



# SmartDesign MSS

## MSS I/O Configuration

Doc Version 1.0

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## Introduction

The SmartFusion Microcontroller Subsystem (MSS) has two banks of dedicated MSS I/Os. In the SmartFusion architecture MSS I/Os are shared between two MSS peripherals or between a MSS peripheral and the FPGA fabric.

In this document, we describe how to assign and configure MSS I/Os to connect to the FPGA fabric.

## Configuration Options

### Connectivity Options

IO\_<index> (<peripheral>). Select this option to indicate that the selected MSS I/O will be connected to the FPGA fabric. You must select whether you want the MSS I/Os to be configured as an INBUF, OUTBUF, TRIBUFF or BIBUF.

- <index>: indicates which MSS I/O port the parameter relates to.
- <peripheral>: indicates which MSS peripheral this MSS I/O is shared with.

### 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 I/Os that are not used to connect to a MSS peripheral can be connected to the FPGA fabric. The MSS I/O configurator provides direct feedback regarding whether a MSS I/O can be used into the current design.

### GPIO[31:16]

MSS I/Os 0 to 15 (IO\_<0...15> in the configurator) are shared with GPIO 0 to 15. If GPIO[index] is configured to be used in the GPIO configurator, 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. 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 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.

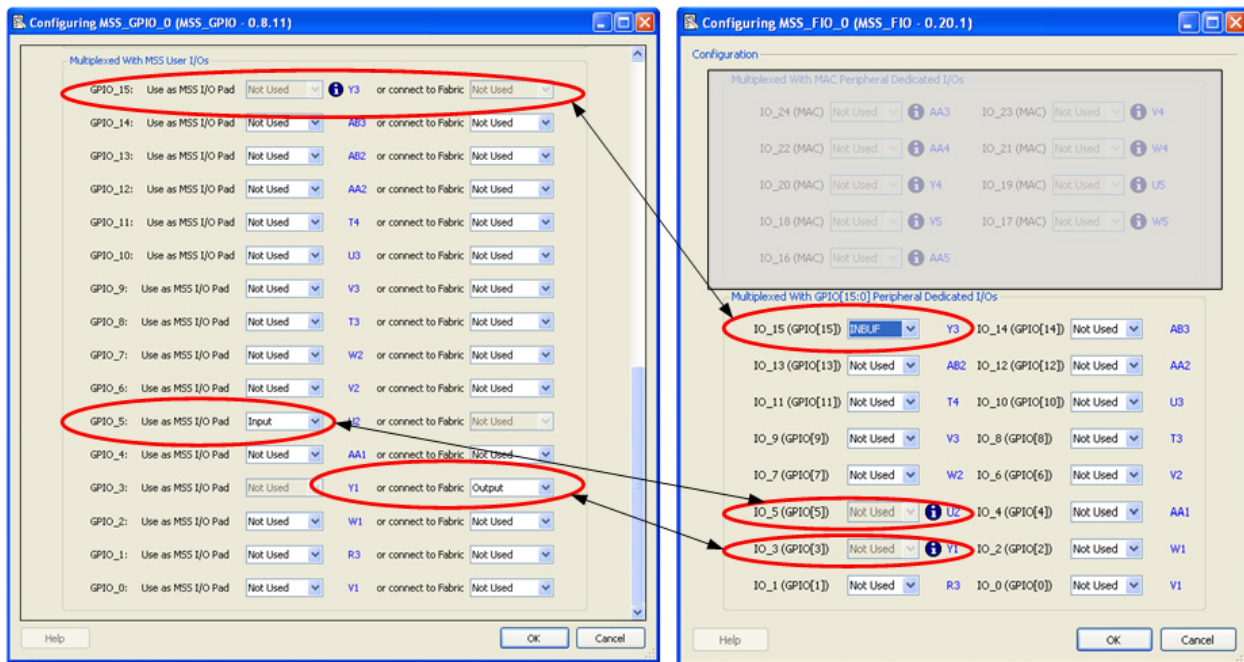


Figure 1: MSS I/O and GPIO Configuration Example

## Ethernet MAC

MSS I/Os 16 to 24 (IO\_<16...24> in the configurator) are shared with the Ethernet MAC peripheral. If the MAC peripheral is used (enabled on the MSS canvas), then the MSS I/O Pad pull-down menus are grayed-out for all corresponding shared MAC ports 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. This information is useful for planning board layout.

## Port Description

**Table 1:** Port Description

Port Name	Direction	PAD?	Description
IO_<index>_PADIN	In	Yes	Port name when IO_<index> is configured as an MSS I/O ' <b>INBUF</b> ' port
IO_<index>_PADOUT	Out	Yes	Port name when IO_<index> is configured as an MSS I/O ' <b>OUTBUF</b> ' port
IO_<index>_PADTRI	Out	Yes	Port name when IO_<index> is configured as an MSS I/O ' <b>TRIBUFF</b> ' port
IO_<index>_PADBI	Inout	Yes	Port name when IO_<index> is configured as an MSS I/O ' <b>BIBUF</b> ' port
IO_<index>_D	In	No	Port name when IO_<index> is configured to connect to the FPGA fabric as an ' <b>OUTBUF</b> ' port (it is really the D port of the OUTBUF macro).
IO_<index>_E	In	No	Port name when IO_<index> is configured to connect to the FPGA fabric as a ' <b>TRIBUFF</b> ' or ' <b>BIBUF</b> ' port (it is really the E port of the TRIBUFF or BIBUF macro).
IO_<index>_Y	Out	No	Port name when IO_<index> is configured to connect to the FPGA fabric as an ' <b>INBUF</b> ' or ' <b>BIBUF</b> ' port (it is really the Y port of the INBUF or BIBUF macro).

**Notes:**

- 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.

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