Programming Avalanche Space Grade Dual QSPI P-SRAM Memory ASxxxx208 Using Corelis BusPro-S Programmer

AN000021 provides a simple and easy method to program the Avalanche Dual QSPI P-SRAM using the Corelis BusPro-S SPI programmer

1. Introduction

Avalanche's MRAM memory solution offers significant benefits over existing memory solutions in the traditional SRAM based FPGA. These key attributes, including infinite endurance, low latency, low power, high reliability, make MRAM product an ideal memory solution for FPGA configuration bitstream storage and boot code storage for microcontrollers and microprocessors.

For the purpose of this application note, an Avalanche Dual QSPI P-SRAM Kit for Xilinx Versal VCK190 is used to house the Dual QSPI P-SRAM device and to connect the device to the BusPro-S SPI programmer. The BusPro-S SPI programmer can be connected to any development test board that has an Avalanche Dual QSPI P-SRAM device with SPI signal pins as indicated in Section 3 – SPI Signal Pin Connection below.

2. Prerequisites

Ensure the following before proceeding

- Familiarity with the Xilinx Vivado Design Suite & the Vitis software development platform
- Fully configured Xilinx Vivado tools working environment
- Installed PetaLinux software tool
- A generated bitfile image from Vivado (e.g. QSPI_MRAM.bit)

Splitting the Vivado Bitfile Image into Primary and Secondary BIN files

The Avalanche Dual QSPI P-SRAM utilizes two Quad SPI devices, each controlled by separate Chip Select signal (CS1# and CS2#). Each device operates independently with its own memory space and register sets. Each Quad SPI device has to be programmed separately with corresponding BIN files.

From the Vivado prompt, use the command syntax below to split the bitfile image file .bit into a primary and secondary files, each loaded at address 0x00:

Write_cfgmen format bin -size 32 -interface SPIx8 -loadbit {up 0x000000 "<path>/*QSPI_MRAM.bit*"} -file"<path>/*QSPI_MRAM_Boot.bin*"

Where: *QSPI_MRAM.bit* is an input file generated by Vivado and *QSPI_MRAM_Boot.bin* is an output file name.

After the Write_cfgmen command is executed, two output files will be generated:

- *QSPI_MRAM_Boot_Primary.bin for programming Quad SPI Device 1*
- *QSPI_MRAM_Boot_Secondary.bin for programming Quad SPI Device 2*

(Refer to *Figure 1 for SPI signal pin connections).*

3. Hardwar and Software Requirements

Hardware

- Corelis BusPro-S SPI programmer
- Avalanche Gen3 Space Grade Dual QSPI P-SRAM Kit for Xilinx
- Avalanche Gen3 Space Grade Dual QSPI P-SRAM Memory Device
- 3.3V 1.8A AC/DC power adapter
- Female-to-Female jumper wires (included with the BusPro-S)
- USB 2.0 cable (included)
- Windows 11 PC with one available USB port

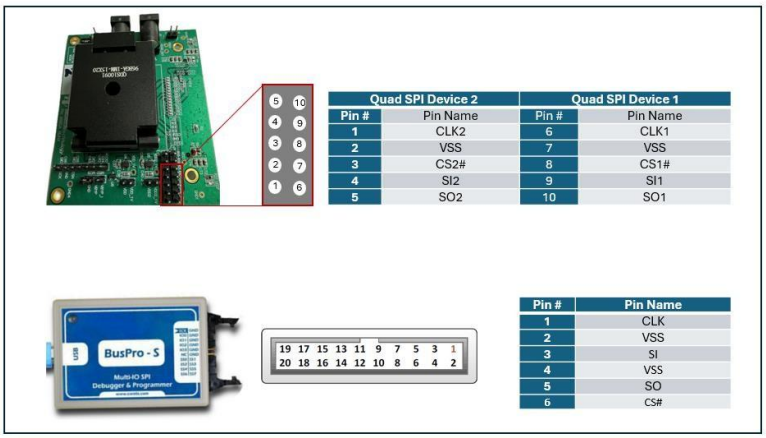
Application Software

- Corelis BusPro-S SPI programmer

4. SPI Signal Pin Connection

Connect the SPI signal pins from the BusPro-S to either Quad SPI Device 1 or 2 as illustrated in Figure 1 below.

The Avalanche Dual QSPI P-SRAM board has a dual-row header and each row contains SPI signals for each Quad SPI device as indicated in the Figure 1 below.



Quad SPI Device 2		Quad SPI Device 1	
Pin #	Pin Name	Pin #	Pin Name
1	CLK2	6	CLK1
2	VSS	7	VSS
3	CS2#	8	CS1#
4	SI2	9	SI1
5	SO2	10	SO1

Pin #	Pin Name
1	CLK
2	VSS
3	SI
4	VSS
5	SO
6	CS#

Figure 1: SPI Signal Connection between BusPro-S and Avalanche Dual QSPI P-SRAM Kit

5. Hardware and Software Configuration Steps

Follow these steps to connect and configure the programmer:

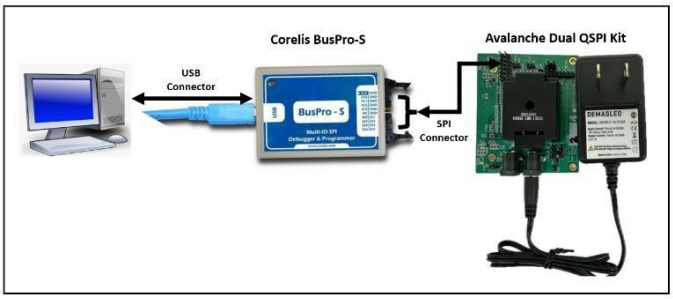


Figure 2: Hardware Connection

1. Install the BusPro-S software on the Windows PC
2. Connect the USB cable from the BusPro-S to the PC
3. Plug the 3.3V 1.8V power adapter to power outlet
4. Follow on-screen instructions to install the required BusPro-S drivers
5. After the BusPro-S application software installation is complete, replace the default *SPI.dev* file:
    - Path: *C:\Program Files (x86)\Corelis\SPI Exerciser*
    - Replace with: *Avalanche-modified SPI.dev* which includes device ID definitions for proper detection within the SPI Exerciser

6. Programming the Avalanche Dual QSPI P-SRAM Device

1. Launch the BusPro SPI programmer test application and click on “Programmer” button.
2. From the pull-down menu, select “Avalanche Technology” as manufacturer
3. Select device capacity: 1Gb/2Gb/4Gb
4. Check both the “Program” box and the “Verify” box
5. Select “Clock Rate” of 30MHz
6. Select “3.3V” voltage
7. Click the “Browse” button
8. Select “All File (*)
9. Select a BIN file to be programmed to Dual QSPI P-SRAM
10. Click “Run” to program and verify
11. Upon completion, the result should indicate “PASS” for both programming and verification

To view programmed data, navigate to the “Read” tab in the main Windows

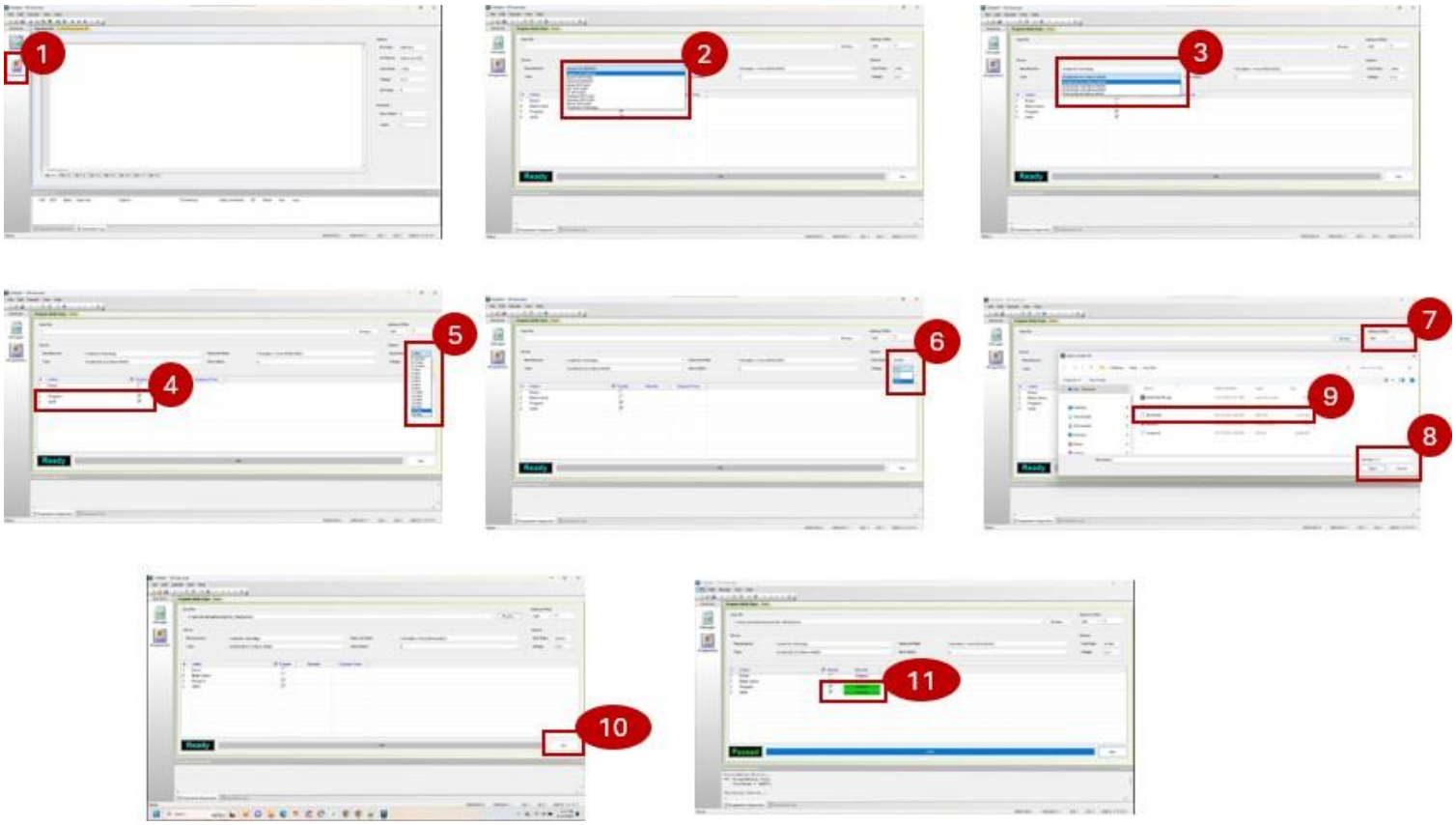


Figure 3: Steps to program the Dual QSPI P-SRAM

Revision History

Revision	Date	Change Summary
REV A	05/12/2025	Initial release
REV B	07/02/2025	Added download link for the updated SPI.dev file