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Interfacing Blackfin® Processors to Winbond W25X16 SPI Flash Devices

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Introduction

This EE-Note describes how to interface to, program, and boot from a Winbond W25X16 SPI flash memory device using the Blackfin® processor SPI peripheral.

The code referenced throughout this EE-Note was developed using the VisualDSP++® 4.5 (June 2007 Update) development tools and revision 2.2 of the ADSP-BF537 EZ-KIT Lite® evaluation platform.

While the discussion throughout this document focuses on the ADSP-BF537 processor, the concepts can be applied to all Blackfin processors, so long as proper care is given to the pins used in the SPI interface to the Winbond flash device and the port multiplexing is properly initialized, where applicable.

Connecting the SPI Device

For the interface between the Blackfin processor SPI port and the Winbond flash device, refer to Table 1.

The chip-select (/CS) must be connected to SPI_SSEL1 (PF10) on the ADSP-BF537 processor in order to utilize the master SPI boot mode. This pin should have an external pull-up resistor to ensure that the chip-select is disabled during power-up. Refer to the “System Reset and Booting” chapter of the *ADSP-BF537 Blackfin Processor Hardware Reference*^[1] for details of the boot process.

The write-protect (/WP) and hold-off (/HOLD) features are not used by this driver, so they must be pulled high to ensure that the feature is not enabled during operation.

Winbond W25X16 Pin #. Name	ADSP-BF537 Pin Name
1. /CS	SPI_SSEL1 (PF10)
2. MISO	MISO (PF12)
3. /WP	NC - Pull-Up to V _{DDEXT}
4. GND	GND
5. MOSI	MOSI (PF11)
6. SCK	SCK (PF13)
7. /HOLD	NC - Pull-Up to V _{DDEXT}
8. VCC	V _{DDEXT}

Table 1. W25X16 to BF534/6/7 interface

Implementing the W25X16 Driver

The associated file includes a VisualDSP++ project, BF534_6_7_SPI_Programmer_Driver_W25X16, which was developed for use by the VisualDSP++ flash programmer plug-in.

Setting Up the Flash Programmer

The following instructions describe how to use the VisualDSP++ flash programmer plug-in utility to program the device.

1. Open the project file (.dpj):
File -> Open -> Project
2. Build the project to produce the executable file (.dxe):
Project -> Build Project
3. Open the Flash Programmer Plug-In:
Tools -> Flash Programmer...
4. Load the executable into the Flash Programmer
Driver Tab -> Browse

Navigate to:
BF534_6_7_SPI_Programmer_Driver_W25X16\Debug

Select and open:
BF534_6_7_SPI_Programmer_Driver_W25X16.dxe

Click Load Driver.
5. Verify that the driver loaded successfully. The Message Center should display “Success: Driver Loaded”, as shown in Figure 1.

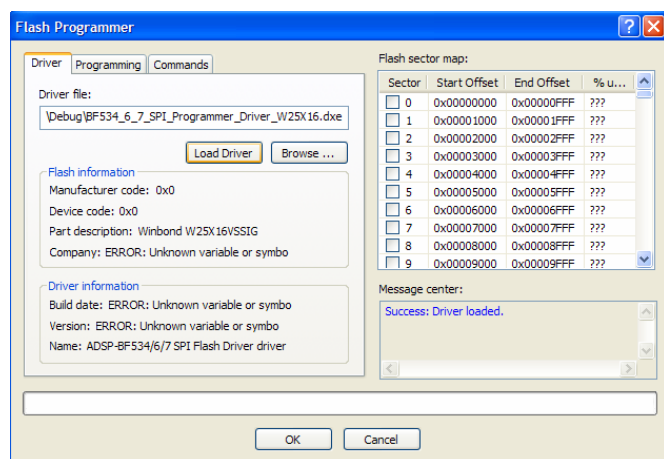


Figure 1. Loading the driver into the flash programmer plug-in

Using the Flash Programmer

There are two ways to use the flash programmer utility to program a Winbond W25X16 flash device.

Individual Commands

The first method is to manually program sectors by sending individual commands through the Commands tab (Figure 1).

For information on using functions from the Commands tab, refer to *VisualDSP++ Flash Programmer API for Blackfin Processors (EE-311)*^[2] and the following topic in VisualDSP++ online Help:

1. From the menu bar in VisualDSP++, choose Help -> Contents.
2. Expand Graphical Environment.
3. Expand Emulation Tools.
4. Expand Flash Programmer.
5. Select About the Flash Programmer.

A screen capture from the VisualDSP++ development tools is shown in Figure 2.

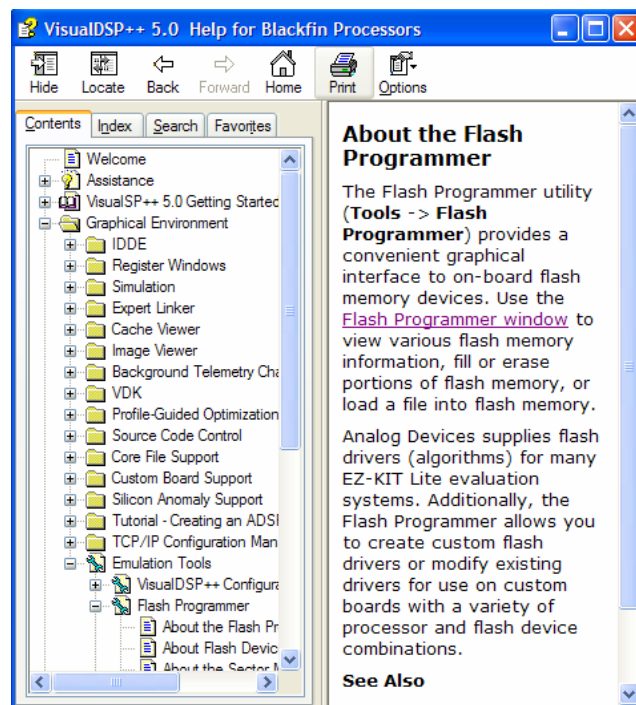


Figure 2. Flash Programmer Help topic

Loader File

The second method of using the flash programmer utility is to program a loader file (.ldr) directly into the Winbond flash device (through the Programming tab as shown in Figure 1).

Creating an SPI-Compatible Loader File

Perform the following procedure to create the loader image that will be used to program the Winbond flash memory device:

1. Open a VisualDSP++ project:
File -> Open -> Project
2. Open the Project Options dialog box:
Project -> Project Options...
3. Under the Type pull-down menu, select Loader file (as shown in the top portion of Figure 3).

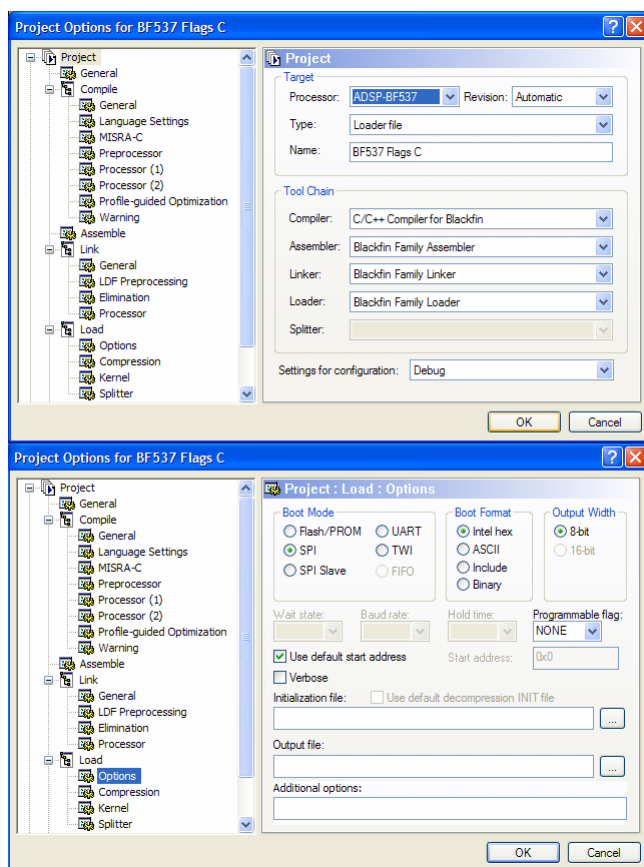


Figure 3. Specifying project and load options

4. In the project tree under the Load control (lower portion of Figure 3), click Options.
5. Under Boot Mode, click SPI
6. Under Boot Format, click Intel Hex
7. Verify that:
 - ❑ 8-Bit is selected under Output width
 - ❑ NONE is selected under the Programmable Flag pull-down menu.
 - ❑ Use default start address is selected
 - ❑ Verbose is not selected
 - ❑ None of the three edit fields (Initialization file, Output file, or Additional options) are populated.
8. Click OK.
9. Rebuild the project:
Project -> Rebuild Project

When the build completes, a loader file (.ldr) will be generated in the project's output directory.

Programming the Loader File into the Device

Once the loader file has been properly generated, can be programmed into the Winbond W25X16 flash device, as follows:

1. Load the driver's executable into the plug-in by following Steps 4 and 5 of

Setting Up the Flash Programmer on page 2.

2. Click the Programming tab.
3. Under Pre-program erase options, select Erase affected.
4. Under File format, select Intel Hex.
5. Select Verify while programming.
6. Click Browse.
7. Navigate to the output directory of the project used in the previous section and select the loader file (.ldr).
8. Click Program and observe the status bar updating.
9. Verify that the device was programmed successfully. The Message Center should display:
 Success: Erased sector(s).
 Success: Program complete

If successful, the Winbond memory device now contains the appropriate loader image for the processor to boot from by way of the master SPI boot mode available on the ADSP-BF537 Blackfin processor.

Booting from the W25X16

If the Winbond memory device is properly connected to the Blackfin processor SPI peripheral, as described in Table 1, booting from the memory device is possible. Simply set the boot mode of the ADSP-BF537 Blackfin processor to b#11 (boot from SPI) and reset the processor. Refer to *ADSP-BF533 Blackfin Booting Process (EE-240)*^[3] for more booting information.

References

- [1] *ADSP-BF537 Blackfin Processor Hardware Reference*. Rev 2.0, May 2005. Analog Devices, Inc.
- [2] *VisualDSP++® Flash Programmer API for Blackfin® Processors (EE-311)*. Rev 1, December 2006. Analog Devices, Inc.
- [3] *ADSP-BF533 Blackfin® Booting Process (EE-240)*. Rev 3, January 2005. Analog Devices, Inc.
- [4] *W25X16/32/64 SPI Flash Datasheet*. Rev F, March 2007. Winbond Electronics Corporation.

Document History

Revision	Description
<i>Rev 1 – January 2, 2008 by Sunish Oturkar and Joe B.</i>	Initial Release