SPI Flash Usage

Access over	Method	Zynq	Zynq MPSoC	FPGA	Notes
JTAG	SDK GUI	YES	YES	NO	
JTAG	program_flash	YES	YES	YES	part of the SDK installation
JTAG	Vivado	YES	YES	YES	
JTAG	Vivado Labtools	YES	YES	YES	
FPGA/SoC	u-boot	YES	YES	YES	
FPGA/SoC	linux	YES	YES	YES	
FPGA/SoC	bare-metal	YES	YES	YES	
JTAG	ISF library	YES	YES	YES	S256 support needs patch for ISF 5.4
JTAG	ToolZ	NO	NO	YES	needs XCS3SPROG bitfile for given FPGA
JTAG	Impact	NO	NO	*	Not recommended since 2013, please use Vivado

program_flash

This is command line tool to program the Flash on Zynq and FPGA devices.

```
Usage:  program_flash  <FLASH OPTIONS>   <CABLE & DEVICE OPTIONS>

[FLASH OPTIONS]:
    -f <image file>       : Image to be written onto the flash memory
    -offset <address>     : Offset within the flash memory at which the image should be written
    -no_erase             : Do not erase the flash memory before programming
    -erase_only           : Only erases the flash as per size of the image file
    -blank_check          : Check if the flash memory is erased
    -verify               : Check if the flash memory is programmed correctly
    -erase_sector <size>  : For flashes whose erase sector is other than 64KB (size in bytes)
    -flash_type <type>    : Supported flash memory types
                             For Zynq Devices
                                    1. qspi_single
                                    2. qspi_dual_parallel
                             For Non-Zynq Devices
                                    Please use the command line option -partlist to list all the flash types
     -partlist <bpi|spi> <micron|spansion> : List all the flash parts for Non-Zynq devices
                                    List all flashes          - program_flash -partlist
                                    List Spansion SPI flashes - program_flash -partlist spi spansion
[CABLE & DEVICE OPTIONS]:
    -cable type xilinx_tcf esn <cable_esn> url <URL of the TCF agent>
    -debugdevice deviceNr <jtag chain no>
EXAMPLE:
 1. Zynq (QSPI Single)
    program_flash -f BOOT.bin -flash_type qspi_single -blank_check -verify
```

Some options are stripped from the above usage, please run zynq_flash with no parameters to get full usage information.

Flash Programming, Zynq

SPI Boot Flash on Zynq is connected to PS only and is not directly accessible from PL or over JTAG. Whenever SPI Flash is programmed on Zynq following actions take place:

1. OCM RAM is re-mapped as single linear memory at high address range, giving 256KByte continuous memory
2. mini-version of u-boot.elf is loaded to this OCM RAM and executed
3. data for programming is copied to Zynq OCM RAM
4. flash tool communicates with u-boot over JTAG using ARM DCC channel

The same process takes place no matter what method is used to flash the SPI on Zynq.

Flash Programming, Zynq UltraScale+

Flash Programming for Zynq UltraScale+ MPSoC need JTAG as devices Boot Mode.

Flash Programming, FPGA

Flash programming over JTAG for Xilinx FPGA devices is done using "SPI indirect" method - FPGA is loaded with JTAG to SPI gateway bit stream, and then JTAG is used to talk to the SPI flash.

Xilinx Vivado Programmer does this transparently it is not visible to the user.

Quad Enable Bit

For SPI Flash use in x4 mode Quad Enable bit must be set in nonvolatile Status Register. The commands for this depend the SPI Flash Vendor and/or Flash type. Vivado Flash Programmer when programming bit file generated with X4 option would set this bit automatically. All Trenz SoM's that need the Quad Enable bit set for proper operation are delivered with this bit set.

Spansion S256

Checking if the Quad Enable bit is set is possible from u-boot

```
> sspi 0 16 35
```

if result is 0002 then the nonvolatile Quad Enable bit is set

It is also possible to write the Quad Enable bit, 2 commands are needed

```
> sspi 0 8 06
```

```
> sspi 0 24 010002
```

The above will set Quad Enable bit in non volatile status register

References

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