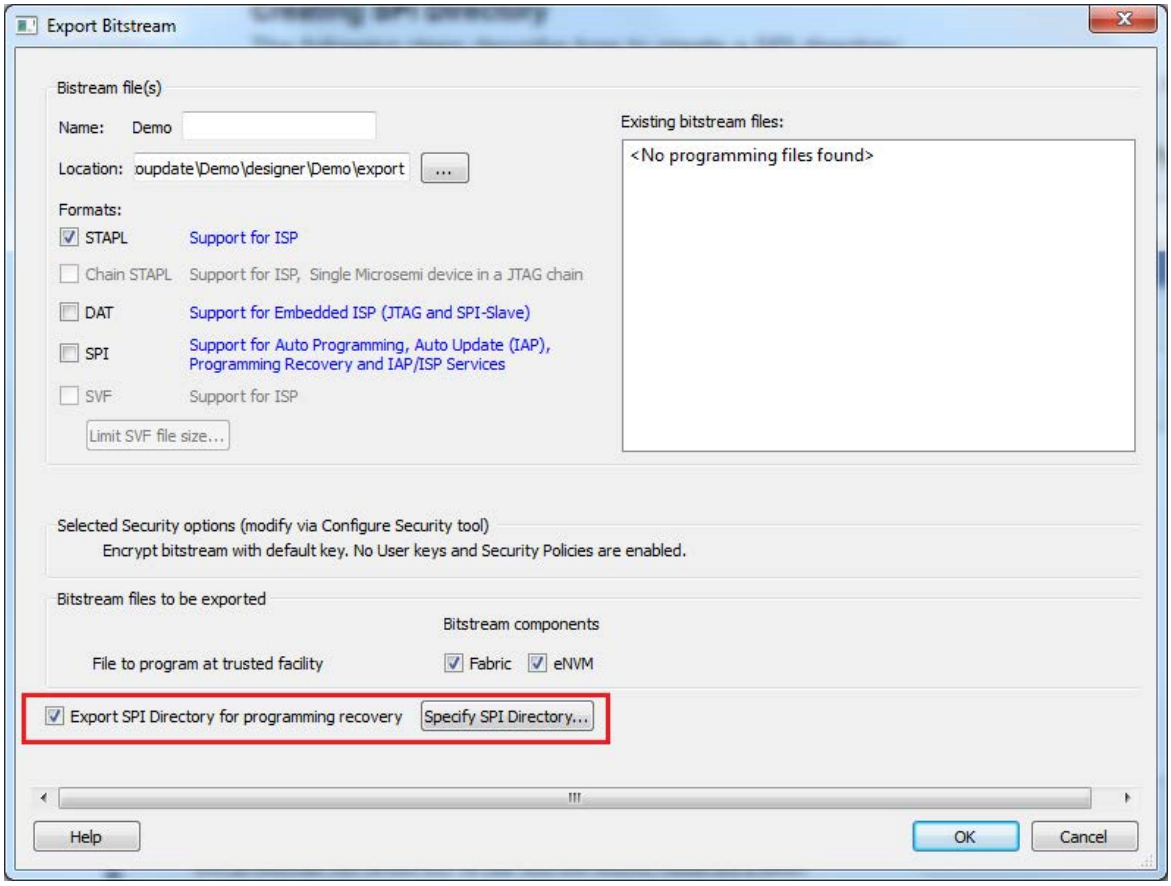
- 0x0 - 0xFFF is for loading SPI Directory
- 0x1000 - 0x3FFFFF is for loading Golden Image
- 0x400000 - 0x7FFFFF is for loading Auto Update Image

2.3.2.1.1 Creating SPI Directory

The following steps describe how to create a SPI directory:

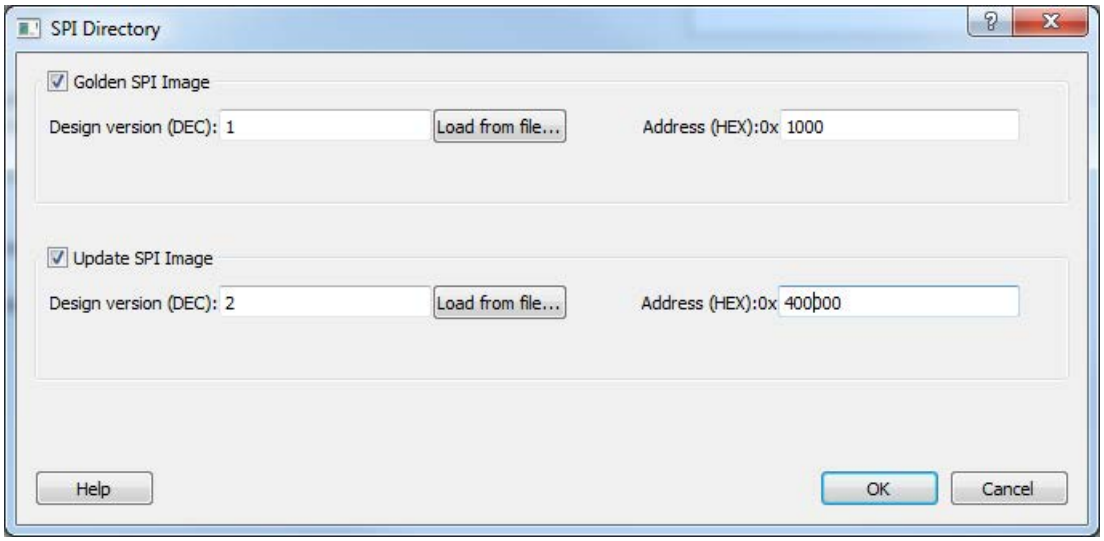
1. To create SPI directory, open Libero project and select **Export Bit Stream** from **Design Flow** window. **Export Bitstream** window is displayed, as shown in the following figure.
2. Select **Export SPI Directory for programming recovery** and click **Specify SPI Directory**.

Figure 5 • **Export Bitstream**



The **SPI Directory** window is displayed as shown in the following figure. Enter the design version and address for Golden Image and Update Image. Golden and Update image addresses, which are configured in the SoftConsole Project need to be entered in the SPI Directory window.

Figure 6 • **SPI Directory**



The design version size is 16-bit. An address indicates the starting address of Golden and Update images, and the address field size is 32-bit. Using the TFTP/Ethernet SPI Directory, Golden Image, and Auto Update images are transferred to SPI addresses 0x0, 0x1000, and 0x400000 respectively. Golden and Update images are provided with the file extension `.spi`.

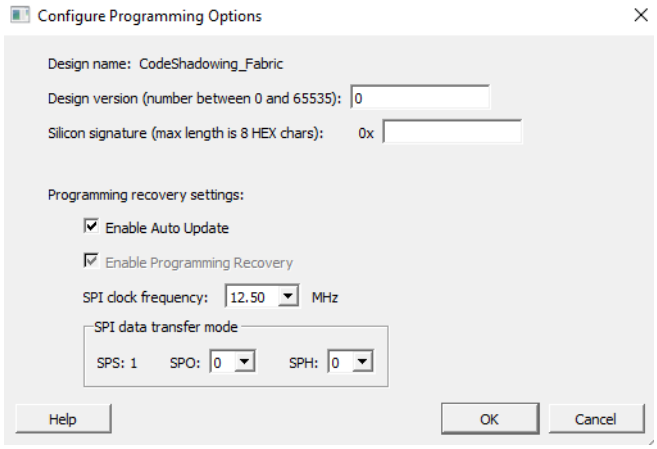
The System Controller reads the Golden Image address from the SPI directory and programs the Golden Image available at 0x1000 in case of power failure during the programming operation.

2.3.2.2 Auto Update

When the Auto Update feature is enabled, the device is auto programmed with an Update Image on power-up or assertion of the DEVRST_N pin. This applies when the Update Image design version (that is, stored in SPI flash) is greater than the image design version that is already programmed in the device. Auto Update feature is enabled using Libero SoC software. To enable the Auto Update feature, open the provided Libero Project and select **Configure Programming Recovery** option in **Design Flow** window, select **Enable Auto Update** in Configure Programming Recovery, as shown in the following figure.

Enabling the Auto Update enables the Programming Recovery by default. During the Auto Update, in case of power failure, the Programming Recovery is run automatically.

Figure 7 • **Configure Programming Recovery - Enable Auto Update**



Based on the inputs provided by the Auto Update programming file, three types of programming are possible:

- **eNVM programming:** This file has only eNVM content.
- **FPGA Fabric programming:** This file has only the FPGA fabric content.
- **eNVM and FPGA Fabric programming:** This file has both the FPGA fabric and eNVM content.

Auto Update Image provided with design files in this demo has both eNVM and Fabric content.

The Auto Update option requires an external SPI flash to be connected to MSS SPI_0. The External SPI flash needs to be loaded with the SPI directory, Golden Image, and Update Image. The SPI directory provides the address for Golden Image, Update Image, and their design versions. For more information, refer to Table 2, page 7.

If the flash memory has enough memory, then it can have more than one Auto Update Image. To update from different Auto Update images, the user needs to create a new SPI directory with a new Auto Update Image Address and its Design Version.

In this demo, Auto Update Image is available at 0x400000 address. The same address must be entered when creating the SPI directory, as shown in Figure 6, page 8.

To update from different Auto Update Images, a new Update Image address and version must be entered in the GUI when creating the SPI directory. This new SPI directory needs to be programmed to the SPI flash.

For more information about how to create SPI directory, refer to Creating SPI Directory, page 7.

On power-up or assertion of the DEVRST_N pin, the System Controller reads the image version in the SPI directory and programs the Update Image available at 0x400000, if it contains the higher image version than the image already programmed in the FPGA.

2.3.2.3 TFTP Server Application

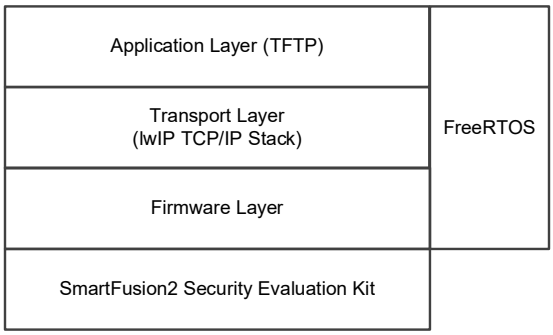
To transfer the Programming Images (`.spi` format) and load them to the SPI flash memory, the Trivial File Transfer Protocol (TFTP) is used. The TFTP server application is implemented in the firmware project to transfer the SPI images from the Host PC to the external flash memory (available on SmartFusion2 Security Evaluation Kit board).

TFTP server application has following layers:

- Application Layer
- Transport Layer
- Firmware Layer

The following figure illustrates the block diagram of the TFTP server application on SmartFusion2 device used in this demo design.

Figure 8 • **TFTP Server Application - Block Diagram**



2.3.2.3.1 Application Layer

The TFTP protocol is implemented in the application layer. TFTP is used to transfer the files between client and server. A file transfer is initiated by the client issuing a request to read or write a particular file on the server.

The TFTP client (Host PC) transfers the file using TFTP PUT command to the SmartFusion2 device (TFTP server). Transferred files are stored in the external flash memory connected to the MSS SPI_0 on SmartFusion2 Security Evaluation Kit board.

2.3.2.3.2 Transport Layer (lwIP TCP/IP Stack)

The lwIP stack is suitable for the embedded systems because of its less resource usage. It is used with or without the operating system. The lwIP consists of the actual implementations of the IP, ICMP, UDP, and TCP protocols, as well as the support functions such as buffer and memory management.

For more information on the design and implementation, refer to www.sics.se/~adam/lwip/doc/lwip.pdf.

2.3.2.3.3 RTOS and Firmware Layer

FreeRTOS is an open source real time operating system kernel. FreeRTOS is used in this demo to prioritize and schedule the tasks. For more information about FreeRTOS and the latest source code, refer to http://www.freertos.org.

The firmware provides the software driver implementation to configure and control the following MSS components:

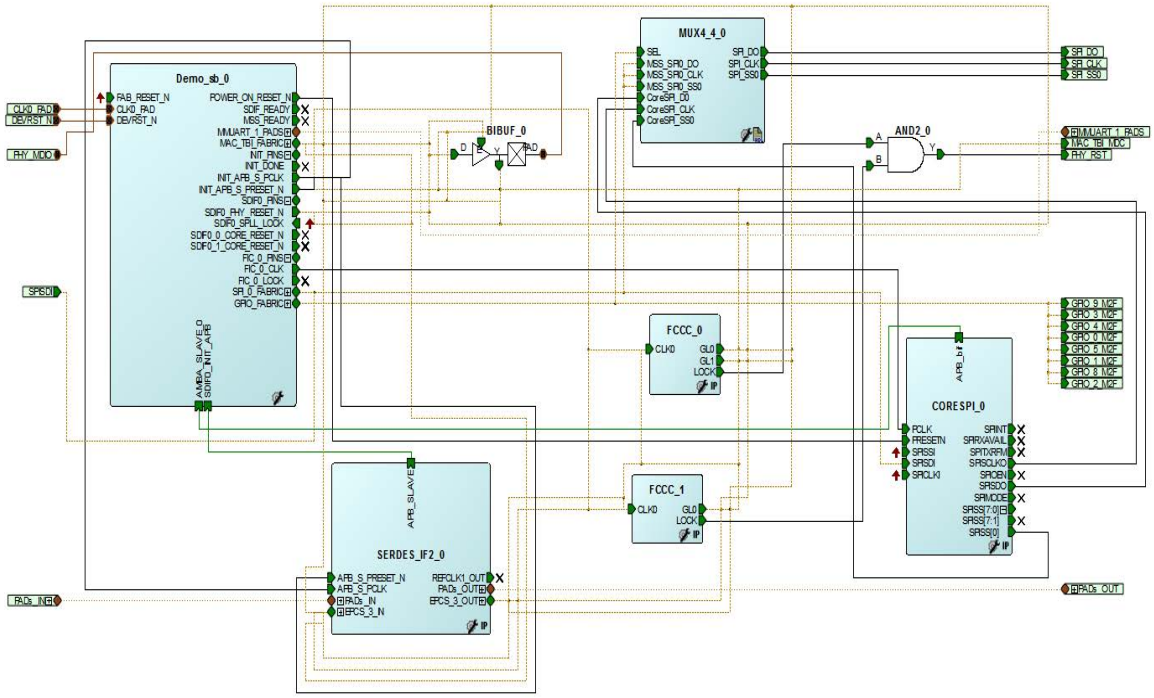
- Ethernet MAC
- MMUART
- GPIO
- SPI
- RTC

2.3.3 Hardware Implementation

In this demo design, the following blocks are configured in Libero hardware project:

- MSS GPIO block is enabled and configured as: GPIO_0 to GPIO_7 as outputs and connected LEDs.
- M3_CLK clock is configured to 100 MHz.
- MSS SPI_0 controller is enabled to access the external SPI flash memory.
- CoreSPI controller in fabric is configured to access the external Flash Memory.
- MMUART1 is enabled for RS-232 communication on the SmartFusion2 Security Evaluation Kit board.
- The MSS TSEMAC is configured for the ten-bit interface (TBI) operation.
- The SERDES_IF_2 in the SmartFusion2 device is configured for EPCS Lane3.

Figure 9 • **Libero SmartDesign**



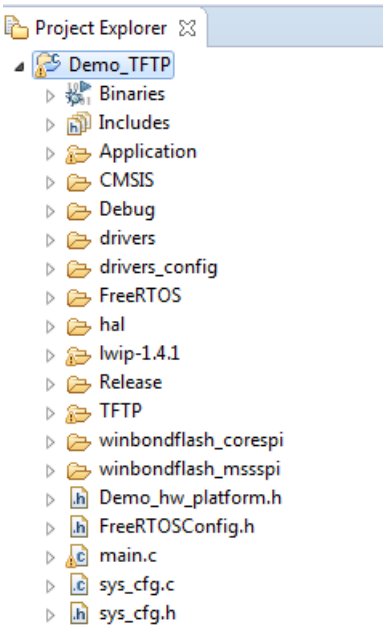
2.3.4 SoftConsole Firmware Project

The following stacks are used for this demo design:

- lwIP TCP/IP stack version 1.4.1
- FreeRTOS

The following figure shows SoftConsole software directory structure of the demo design.

Figure 10 • **SoftConsole Project Explorer Window**



The SoftConsole workspace consists of the following projects.

- **Demo_TFTP:** Contains TFTP server application using LWIP and FreeRTOS. This SoftConsole project transfers only the SPI directory, Golden, and Update Images to SPI Flash memory using Ethernet Interface. Also, all the firmware and hardware abstraction layers are correspond to the hardware design.

Note: External SPI flash can be programmed using MSS SPI0 or Fabric CoreSPI controller. By default CoreSPI is configured in SoftConsole project provided in the design files. To configure MSS SPI0 to transfer `.spi` files, refer to Appendix 7: Configuring MSS SPI0 in SoftConsole Project, page 37.

2.4 Setting Up the Demo Design

The following steps describe how to set up the hardware demo for the SmartFusion2 Security Evaluation Kit board:

1. Connect the jumpers on the SmartFusion2 Security Evaluation Kit board, as listed in the following table.

Table 3 • **SmartFusion2 Security Evaluation Kit Jumper Settings**

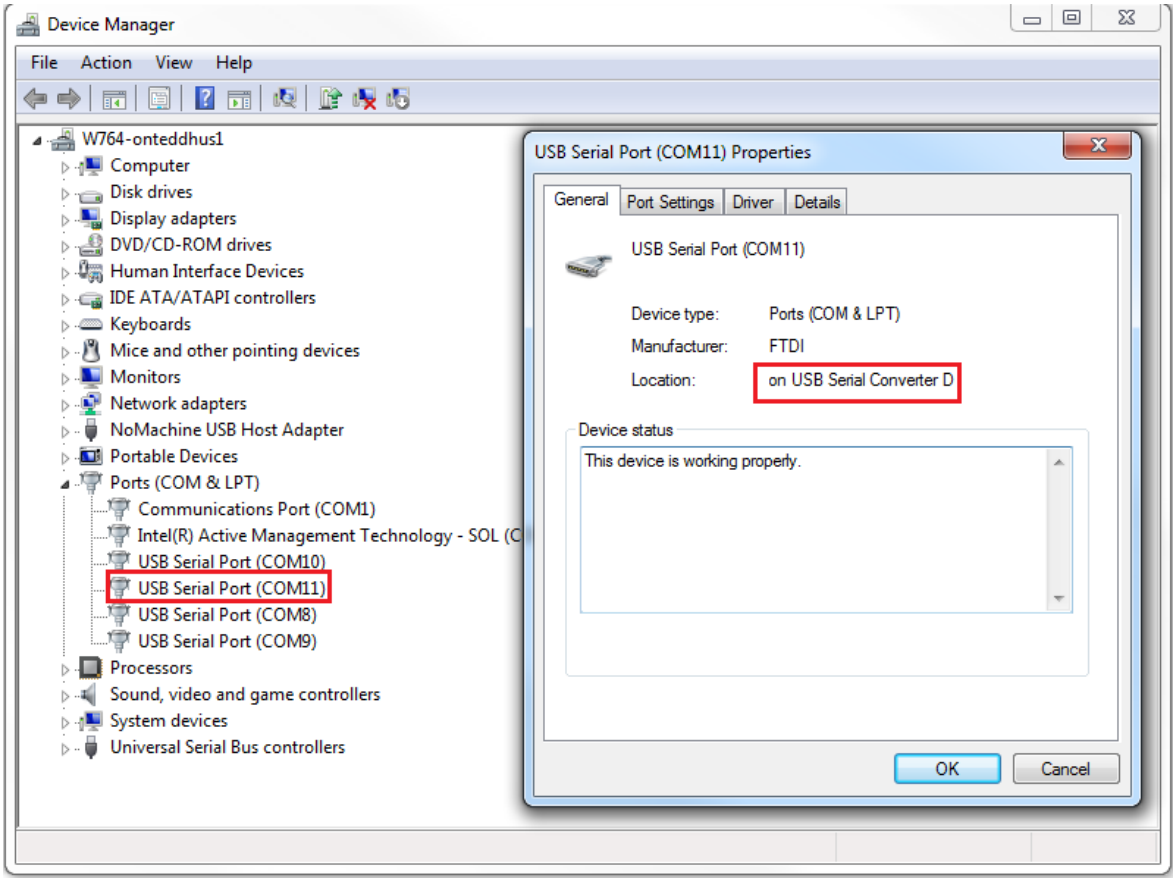
Jumper	Pin (From)	Pin (To)	Comments
J22, J23, J24, J8, J3	1	2	Default These are the default jumper settings of the SmartFusion2 Security Evaluation Kit board. Ensure that these jumpers are set properly.

Appendix 3: SmartFusion2 Security Evaluation Kit Board Jumper Locations, page 24 provides the SmartFusion2 Security Evaluation kit silk screen to identify the jumper locations on board.

Note: Ensure that the power supply switch, **SW7** is switched OFF while connecting the jumpers on the SmartFusion2 Security Evaluation Kit board.

2. Connect the Host PC to the J18 connector using the USB Mini-B cable. The USB to UART bridge drivers are automatically detected.
3. From the detected four COM ports, right-click any one of the COM ports and select Properties. The selected COM port properties window is displayed, as shown in the following figure.
4. Ensure to have the Location as **on USB Serial Converter D** in the Properties window as shown in the following figure.

Figure 11 • **Device Manager Window**



5. Install the USB driver, if the USB drivers are not detected automatically.
6. Install the FTDI D2XX driver for serial terminal communication through the FTDI mini USB cable. Download the drivers and installation guide from: http://soc.microsemi.com/download/rsc/?f=CDM_2.08.24_WHQL_Certified
7. Connect the FlashPro4 programmer to the J5 connector of the SmartFusion2 Security Evaluation Kit board.
8. Connect the power supply to the J6 connector of the SmartFusion2 Security Evaluation Kit.
9. This design example can run in both Static IP and Dynamic IP modes. By default, the programming files are provided for dynamic IP mode.
    - For static IP, connect the Host PC to the J13 connector of the SmartFusion2 Security Evaluation Kit board using an RJ45 cable.
    - For dynamic IP, connect any one of the open network ports to the J13 connector of the SmartFusion2 Security Evaluation Kit board using an RJ45 cable.

2.4.1 Board Setup Snapshot

Snapshots of the SmartFusion2 Security Evaluation Kit board with all the setup made is given in Appendix 2: Board Setup for Running the Demo, page 23.

2.5 Running the Demo Design

The following steps describe how to program the demo design:

1. Download the demo design from: *http://soc.microsemi.com/download/rsc/?f=m2s_dg0636_df*
2. Switch **ON** the SW7 power supply switch.
3. Start any serial terminal emulation program such as:
    - HyperTerminal
    - PuTTY
    - Tera Term

Note: In this demo, PuTTY is used.

The configuration for the program is:

- Baud Rate: 115200
- Eight data bits
- One stop bit
- No Parity
- No flow control

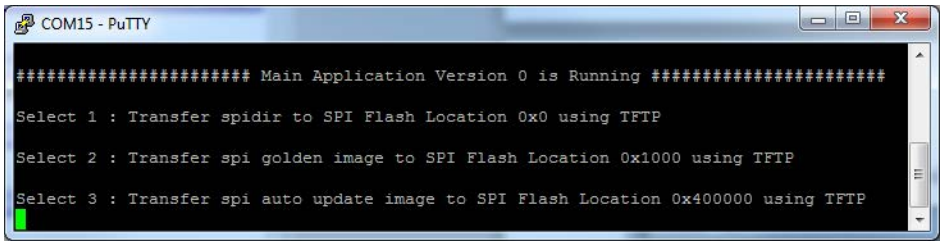
For more information about how to configure the serial terminal emulation programs, refer to *Configuring Serial Terminal Emulation Programs Tutorial*.

4. Program the SmartFusion2 Security Evaluation Kit board with the job file provided as part of the design files using FlashPro Express software, refer to Appendix 1: Programming the Device Using FlashPro Express, page 20.

Note: The demo can be run in both static and dynamic modes. To run the design in Static IP mode, refer to Appendix 5: Running the Design in Static IP Mode, page 30.

The following figure shows sample messages displayed in PuTTY window.

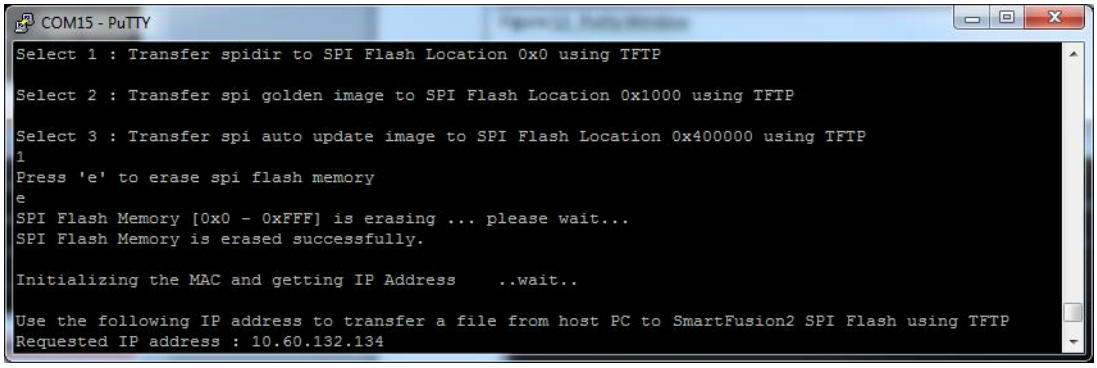
Figure 12 • **PuTTY Window**



5. Enable TFTP client in Host PC. To enable the TFTP client in Host PC, refer to Appendix 4: Enable TFTP Client, page 25.
6. Enter **1** to initiate SPI directory transfer.

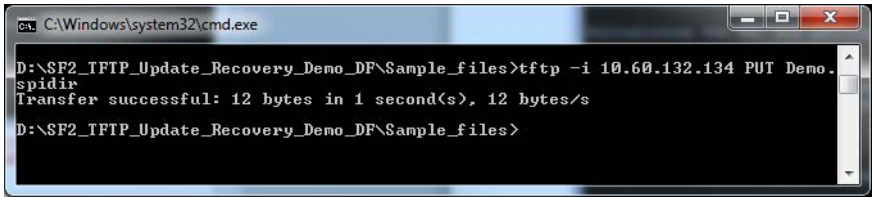
7. Enter **e** to erase the SPI flash memory location (0x0 – 0xFFF).

Figure 13 • **Erasing the SPI Flash Memory Location [0x0 - 0xFFF]**



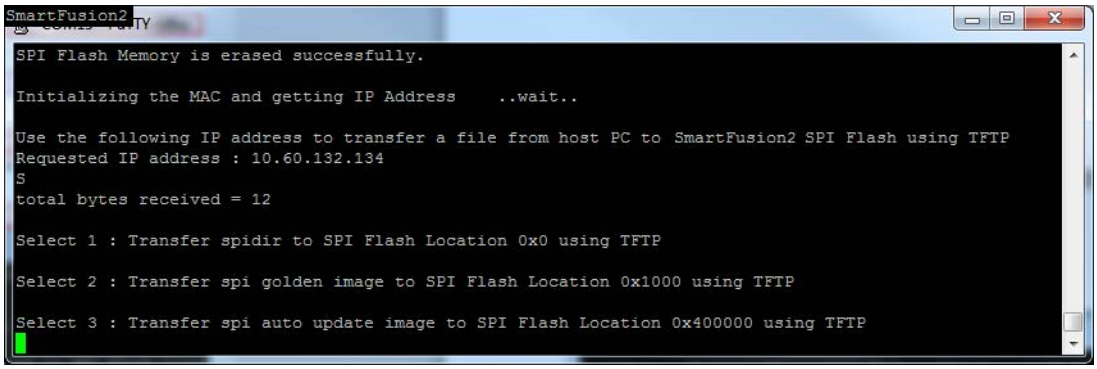
8. After completion of SPI flash erase operation, the Ethernet link is up and IP address is displayed on PuTTY terminal. The LED 2 on the SmartFusion2 Security Evaluation Kit board starts blinking.
9. On the Host PC command prompt, browse to the folder *downloadfolder>\m2s_dg0636_df\Sample_files*
10. Type the following command to transfer SPI Directory as shown in the following figure.
    `tftp -i 10.60.132.134 PUT Demo.spidir`

Figure 14 • **Transfer SPI Directory**



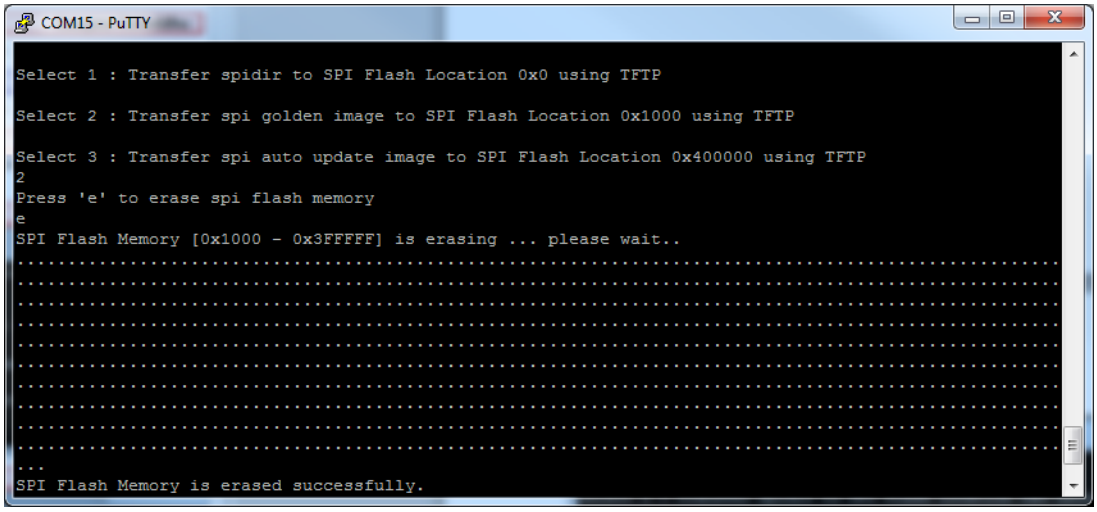
11. Wait until total bytes received message is displayed on the PuTTY terminal, to ensure that the SPI directory TFTP transfered to SPI Flash.

Figure 15 • **SPI Directory Transferred Successfully Window**



To run the Programming Recovery option, select Option 2 and enter **e** to erase the SPI flash memory location [0x1000 – 0x3FFFFF] for transferring the Golden Image version 1 to the address 0x1000.

Figure 16 • **Erase the SPI Flash Memory [0x1000 - 0x3FFFFF]**



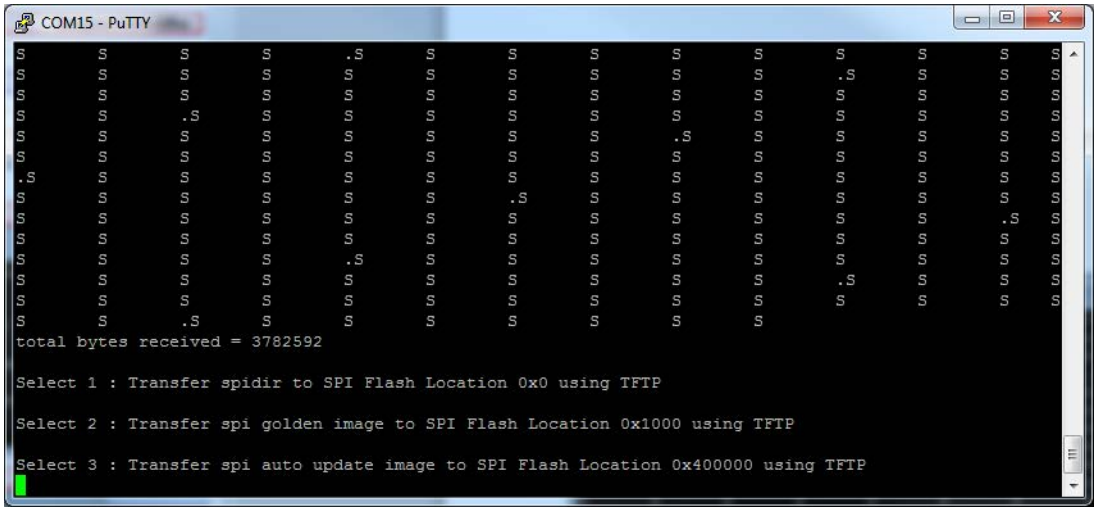
1. On the Host PC command prompt, browse to the folder *downloadfolder>\m2s_dg0636_df\Sample_files*
2. Type the following command to transfer the Golden Image Version 1 to 0x1000 memory location of SPI Flash.

   ```
   tftp -i 10.60.132.134 PUT Demo_Golden_V1.spi
   ```

Figure 17 • **Transferring Golden Image Version 1**

Wait until “total bytes received” message is displayed on the PuTTY terminal, to ensure Golden Image Version 1 TFTP transfer to SPI Flash is completed.

Figure 18 • **Successful Transfer of Golden Image Window**

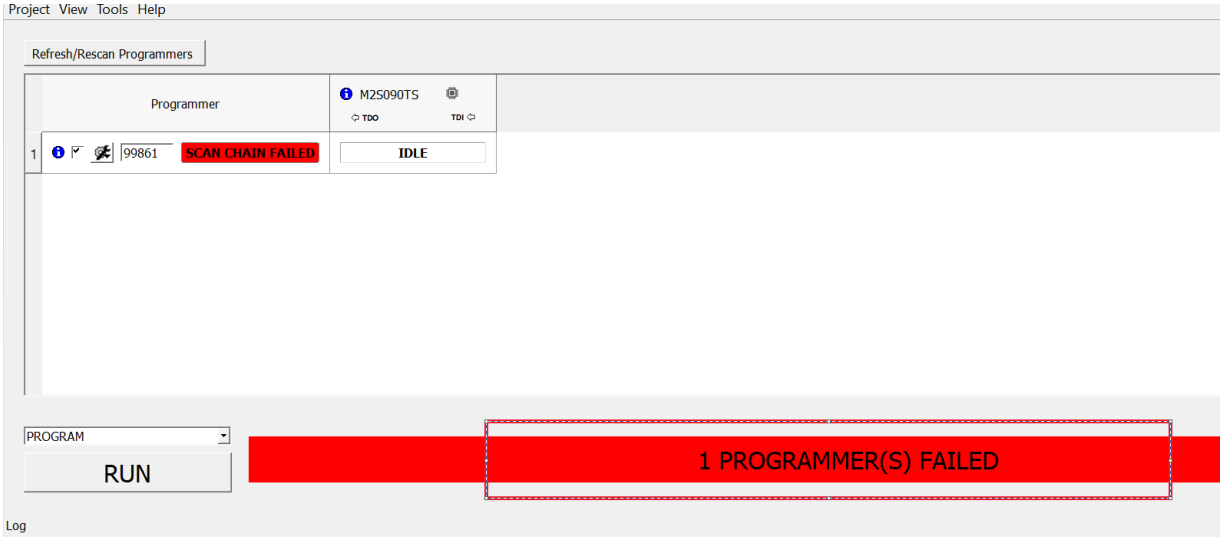


In order to run the Programming Recovery option, create a scenario where the programming operation meets a power failure. One of the ways to perform this task, is to start programming the device using the FlashPro Express software. Ensure to switch off the power supply to the board before programming operation is completed by FlashPro programmer. After the power failure situation is created, then the FlashPro programmer can be removed.

The following instructions describe the programming recovery operation of SmartFusion2 system controller:

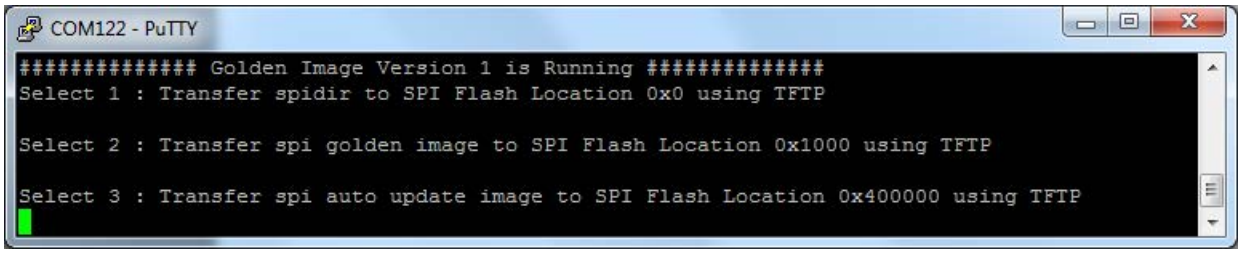
1. Run FlashPro Express software and select the same `top.job` file provided in the Programming File folder.
2. Click **PROGRAM**.
3. While the programming is going ON, user can observe LEDs (H5, H6, J6, H7, F3, F4, and E1) are turned OFF on the SmartFusion2 Security Evaluation Kit board and after seeing LED's turn OFF, immediately switch OFF the board using SW7.
4. FlashPro hardware should stop programming the device and FlashPro Express software should display an error message, as shown in the following figure.

Figure 19 • **FlashPro Error Display Window**



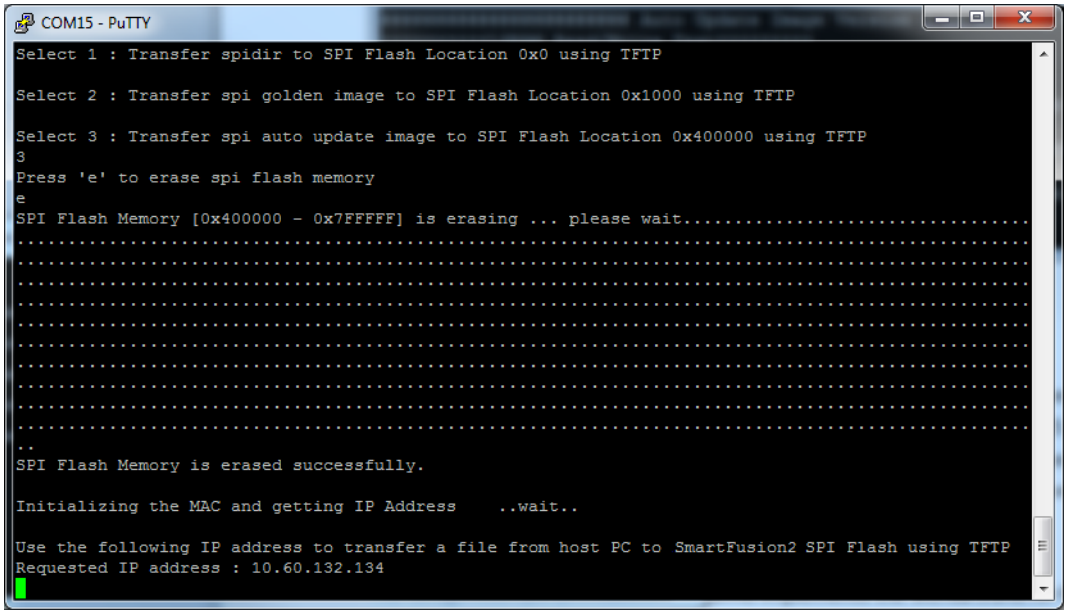
5. Switch ON the SmartFusion2 Security Evaluation Kit board. The System Controller reads the Golden Image address from SPI directory and programs the Golden Image available at 0x1000. The Programming Recovery process takes approximately four to five minutes. After successful Programming Recovery, PuTTY terminal displays a message "Golden Image Version 1 is Running" and Ensure LEDs (H5, J6, G7, and F4) are ON. This activity confirms that the Golden Image Version 1 is recovered.

Figure 20 • **Running Golden Image Version 1**



To run the Auto Update option, select **3** and enter **e** to erase the SPI flash memory location [0x400000 – 0x7FFFFF] for transferring the Auto Update Image Version 2 to address 0x400000.

Figure 21 • **Erasing the SPI Flash Memory Location [0x400000 - 0x7FFFFF]**



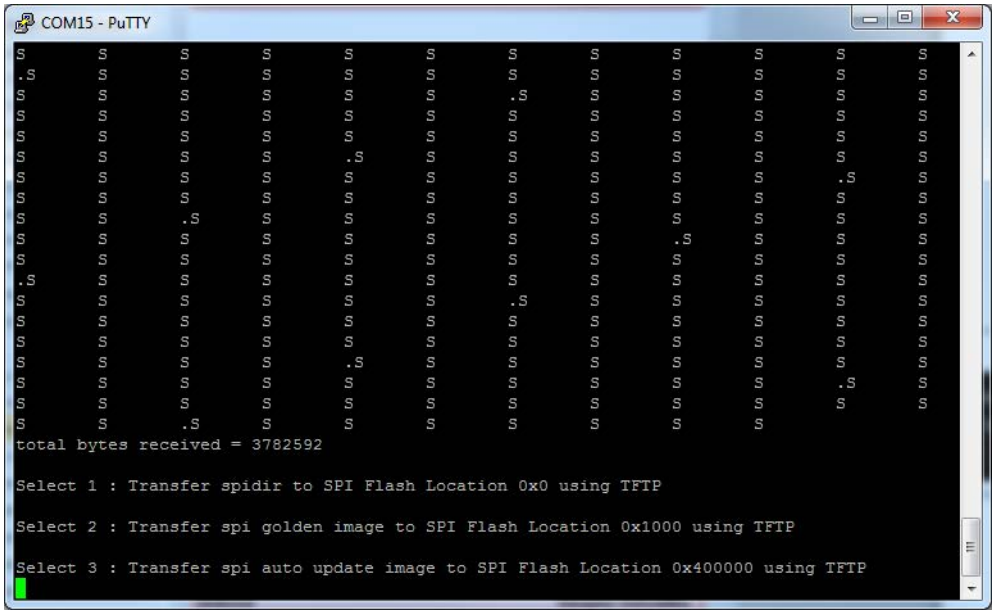
1. On the Host PC Command prompt, browse to the *downloadfolder>\m2s_dg0636_df\Sample_files* folder
2. Type the following command to transfer Auto Update Image Version 2 to 0x400000 memory location of the SPI flash.

   ```
   tftp -i10.60.132.134 PUT Demo_Update_V2.spi
   ```

Figure 22 • **Transferring Auto Update Image Version 2**

Wait until a message “total bytes received” is displayed on the PuTTY terminal, which ensures that the Auto Update Image Version 2 TFTP transfer to SPI Flash is completed.

Figure 23 • **Transfer Successful Auto Update Image**



3. Select **SW6** to reset the SmartFusion2 Security Evaluation Kit board and wait for approximately four to five minutes.
4. During Auto Update, LEDs (H5, H6, J6, H7, F3, F4, and E1) are turned OFF.
5. After successful Auto Update, PuTTY terminal displays a message “Auto Update Image Version 2 is Running” and also ensure LEDs (H5, H6, J6, are H7) are ON.

Figure 24 • **Auto Update Image**

2.6 Known Issue

The System Controller is unable to change the oscillator frequency after a successful Programming Recovery. The oscillator frequency is 25 MHz instead of 50 MHz. This is a known silicon issue, which is documented in *ER0196- SmartFusion2 Device, Errata*.

After Recovery Operation, junk messages are displayed on the Serial Terminal. The workaround is to apply a system reset after a successful recovery. It is recommended that this workaround is implemented for any design, which uses the Programming Recovery. For more information about how to implement this workaround, refer to Appendix 6: Implementing Workaround to Reset the Device after Programming Recovery, page 33.

The design example provided in this demo implements the workaround for Programming Recovery issue and the design files are available in the following location:

```
<downloadfolder>\m2s_dg0636_df\Sample_files\Recovery_WA
```

The same workaround is also implemented in the Program Recovery Image that is, `Demo_Golden_V1.spi` which is demonstrated in Running the Demo Design, page 14 already.

3 Appendix 1: Programming the Device Using FlashPro Express

This section describes how to program the SmartFusion2 device with the programming job file using FlashPro Express.

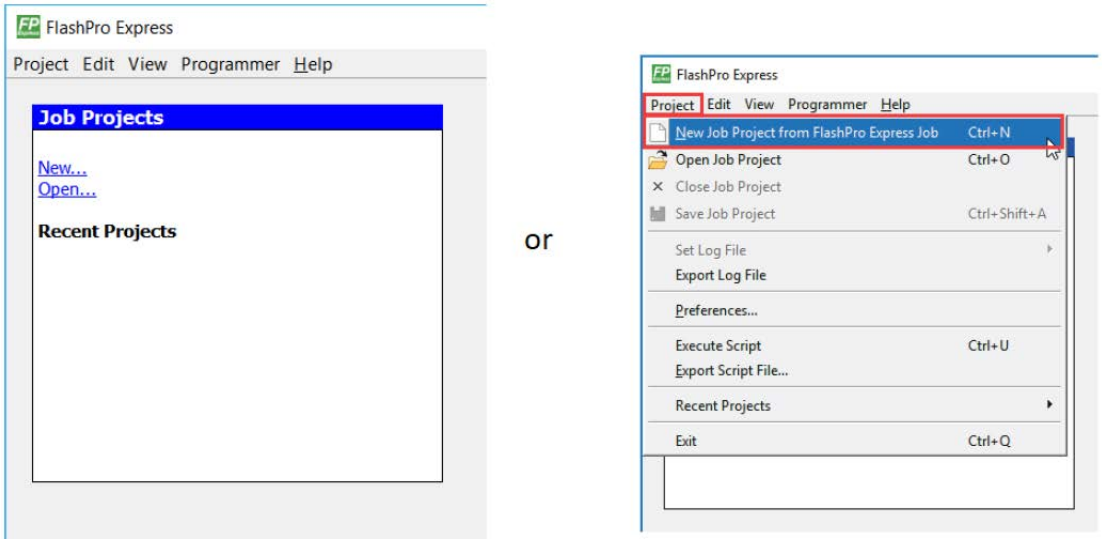
To program the device, perform the following steps:

1. Ensure that the jumper settings on the board are the same as those listed in Table 3, page 13.

Note: The power supply switch must be switched off while making the jumper connections.

2. Connect the power supply cable to the **J6** connector on the board.
3. Power **ON** the power supply switch **SW7**.
4. On the host PC, launch the **FlashPro Express** software.
5. Click **New** or select **New Job Project from FlashPro Express Job** from **Project** menu to create a new job project, as shown in the following figure.

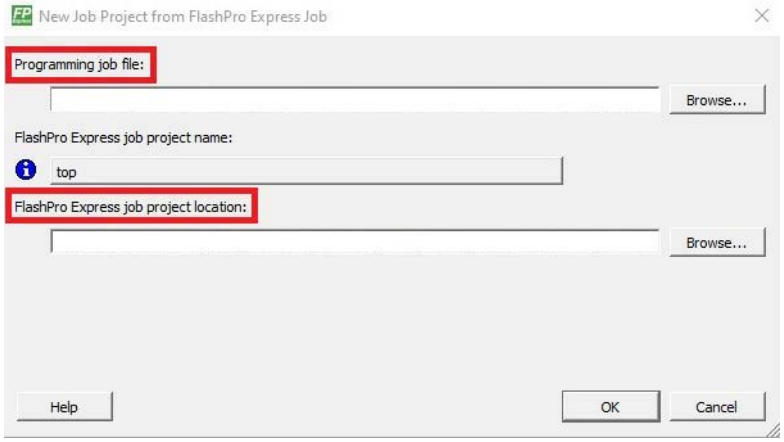
Figure 25 • **FlashPro Express Job Project**



6. Enter the following in the **New Job Project from FlashPro Express Job** dialog box:

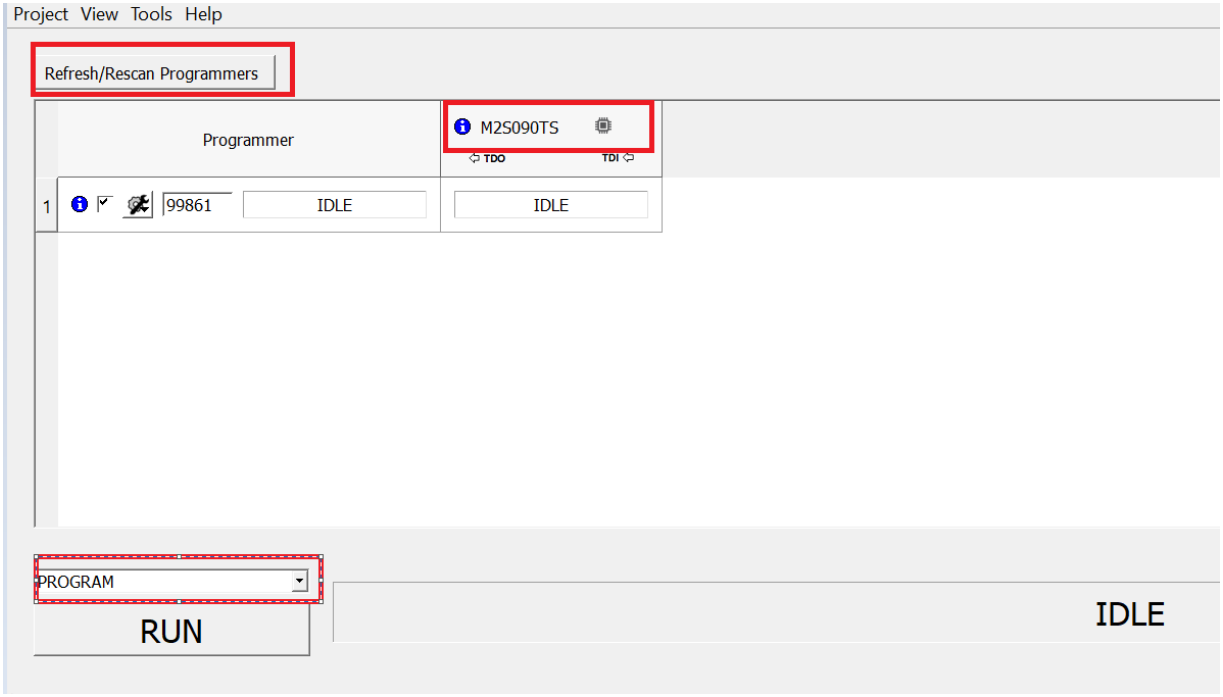
- **Programming job file:** Click **Browse**, and navigate to the location where the .job file is located and select the file. The default location is: *<download_folder>\m2s_dg0636_df\Programming files*
- **FlashPro Express job project name:** Click **Browse** and navigate to the location where you want to save the project.

Figure 26 • **New Job Project from FlashPro Express Job**



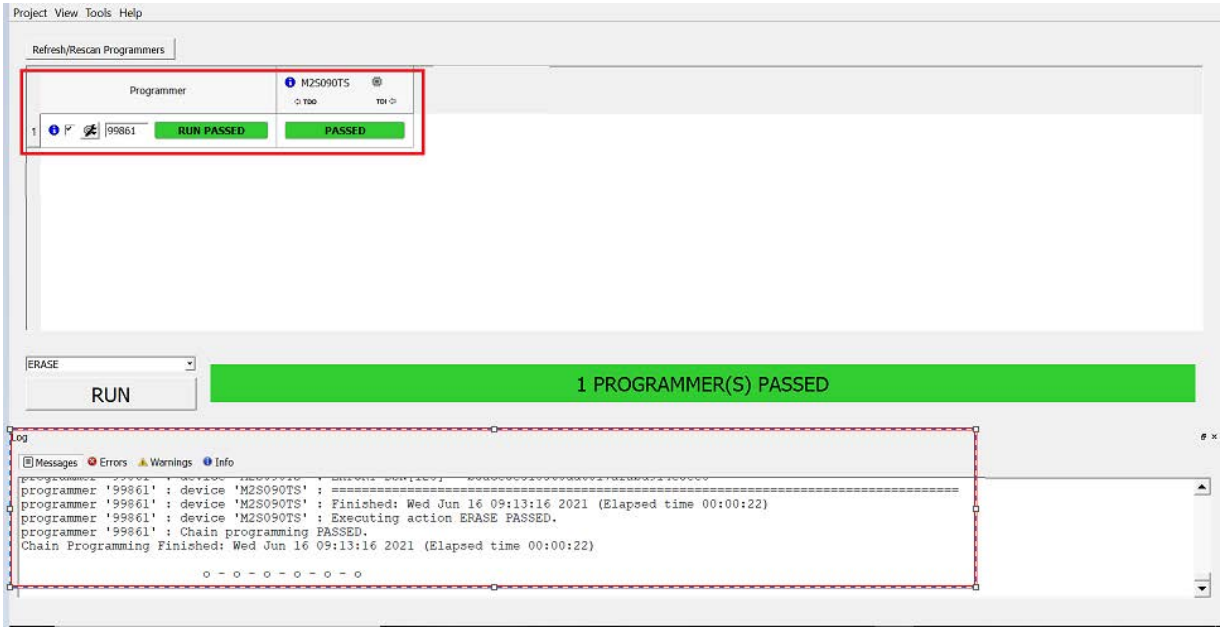
7. Click **OK**. The required programming file is selected and ready to be programmed in the device.
8. The FlashPro Express window appears as shown in the following figure. Confirm that a programmer number appears in the Programmer field. If it does not, confirm the board connections and click **Refresh/Rescan** Programmers.

Figure 27 • **Programming the Device**



9. Click **RUN**. When the device is programmed successfully, a **RUN PASSED** status is displayed as shown in the following figure.

Figure 28 • **FlashPro Express—RUN PASSED**

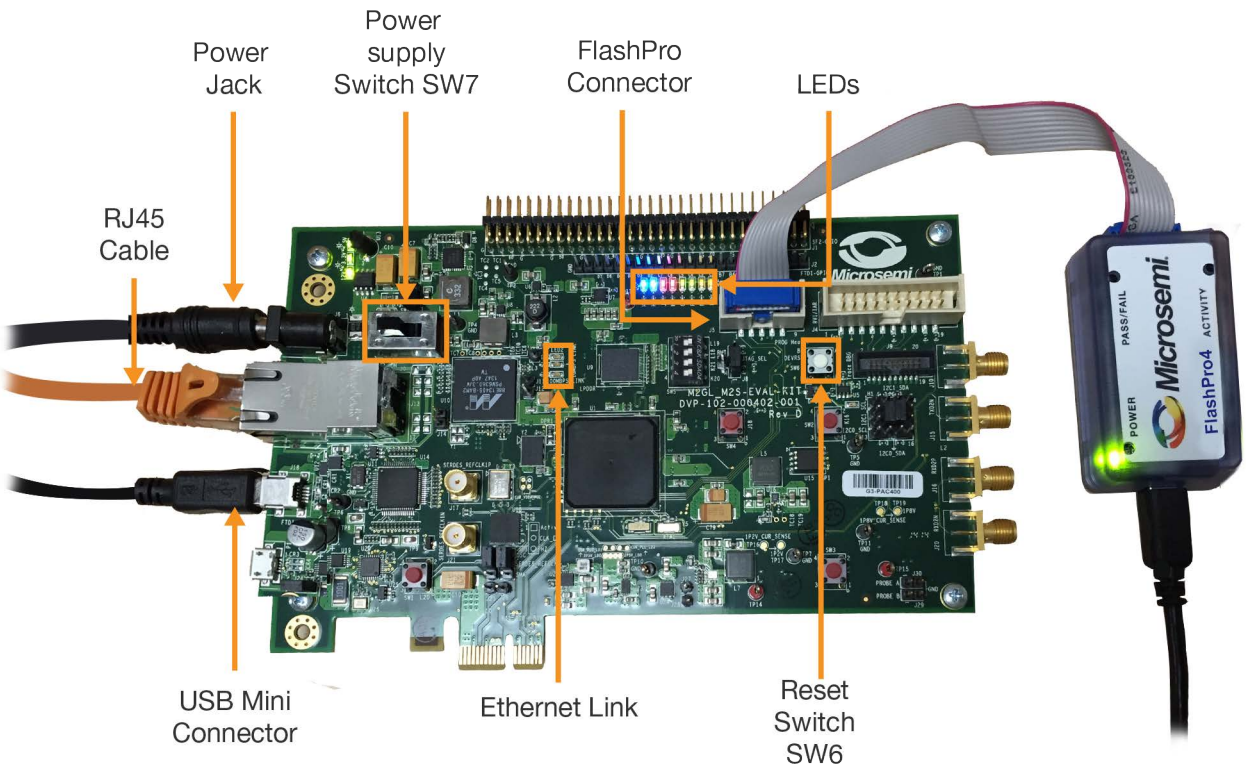


10. Close **FlashPro Express** or in the Project tab, click **Exit**.

4 Appendix 2: Board Setup for Running the Demo

The following figure shows the board setup for running the demo on the SmartFusion2 Security Evaluation Kit board.

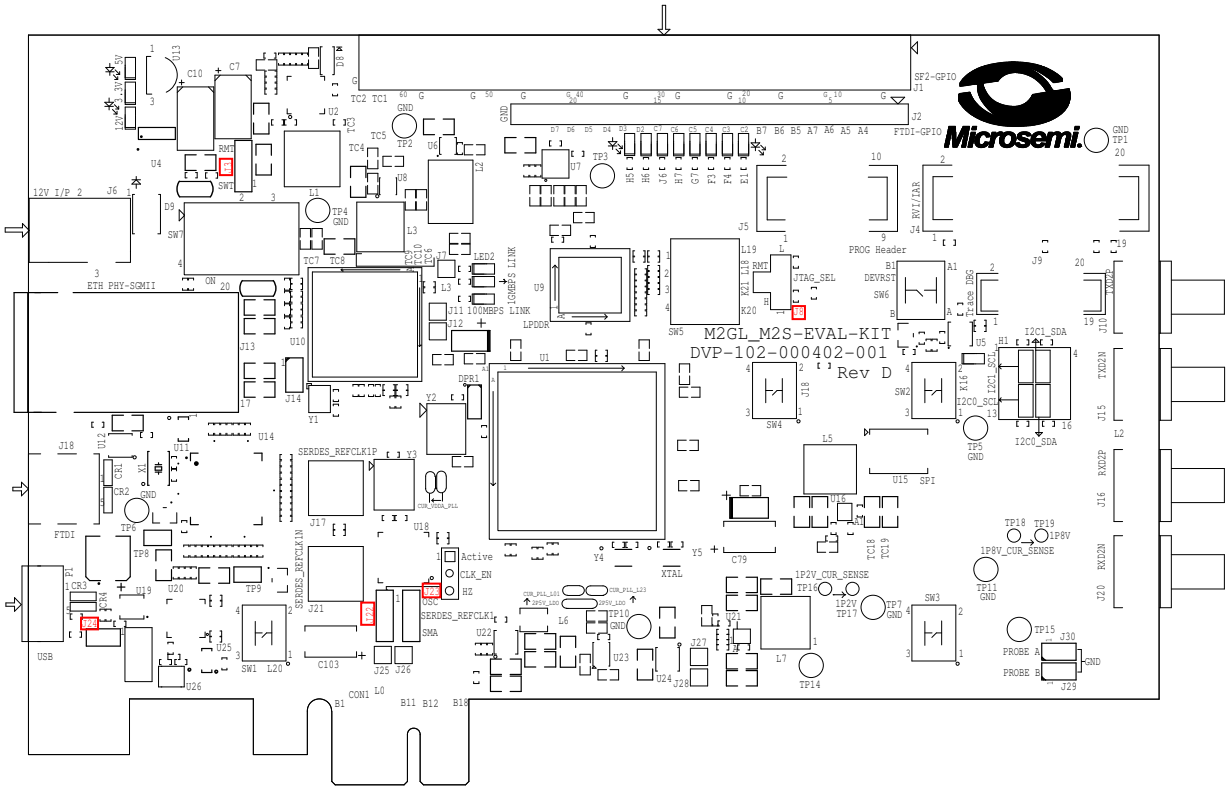
Figure 29 • **SmartFusion2 Security Evaluation Kit Setup**



5 Appendix 3: SmartFusion2 Security Evaluation Kit Board Jumper Locations

The following figure shows the jumper locations on the SmartFusion2 Security Evaluation Kit board.

Figure 30 • **SmartFusion2 Security Evaluation Kit Board Jumper Locations**



Notes:

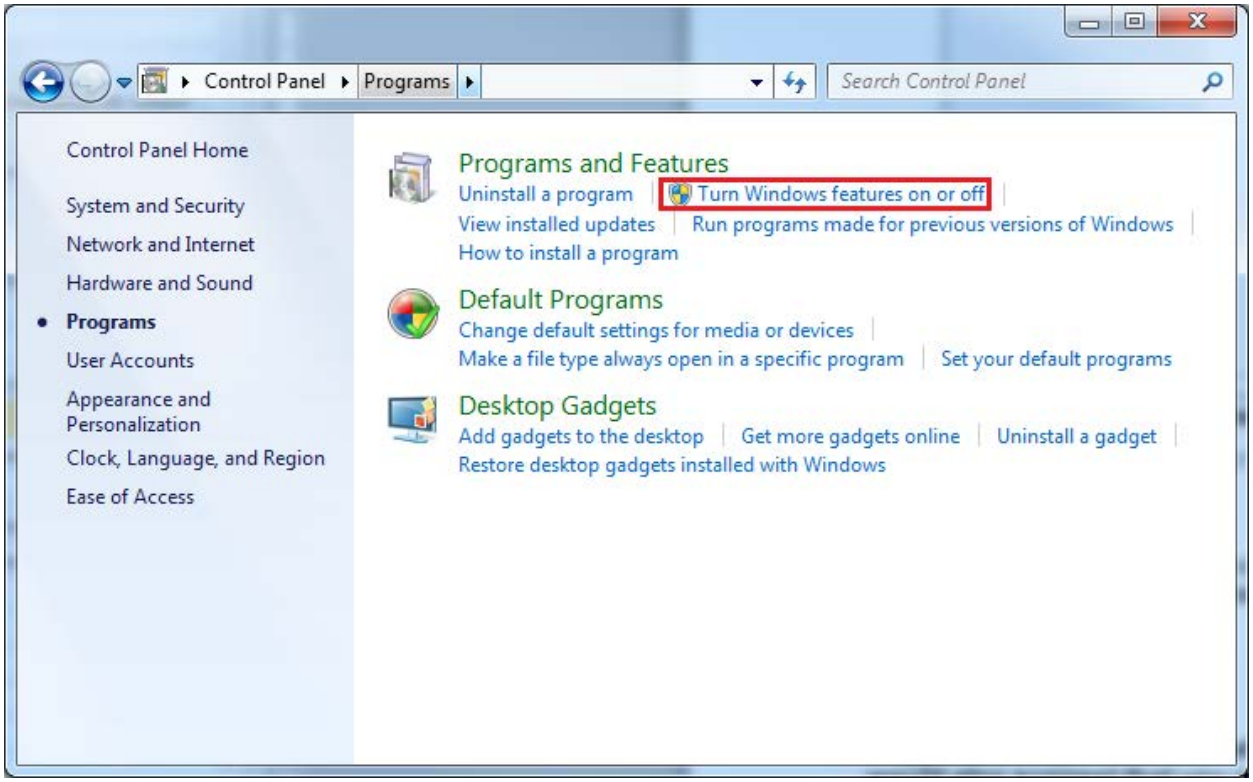
- Jumpers highlighted in red (J22, J23, J24, J3, J8) are set by default.
- The location of the jumpers in Figure 30, page 24 are searchable.

6 Appendix 4: Enable TFTP Client

The following steps describe how to enable TFTP client:

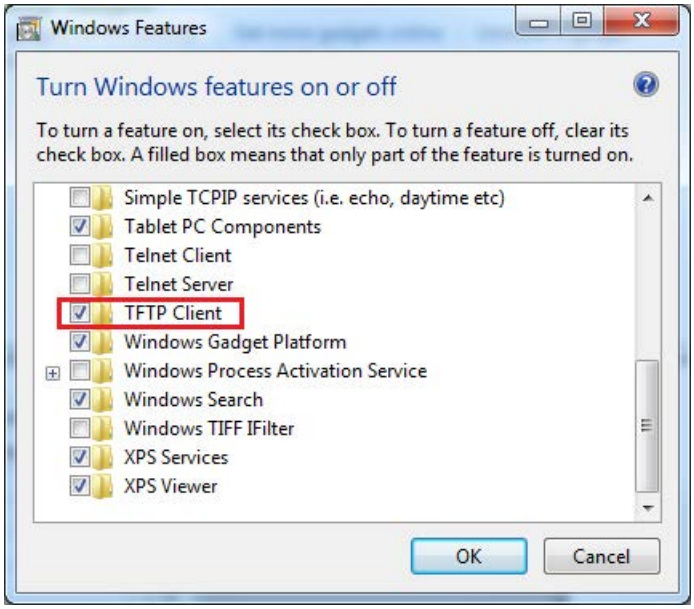
1. Navigate to **Control Panel** > **Programs**. Click **Turn Windows Features On or Off** as shown in the following figure.

Figure 31 • **Control Panel - Programs and Features**



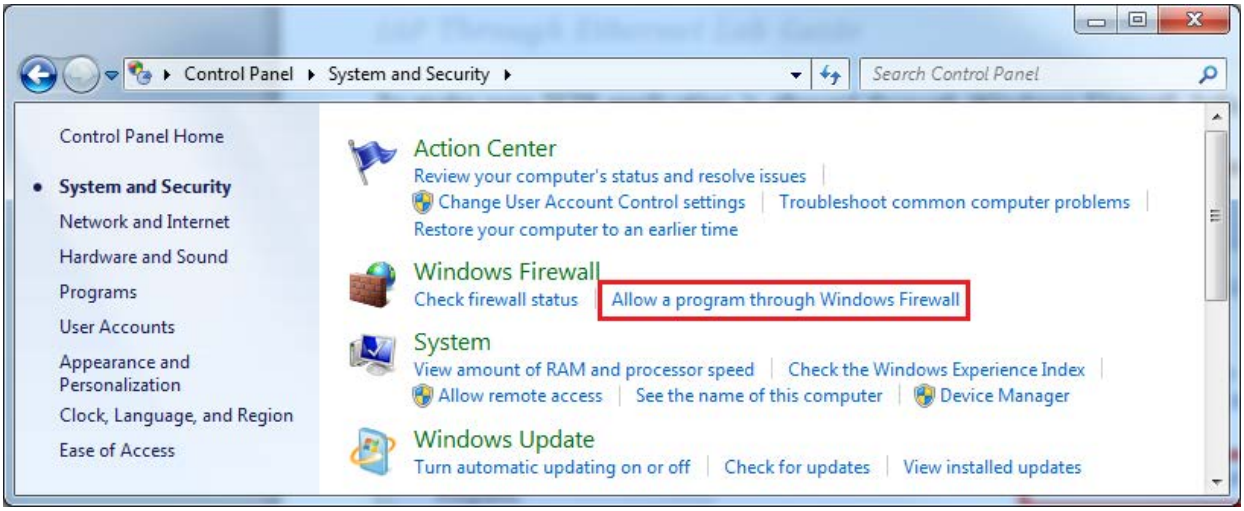
2. Select the **TFTP Client** check box from Windows Features as shown in the following figure.

Figure 32 • **Selecting TFTP Client from Windows Features**



3. Browse through **Control Panel** > **System and Security**, click **Allow a program through Windows Firewall**.

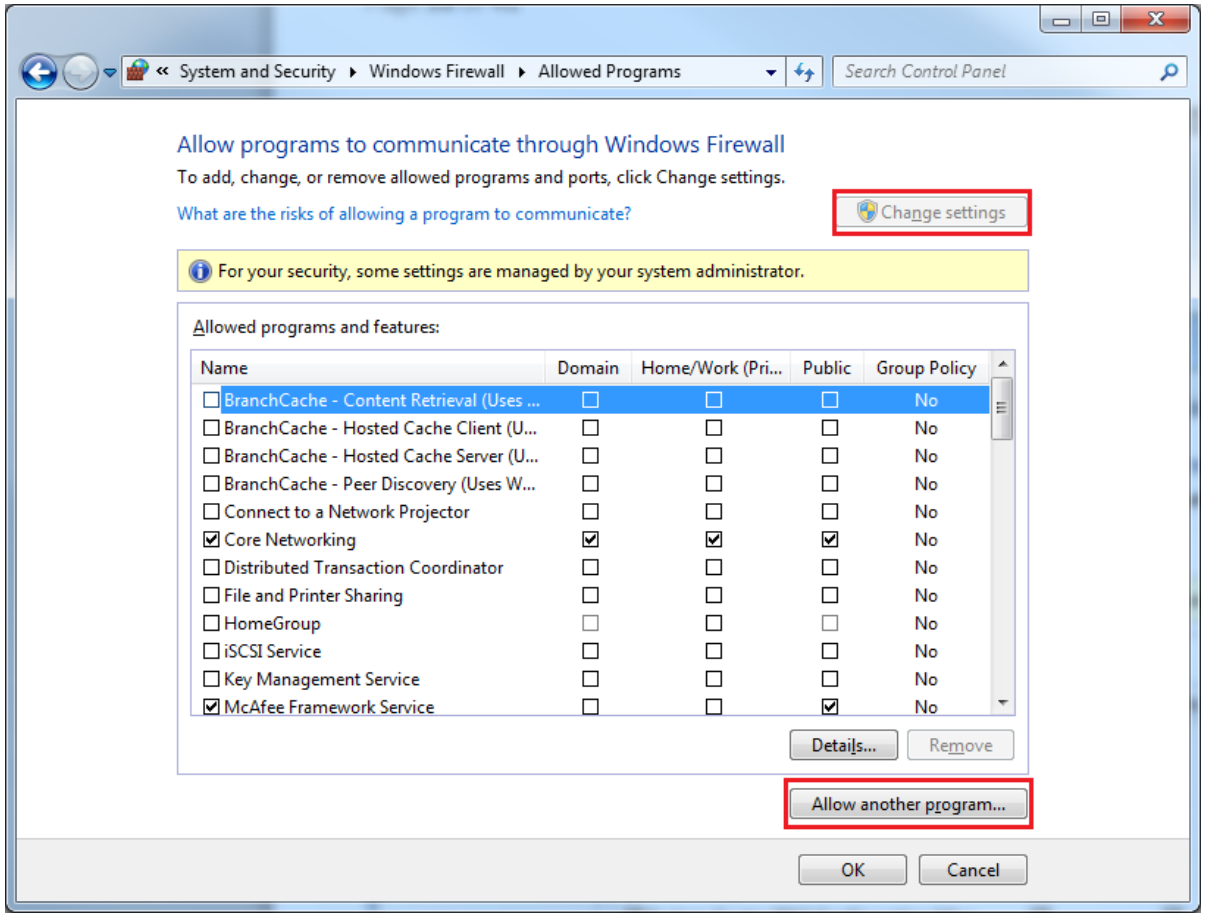
Figure 33 • **System and Security Window**



Note: If the System and Security option is not available, then enter the firewall in the search window to perform step 3.

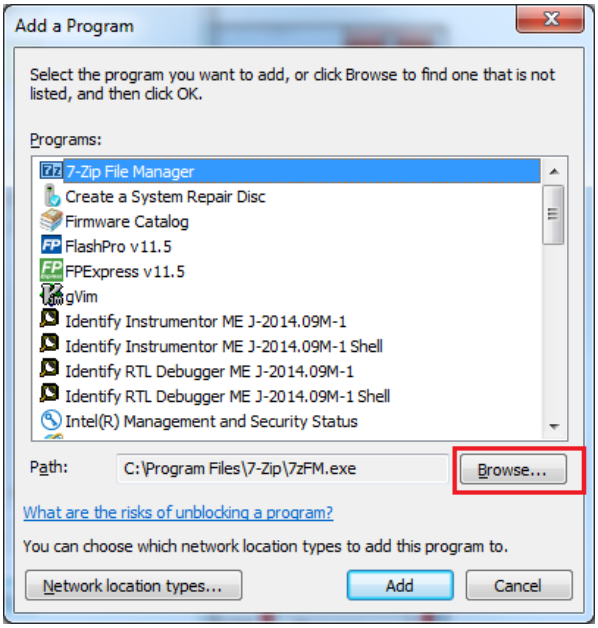
4. Click **Change settings** and choose **Allow another program…**

Figure 34 • **Allowed Programs Window**



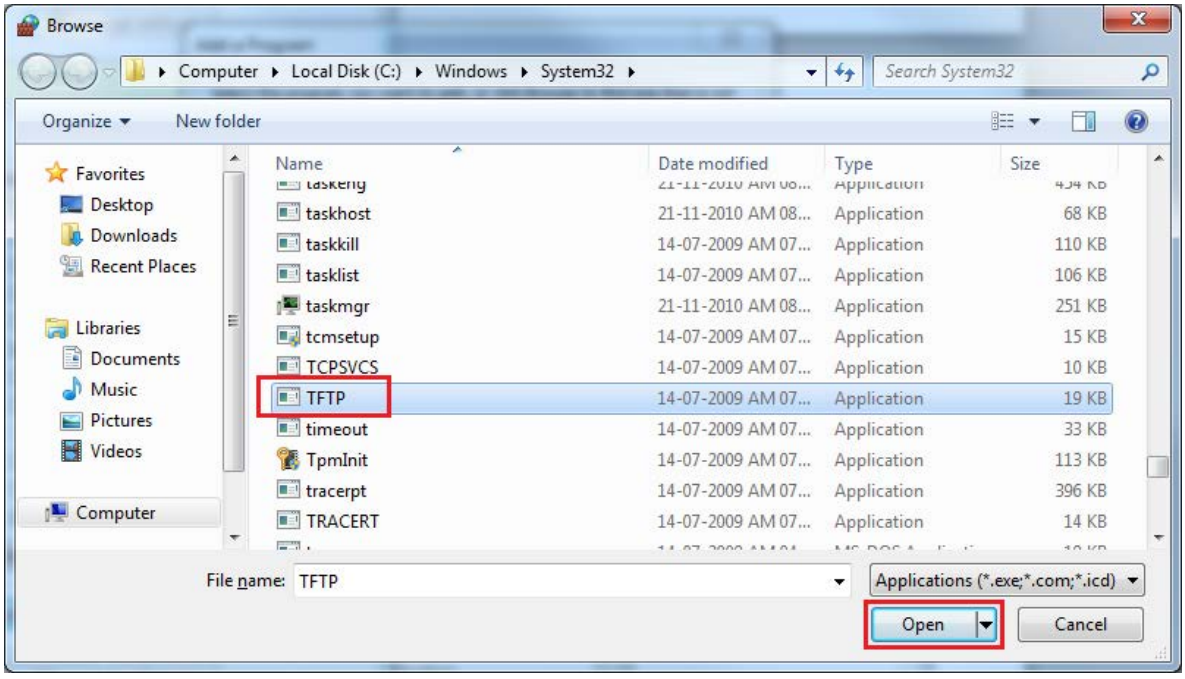
5. The **Add a Program** window is displayed and click **Browse…**

Figure 35 • **Add a Program Window**



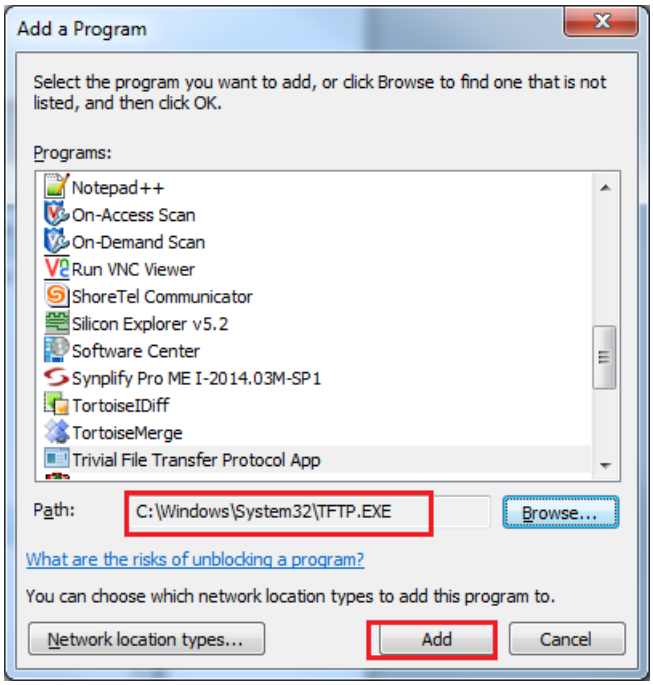
6. Browse through `C:\ -> Windows->System32` and choose **TFTP.exe** and click **Open**.

Figure 36 • **Selecting the TFTP Executable File**



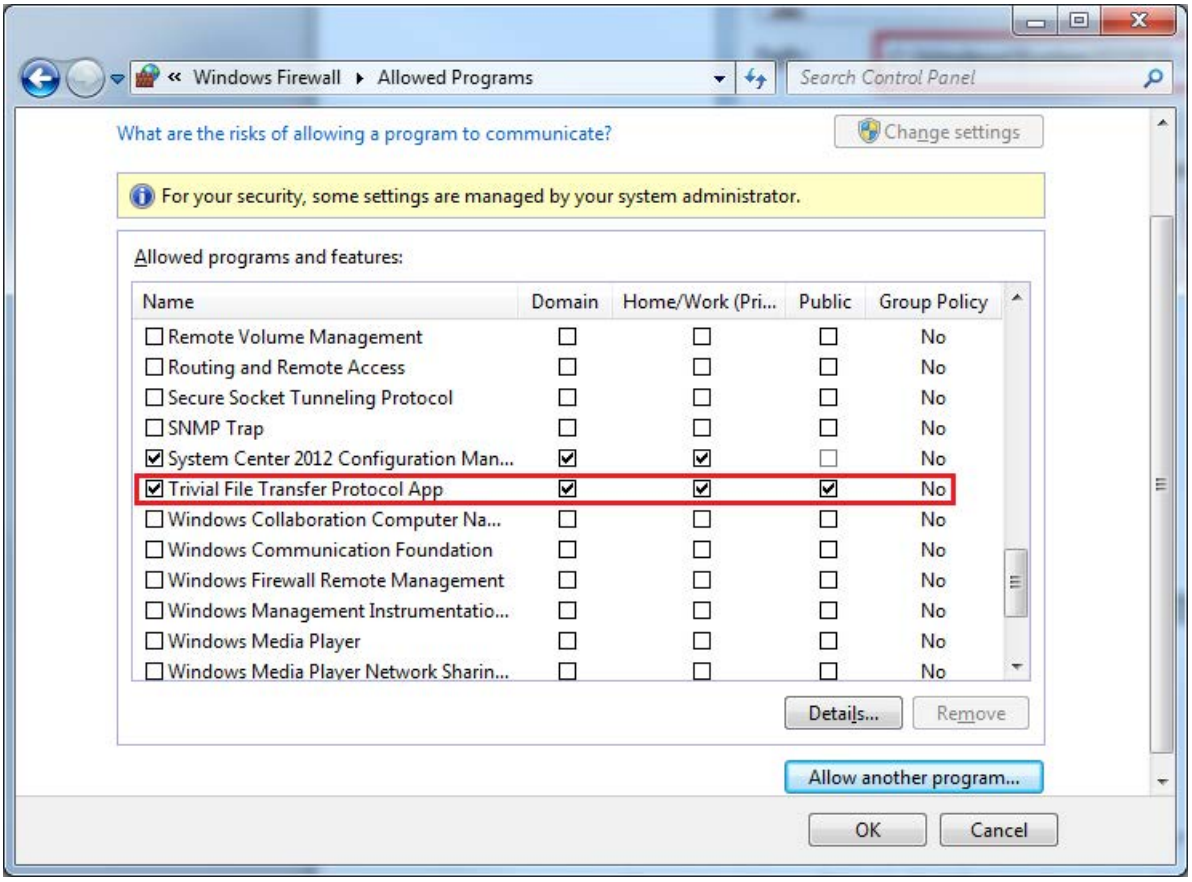
7. Ensure that the TFTP.EXE path (C:\Windows\System32\TFTP.EXE) is selected correctly and click **Add.**

Figure 37 • **TFTP.EXE Path in Add a Program Window**



8. Ensure that the **Trivial File Transfer protocol App** is added and also select all the check boxes (Domain, Home/Work, Public) as shown in the following figure.

Figure 38 • **Selecting Trivial File Transfer Protocol App in Allowed Programs Window**



9. Click **OK**.

7 Appendix 5: Running the Design in Static IP Mode

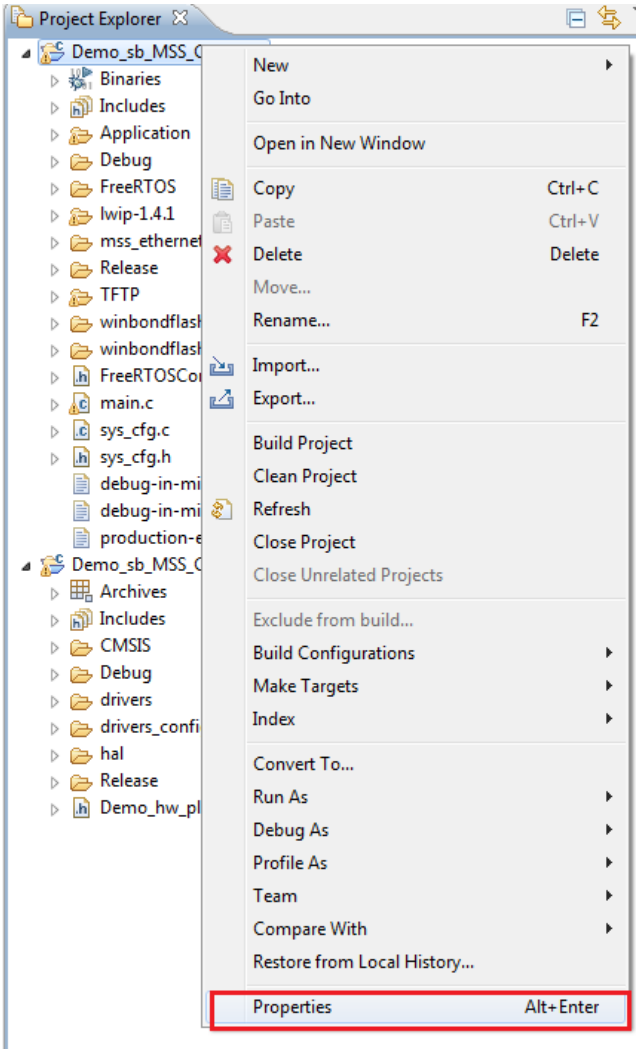
A static IP address will never change until it is explicitly changed and it is a permanent address assigned to a device to access the Internet. A device using a static IP address must be reconfigured each time it switches the networks. A dynamic IP address is a temporary address that is assigned each time a computer or device accesses the Internet. Dynamic IP address requires a DHCP-capable router.

Note: In this demo, the design files are provided with the dynamic IP address settings.

The following steps describe how to run the design in Static IP mode:

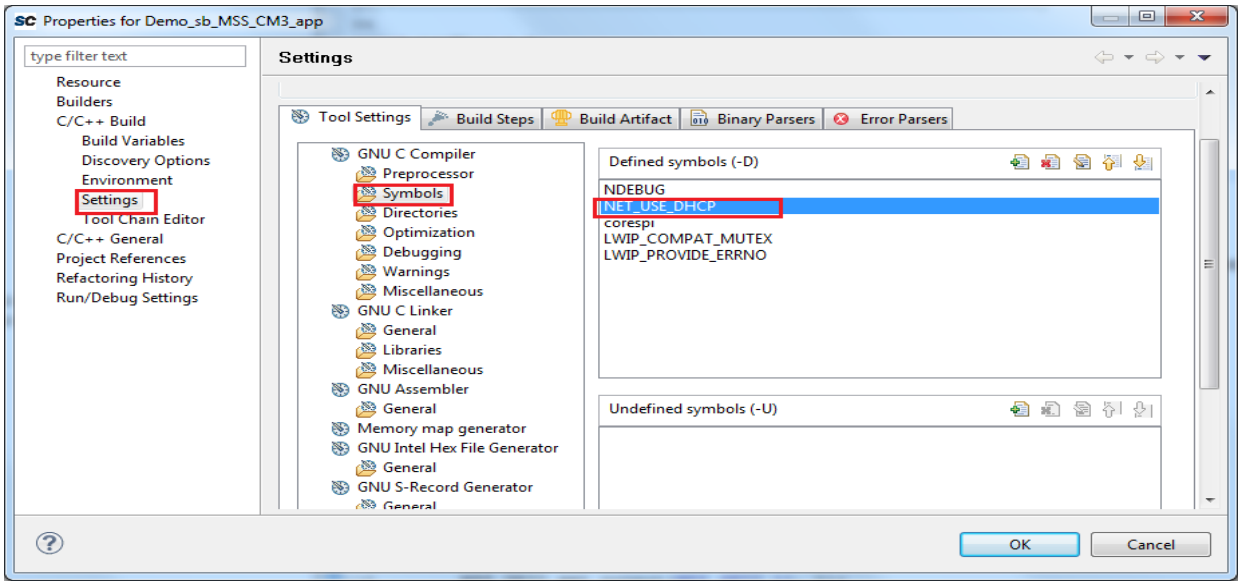
1. Click **Start > Programs > Microsemi SoftConsole v(x.x) > Microsemi SoftConsole v(x.x)** to open SoftConsole IDE.
2. Browse to the project Location *<downloadfolder>\m2s_dg0636_df/Libero_Project/Softconsole*
3. To run the design in Static IP mode, right-click the Demo_TFTP project and select **Properties** as shown in the following figure.

Figure 39 • **Project Explorer Window SoftConsole Project**



4. Remove the symbol **NET_USE_DHCP** in **Tool Settings** of the Properties for Demo_TFTP window as shown in the following figure.

Figure 40 • **Properties for Demo_TFTP**

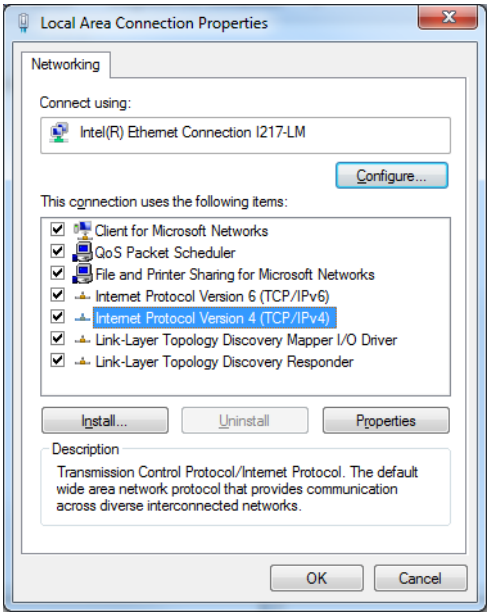


5. Rebuild the SoftConsole Project. Load the design in to the eNVM.

Note: Programming file with static IP settings is available in the following path. *<Downloadfolder>m2s_dg0636_df\Programmingfile\StaticIP*.

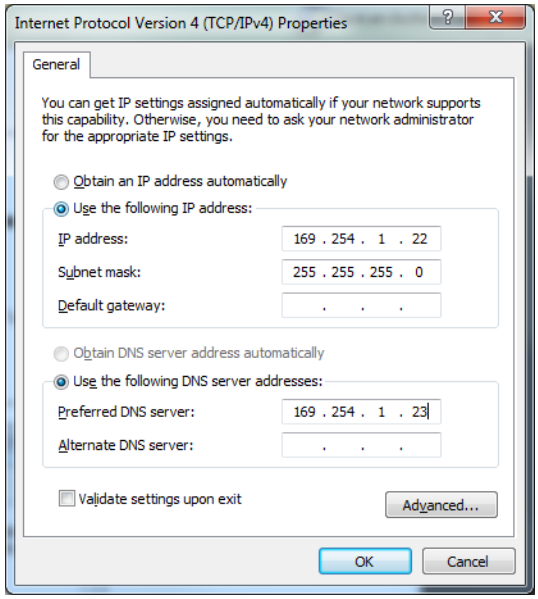
6. Navigate to Control Panel and enter **Network and Sharing Center** in search window.
7. In **Network and Sharing Center** window, select **Change Adapter Settings**.
8. Right-click on **Local Area Connection** and select **Properties**.
9. If the device is connected in Static IP mode, the board static IP address is 169.254.1.23, then change the host TCP/IP settings to reflect the IP address. The following figure shows the Host PC TCP/IP settings.

Figure 41 • **Local Area Connection Properties Window**



10. Update the static IP settings as shown in the following figure. Click **OK**.

Figure 42 • **Internet Protocol Version 4 (TCP/IPv4) Properties**



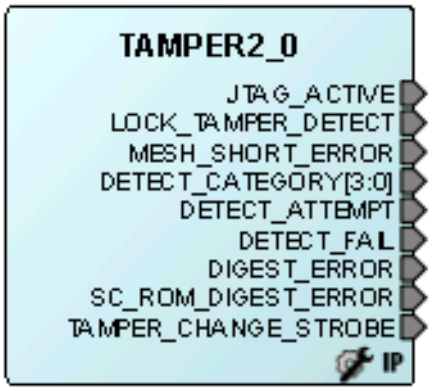
11. Run the demo with Static IP address 169.254.1.23 as described in the Running the Demo section.

8 Appendix 6: Implementing Workaround to Reset the Device after Programming Recovery

The following changes are required in the Libero design.

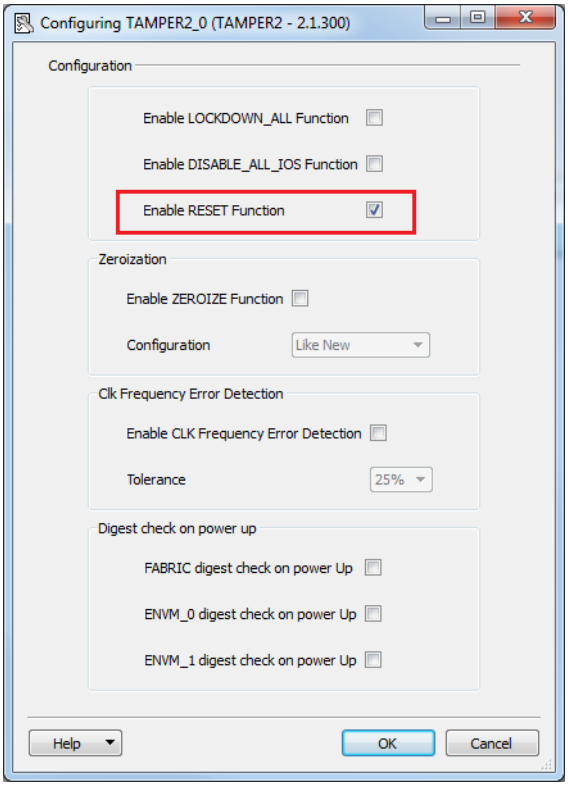
1. Select **File** > **New** > **SmartDesign**.
2. Enter the name as Program_Recovery_WA in **Create New SmartDesign** window.
   - Browse to the Libero catalog to open **Tamper Macro**. The Tamper Macro resets the device when the RESET_N input port is connected to the logic 0.
   - Drag-and-drop the **Tamper Macro** that is available in the Libero catalog to the Program_Recovery_WA SmartDesign canvas as shown in the following figure.

Figure 43 • **Tamper Macro**



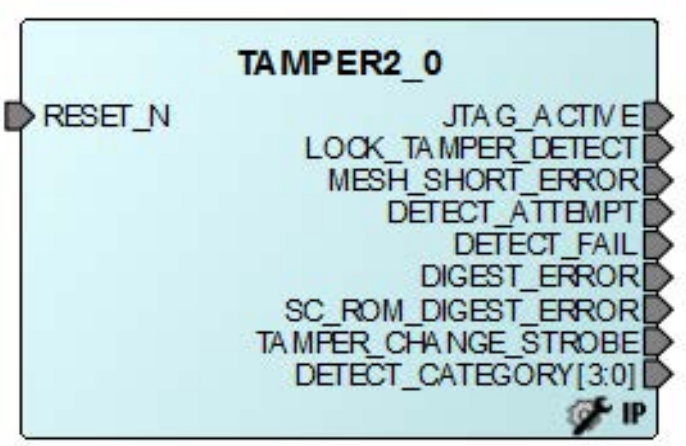
   - Select the **Enable RESET Function** check box in the **Configuring Tamper 2_0** window.
   - Click **OK**. The System Reset option is enabled.

Figure 44 • **Tamper Macro Configuration Window**



The following figure shows the TAMPER2_0 macro after configuration.

Figure 45 • **Tamper Macro**



3. Instantiate the Clock_check HDL Module that is provided in the design files. The HDL module is a 25 bits ring counter and it counts the number of pulses coming into clock input pin and it is enabled by the logic high on the reset pin. The pulse output pin is asserted high only when any of the ring counter bits 10, 11, 12, 13, or 14 is high, and it occurs only at the negative edge of reset. So, this module generates output pulses only for 25 MHz and not for 50 MHz. Follow the steps to add Clock_check HDL module to Libero design.
   - Choose **File** > **Import** > **HDL Source Files**.
   - Browse to the following `Clock_check.v` file location in the design files folder.

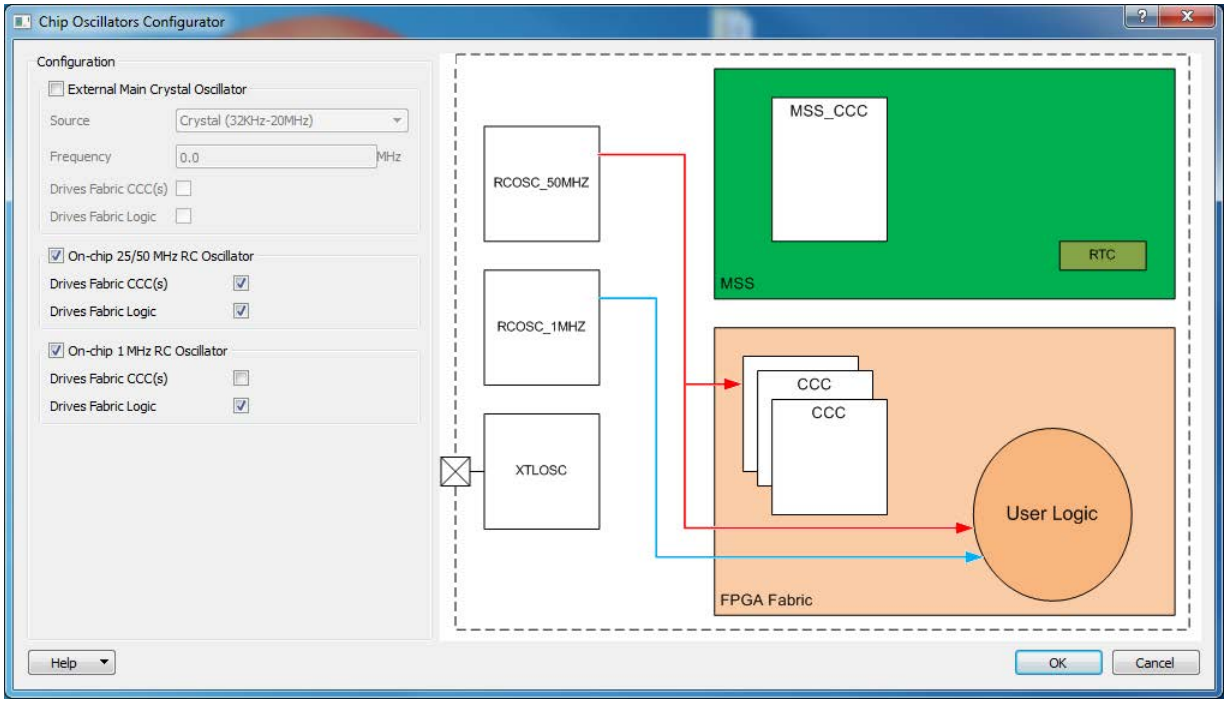
     `<downloadfolder>\m2s_dg0636_df\Sample_files\Recovery_WA\Sourcefiles`

- Click **Program_Recovery_WA** tab and drag-and-drop the `Clock_check.v` component from the from the Design Hierarchy to the Program_Recovery_WA SmartDesign canvas. The following figure shows the Clock_check HDL module.

Figure 46 • **Clock_check HDL Component**

4. Right-click **Demo_sb** under **Demo** in **Design Hierarchy** window and select **Open As SmartDesign**.
5. Select **Demo_sb** tab and double-click **FABOSC_0 (On Chip Oscillator)**.
6. Configure the FABOSC_0 with the following settings as shown in the following figure.
   - On-chip 25/50 MHz RC Oscillator should be enabled to Drive Fabric Logic.

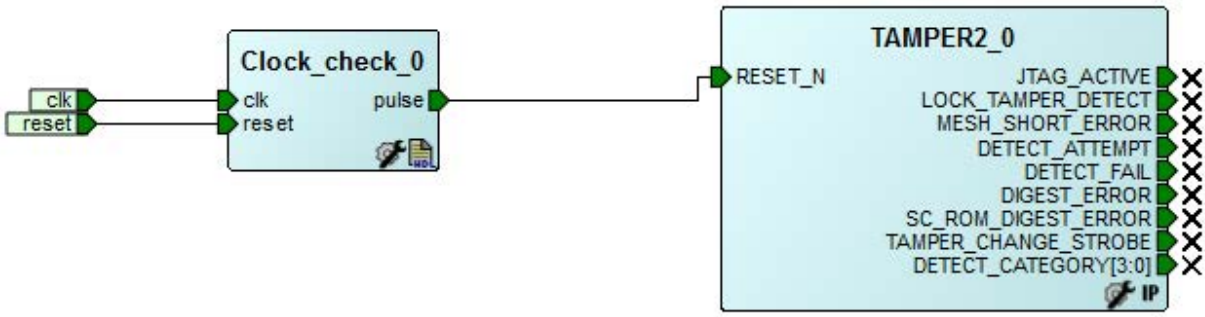
Figure 47 • **Chip Oscillators Configurator**



7. Select **Demo** tab.
8. Right-click **Demo_sb_0** and select **Update Instance** with the latest component.

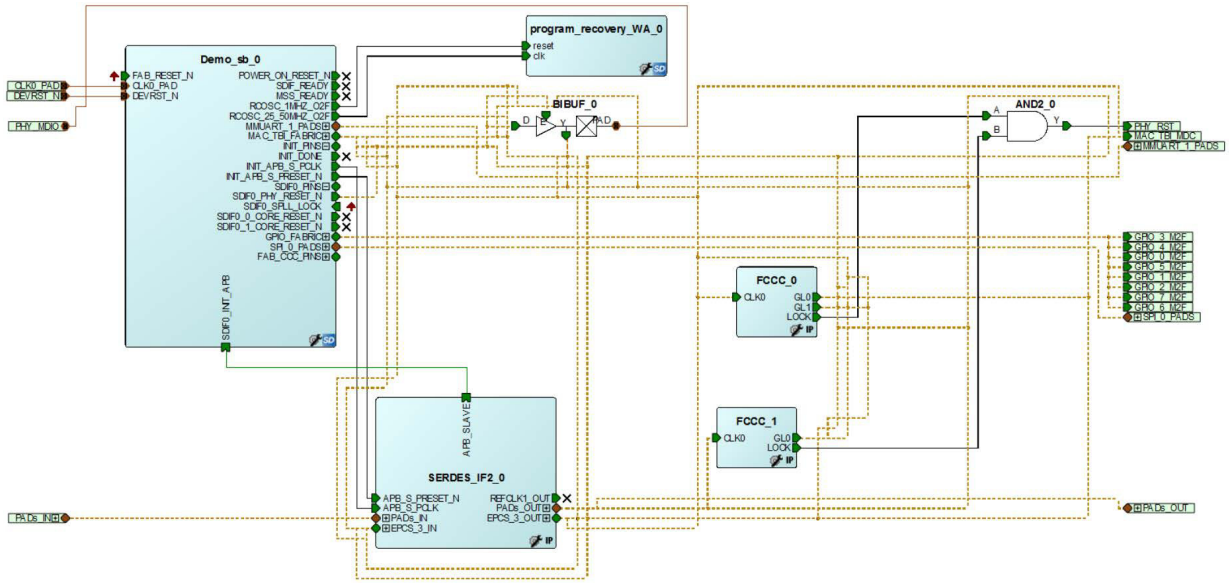
9. Click **Program_Recovery_WA** tab and make the connections as shown in the following figure.

Figure 48 • **Program_Recovery_WA**



10. Click **Demo** tab and drag-and-drop the **Program_Recovery_WA** component from the Design Hierarchy to the Demo SmartDesign canvas.
11. Make the connection as shown in the following figure and generate Demo SmartDesign. This completes the implementation of the workaround.

Figure 49 • **Demo Smart Design**



Note:

1. If the Auto Update feature is enabled and update image is available in the Flash memory, then after recovery, a default reset occurs due to the workaround. As a result, Update Image is programmed, if the Update Image version is greater than the Golden Image.
2. This workaround only works for Mode 1.2 settings in the SPI images.

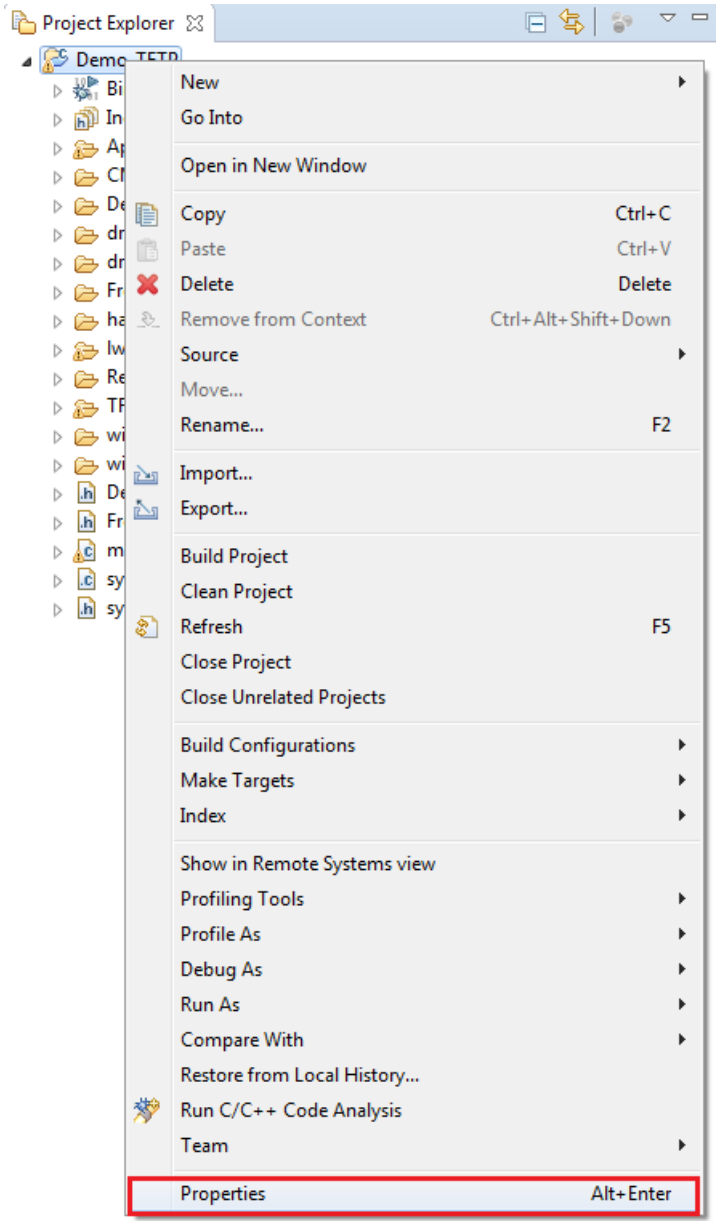
Reason: If the SPI images are set to Mode 1 V settings, then the device may undergo permanent reset. As it continuously holds reset by the workaround since, the oscillator frequency is 25 MHz.

9 Appendix 7: Configuring MSS SPI0 in SoftConsole Project

The following procedure allows you to configure MSS SPI0 in the SoftConsole project.

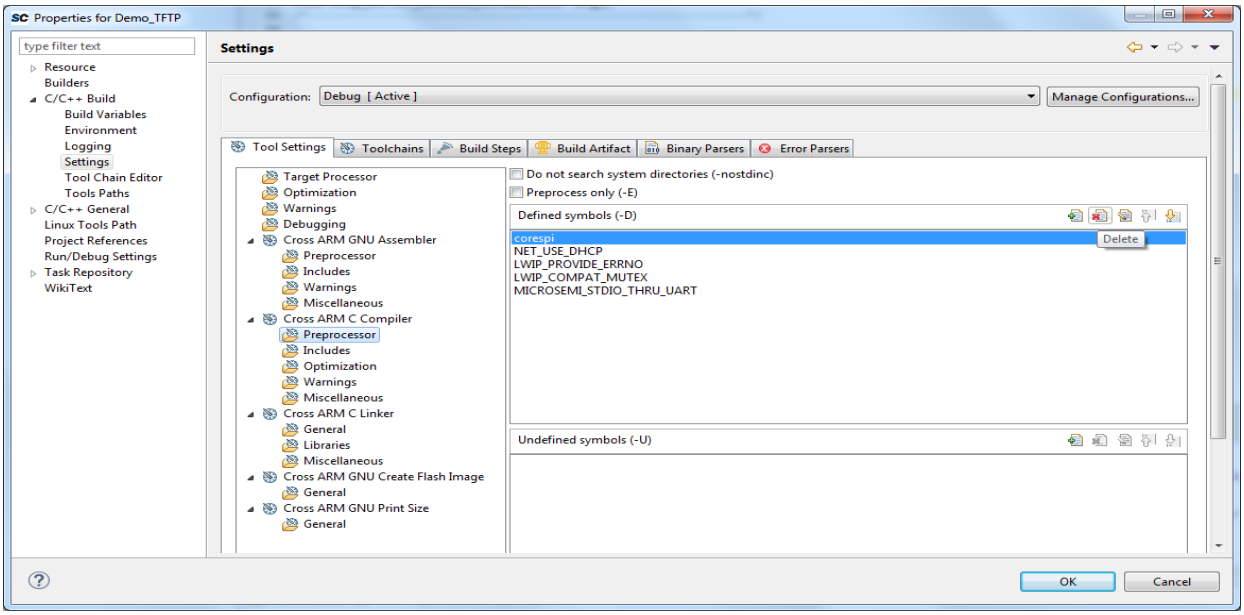
1. Click **Start** > **Programs** > **Microsemi SoftConsole v(x.x)** > **Microsemi SoftConsole v(x.x)** to open SoftConsole IDE.
2. Browse to the project location: *<downloadfolder>\m2s_dg0636_df/Libero_Project/SoftConsole*
3. To configure MSS SPI0, right-click the Demo_TFTP project and select **Properties** as shown in the following figure.

Figure 50 • **Project Explorer - Properties**



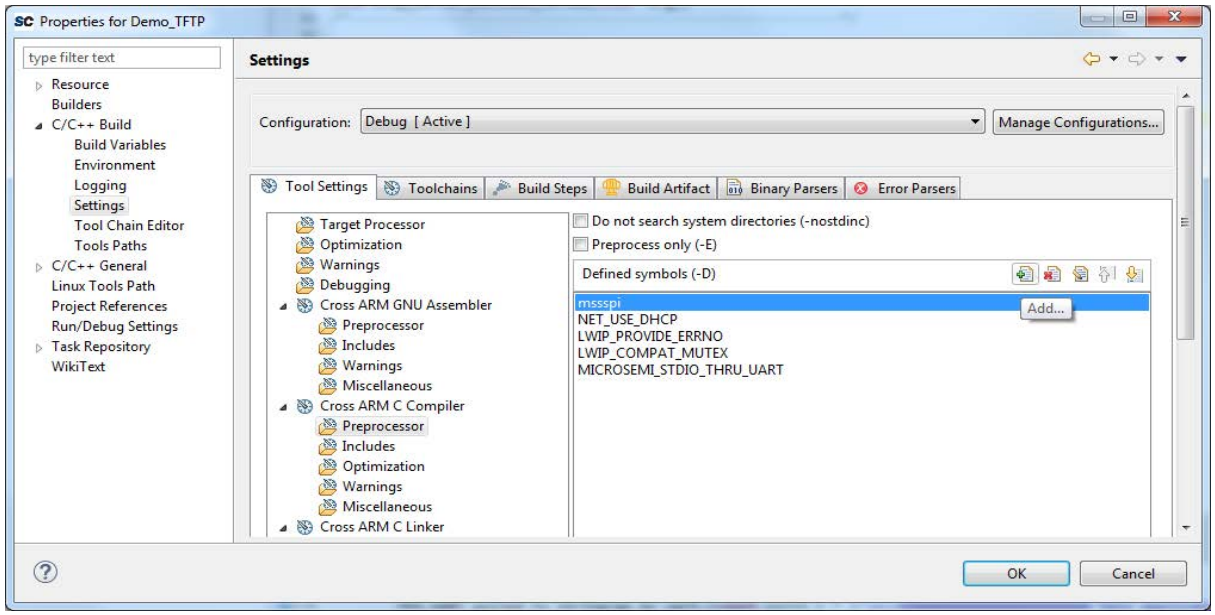
4. Remove the symbol **corespi** in Tool Settings of the Properties for Demo_TFTP window as shown in the following figure.

Figure 51 • **Properties for Demo_TFTP**



5. Add symbol **mssspi** in the properties for Demo_TFTP window as shown in the following figure.

Figure 52 • **Symbols - Properties for Demo_TFTP**



6. Rebuild the SoftConsole Project. Load the design in to the eNVM.
7. Programming file with MSSSPI0 settings is available in the following path:
   - *<Downloadfolder>m2s_dg0636_df\Programmingfile\StaticIp\mssspi\Demo_main.job*
   - *<Downloadfolder>m2s_dg0636_df\Programmingfile\DynamicIp\mssspi\Demo_main.job*