SmartDesign MSS

GPIO Configuration

Actel
POWER MATTERS

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1 Configuration Options

The SmartFusion Microcontroller Subsystem (MSS) provides a GPIO hard peripheral (APB_1 sub bus) with 32 configurable GPIOs. The actual behavior of each GPIO (input, output and output enable register controls, interrupt modes, etc.) can be defined at the application level using the SmartFusion MSS GPIO Driver provided by Actel. However, you must define whether a GPIO is directly connected to an external pad (MSS I/O) or to the FPGA fabric. This portion of the device configuration is done using the MSS GPIO configurator and is described in this document.

For more details about the MSS GPIO hard peripheral, please refer to the Actel SmartFusion Microcontroller Subsystem User's Guide.

Connectivity Options

MSS I/O Pad - Select this option to indicate that the selected GPIO will be connected to an external dedicated pad (MSS I/O). You must select the type of I/O buffer - **INBUF**, **OUTBUF**, **TRIBUFF** and **BIBUF** - that will define how the MSS I/O pad is being configured. Note that this option may not be available if the MSS I/O is already used by another peripheral or the fabric (see the MSS I/O Sharing section for more details)

Fabric - Select this option to indicate that the selected GPIO will be connected to the FPGA fabric. You must select whether you want the GPI (**Input**), GPO (**Output**) or both GPI and GPO (**Input/Output**) connection(s) to be brought out to connect to the fabric. Note that the GPIO output enable register cannot be brought out to the fabric when this option is selected. Also, GPI's connected to the fabric can trigger interrupts from user logic if the appropriate interrupt enable bits are set properly by your application (MSS GPIO driver initialization functions).

MSS I/O Sharing

In the SmartFusion architecture MSS I/Os are shared between two MSS peripherals or between a MSS peripheral and the FPGA fabric. MSS GPIOs may not be able to connect to a particular MSS I/O if this I/Os is already connected to a MSS peripheral or to the FPGA fabric. The GPIO configurator provides direct feedback regarding whether a GPIO can be connected to a MSS I/O or not.

GPIO[31:16]

GPIO[31:16] are organized in groups that indicate which MSS peripheral they are sharing MSS I/Os with. If a peripheral is used (enabled on the MSS canvas), then the MSS I/O Pad pull-down menu is grayed-out for the corresponding shared GPIOs and an Info icon is displayed next to the pull-down menu. The Info icon indicates that the MSS I/O option cannot be selected because it is already used by a MSS peripheral or, based on the package selected, not bonded.

Example 1

SPI_0, SPI_1, I2C_0, I2C_1, UART_0 and UART_1 are enabled in the MSS canvas.

- GPIO[31:16] cannot be connected to an MSS I/O. Note the grayed-out menus and the Info icons (Figure 1-1).
- GPIO[31:15] can still be connected to the FPGA fabric. In this example, GPIO[31] is connected to the fabric as an Output and GPIO[30] as an Input.

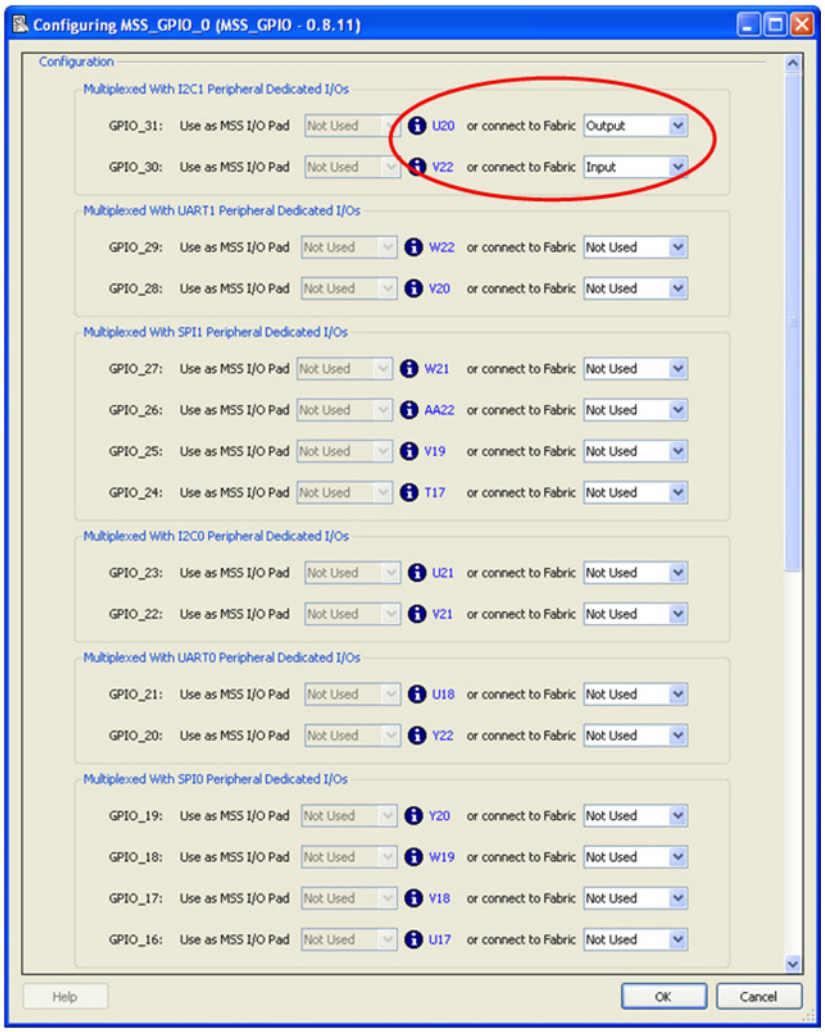

Figure 1-1 · GPIO Configuration Example 1

Example 2

I2C_0 and I2C_1 are disabled in the MSS canvas.

- GPIO[31:30] and GPIO[23:22] can be connected to an MSS I/O (as shown in Figure 1-2).

  In this example, both GPIO[31] and GPIO[30] are connected to a MSS I/O as **Output** ports.

  In this example, GPIO[23] is connected to a MSS I/O as an **Input** port and GPIO[22] is connected to an MSS I/O as a **Bidirectional** port.
- GPIO[29:24,21:16] cannot be connected to an MSS I/O. Note the grayed-out menus and the **Info** icons.

- GPIO[29:24,21:16] can still be connected to the FPGA fabric. In this example, both GPIO[29] and GPIO[28] are connected to the fabric as **Input** ports.

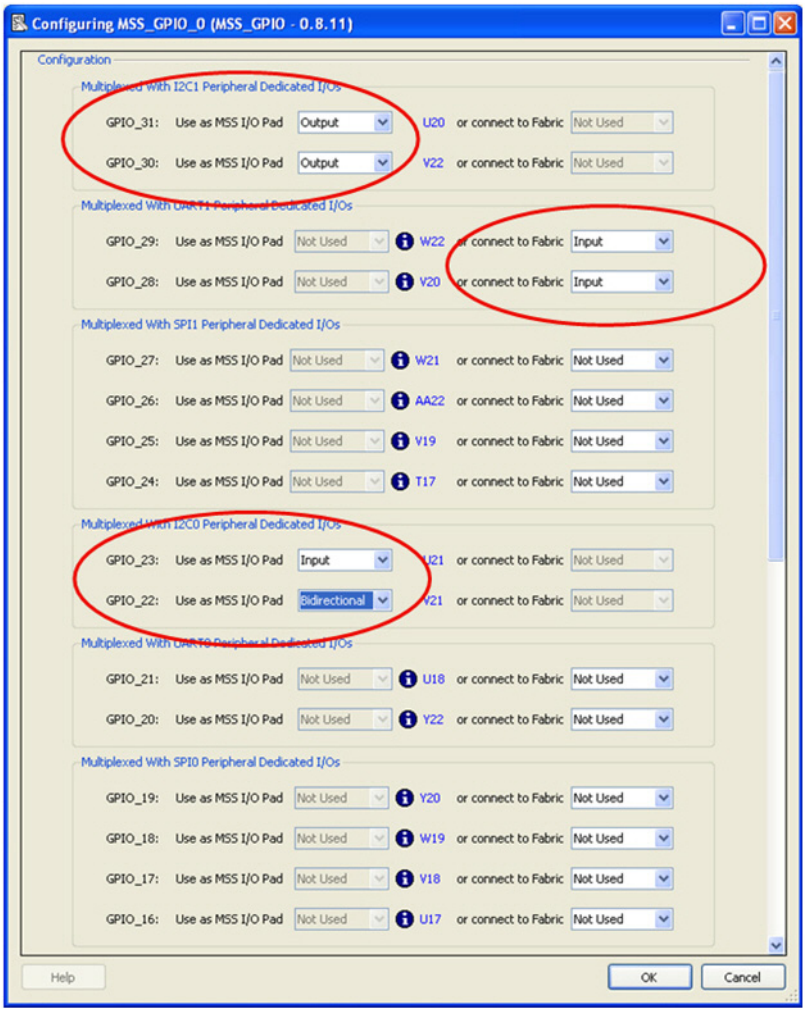

Figure 1-2 · GPIO Configuration Example 2

GPIO[15:0]

GPIO[15:0] share MSS I/Os that can be configured to connect to the FPGA fabric (this later configuration can be done using MSS I/O Configurator). If an MSS I/O is configured to connect to the FPGA fabric, then the MSS I/O Pad pull-down menu is grayed-out for the corresponding shared GPIOs and an Info icon is displayed next to the pull-down menu. The Info icon indicates that the MSS I/O option cannot be selected because it is already used or, based on the package selected, not bonded.

Note that the blue text in the configurator highlights the package pin name for each MSS I/O associated with a GPIO. This information is useful for planning board layout.

Example

To properly demonstrate how the MSS I/O configurations and the GPIO[15:0] configurations are coupled, Figure 1-3 shows both configurators side by side with the following configuration:

- MSS I/O[15] is used as an INBUF port connected to the FPGA fabric. Consequently, GPIO[15] cannot be connected to an MSS I/O.
- GPIO[5] is connected to an MSS I/O as an Input. Consequently MSS I/O[5] cannot be used to connect to the FPGA fabric.
- GPIO[3] is connected to the FPGA fabric as an Output. Consequently MSS I/O[3] cannot be used to connect to the FPGA fabric.

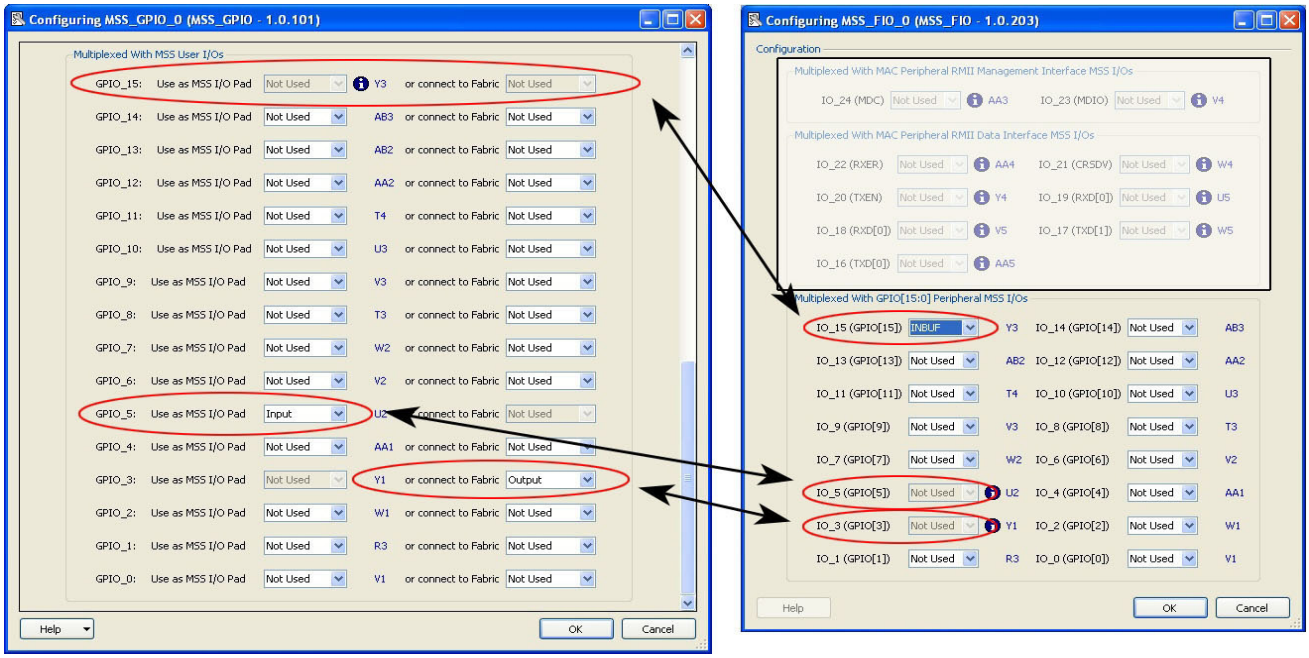

Figure 1-3 · MSSIO and GPIO Configuration Example

2 Port Description

Table 2-1 · GPIO Port Description

Port Name	Direction	PAD?	Description
GPIO_<index>_IN	In	Yes	GPIO port name when GPIO[index] is configured as an MSS I/O **Input** port
GPIO_<index>_OUT	Out	Yes	GPIO port name when GPIO[index] is configured as an MSS I/O **Output** port
GPIO_<index>_TRI	Out	Yes	GPIO port name when GPIO[index] is configured as an MSS I/O **Tristate** port
GPIO_<index>_BI	Inout	Yes	GPIO port name when GPIO[index] is configured as an MSS I/O Bidirectional port
F2M_GPI_<index>	In	No	GPIO port name when GPIO[index] is configured to connect to the FPGA fabric as an **Input** port (F2M indicates that the signal is going from the fabric to the MSS)
M2F_GPO_<index>	In	No	GPIO port name when GPIO[index] is configured to connect to the FPGA fabric as an **Output** port (M2F indicates that the signal is going from the MSS to the fabric)

Note:

- PAD ports are automatically promoted to top throughout the design hierarchy.
- Non-PAD ports must be promoted manually to the top level from the MSS configurator canvas to be available as the next level of hierarchy.

A

Product Support

Actel backs its products with various support services including Customer Service, a Customer Technical Support Center, a web site, an FTP site, electronic mail, and worldwide sales offices. This appendix contains information about contacting Actel and using these support services.

Customer Service

Contact Customer Service for non-technical product support, such as product pricing, product upgrades, update information, order status, and authorization.

From Northeast and North Central U.S.A., call **650.318.4480**
From Southeast and Southwest U.S.A., call **650. 318.4480**
From South Central U.S.A., call **650.318.4434**
From Northwest U.S.A., call **650.318.4434**
From Canada, call **650.318.4480**
From Europe, call **650.318.4252** or **+44 (0) 1276 401 500**
From Japan, call **650.318.4743**
From the rest of the world, call **650.318.4743**
Fax, from anywhere in the world **650.318.8044**

Actel Customer Technical Support Center

Actel staffs its Customer Technical Support Center with highly skilled engineers who can help answer your hardware, software, and design questions. The Customer Technical Support Center spends a great deal of time creating application notes and answers to FAQs. So, before you contact us, please visit our online resources. It is very likely we have already answered your questions.

Actel Technical Support

Visit the Actel Customer Support website (www.actel.com/support/search/default.aspx) for more information and support. Many answers available on the searchable web resource include diagrams, illustrations, and links to other resources on the Actel web site.

Website

You can browse a variety of technical and non-technical information on Actel's home page, at www.actel.com.

Contacting the Customer Technical Support Center

Highly skilled engineers staff the Technical Support Center from 7:00 A.M. to 6:00 P.M., Pacific Time, Monday through Friday. Several ways of contacting the Center follow:

Email

You can communicate your technical questions to our email address and receive answers back by email, fax, or phone. Also, if you have design problems, you can email your design files to receive assistance. We constantly monitor the email account throughout the day. When sending your request to us, please be sure to include your full name, company name, and your contact information for efficient processing of your request.

The technical support email address is tech@actel.com.

Phone

Our Technical Support Center answers all calls. The center retrieves information, such as your name, company name, phone number and your question, and then issues a case number. The Center then forwards the information to a queue where the first available application engineer receives the data and returns your call. The phone hours are from 7:00 A.M. to 6:00 P.M., Pacific Time, Monday through Friday. The Technical Support numbers are:

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Customers needing assistance outside the US time zones can either contact technical support via email (tech@actel.com) or contact a local sales office. Sales office listings can be found at www.actel.com/company/contact/default.aspx.

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