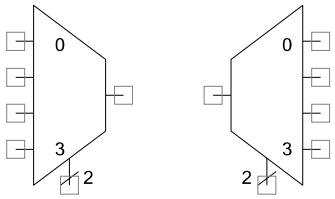
Digital Multiplexer and De-Multiplexer

1.0

Features



- Digital Multiplexer
- Digital De-Multiplexer
- Up to 16 channels

General Description

The Multiplexer component is used to select 1 of n inputs while the De-Multiplexer component is used to route 1 signal to n outputs.

The Multiplexer component implements a 2 to 16 input mux providing a single output, based on hardware control signals. The De-Multiplexer component implements a 2 to 16 output demux from a single input, based on hardware control signals. Only one input or output connection may be made at a time.

When to Use a Multiplexer

Use the Multiplexer and De-Multiplexer components any time a digital signal must be dynamically routed under firmware or hardware control. The most common control method is to connect the mux select signals to a control register using a bus. The control register is then used to select the input or output for the mux/demux. Another option is to drive the select signals from hardware control logic to provide dynamic hardware routing.

Input/Output Connections

This section describes the various input and output connections for the Multiplexer and De-Multiplexer. An asterisk (*) in the list of I/Os indicates that the I/O may be hidden on the symbol under the conditions listed in the description of that I/O.

Multiplexer

0-n – Inputs

Inputs to the Multiplexer, only one of which gets routed to the output based on the select input. The number of inputs depends on the size of the multiplexer.

Output 0

Output from the Multiplexer that is driven from the selected input.

select – Input

Selects input as source for the Multiplexer or output as destination for the De-Multiplexer. The width of the select input depends on the number of inputs and outputs.

De-Multiplexer

0 – Input

Input to the De-Multiplexer that gets routed to one of n outputs.

Outputs 0-n

Outputs from the De-Multiplexer, only one of which is driven based on the select input. The number of outputs depends on the size of the de-multiplexer. The number of outputs must be a power of 2. Not all outputs must be connected.

select – Input

Selects input as source for the Multiplexer or output as destination for the De-Multiplexer. The width of the select input depends on the number of inputs and outputs.

Component Parameters

Drag a Multiplexer or De-Multiplexer onto your design and double-click it to open the **Configure** dialog.

Figure 1. Configure Multiplexer Dialog

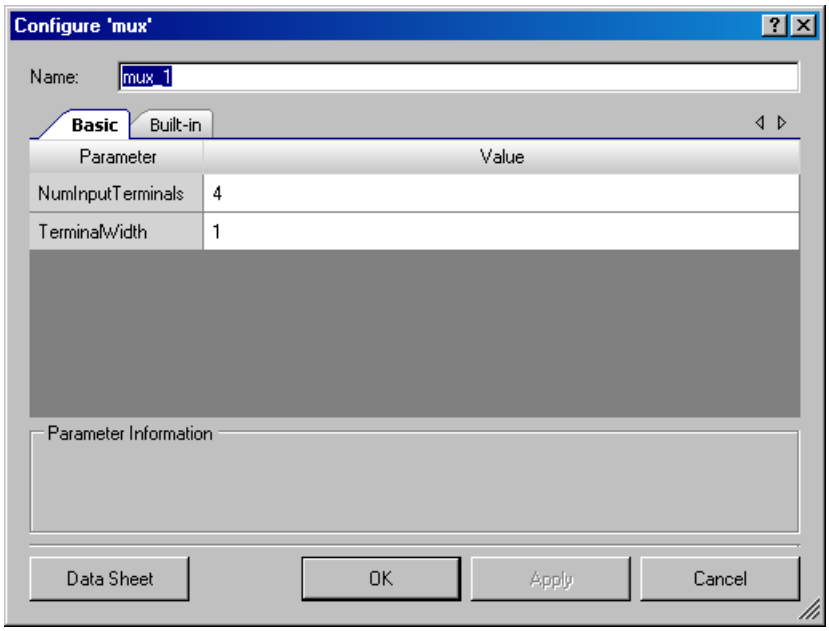
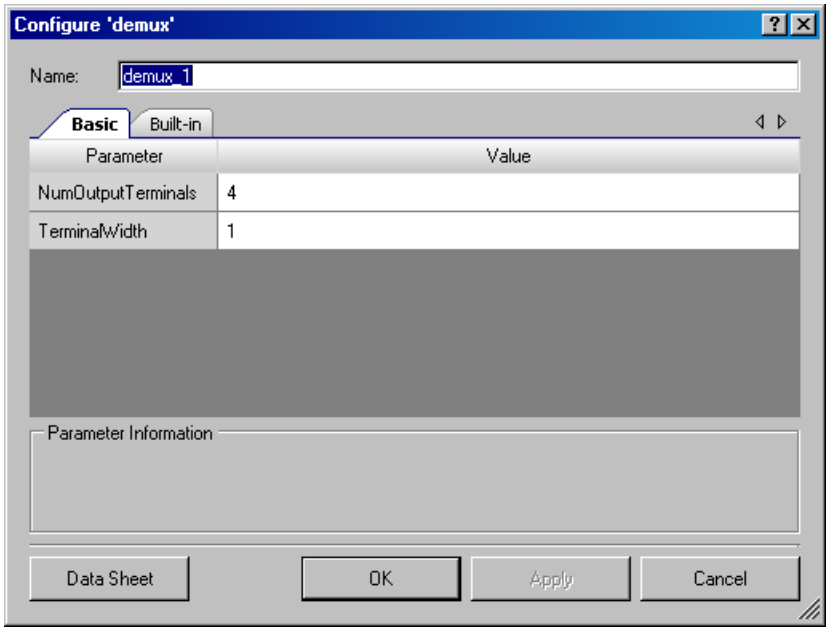


Figure 2. Configure De-Multiplexer Dialog



The Multiplexer and De-Multiplexer provide the following parameters.

NumInputTerminals

This parameter determines the number of Multiplexer inputs. The default is **4**. Acceptable values are 2, 4, 8, and 16 and the corresponding select input widths are 1, 2, 3, and 4. Unused input terminals may be left floating and, if selected, will be interpreted with a value of 0.

NumOutputTerminals

This parameter determines the number of De-Multiplexer outputs. The default is **4**. Acceptable values are 2, 4, 8, and 16 and the corresponding select input widths are 1, 2, 3, and 4. Unused output terminals may be left floating.

TerminalWidth

You can create an array of parallel Multiplexers or De-Multiplexers, which may be useful when the inputs and outputs are buses. This parameter defines the bus width of the inputs and outputs. The default is **1**. The range of valid values is 1 to 32, inclusive. The width of the select input is not affected by this parameter.

Resources

The Multiplexer and De-Multiplexer are implemented with logic equations in macrocells. The product of the component size and width determines the size of the logic equations, and therefore, the number of macrocells.

Sample Firmware Source Code

PSoC Creator provides numerous example projects that include schematics and example code in the Find Example Project dialog. For component-specific examples, open the dialog from the Component Catalog or an instance of the component in a schematic. For general examples, open the dialog from the Start Page or **File** menu. As needed, use the **Filter Options** in the dialog to narrow the list of projects available to select.

Refer to the “Find Example Project” topic in the PSoC Creator Help for more information.

Functional Description

Multiplexer

The Multiplexer selects one of several inputs based on the select input. A letter ‘X’ in the truth table indicates that the input does not affect the output.

Table 1. Four-Input Multiplexer Truth Table

Select[1]	Select[0]	Input 3	Input 2	Input 1	Input 0	Output
0	0	X	X	X	0	0
0	0	X	X	X	1	1
0	1	X	X	0	X	0
0	1	X	X	1	X	1
1	0	X	0	X	X	0
1	0	X	1	X	X	1
1	1	0	X	X	X	0
1	1	1	X	X	X	1

De-Multiplexer

The De-Multiplexer selects one of several outputs based on the select input. The value of the selected output is the value of the input. The value of unselected outputs is false.

Table 2. Four-Output De-multiplexer Truth Table

Select[1]	Select[0]	Input	Output 3	Output 2	Output 1	Output 0
0	0	0	0	0	0	0
0	0	1	0	0	0	1
0	1	0	0	0	0	0
0	1	1	0	0	1	0
1	0	0	0	0	0	0
1	0	1	0	1	0	0
1	1	0	0	0	0	0
1	1	1	1	0	0	0

DC and AC Electrical Characteristics

The following values indicate expected performance and are based on initial characterization data. Unless otherwise specified in the tables below, all T_A = 25 °C, V_{DD} = 5.0 V.

5.0-V/3.3-V DC and AC Electrical Characteristics

Parameter	Typical	Min	Max	Units	Conditions and Notes
Input					
Maximum Clock Rate	---		67	MHz	

Component Changes

This section lists the major changes in the component from the previous version.

Version	Description of Changes	Reason for Changes / Impact
1.0.c	Minor datasheet edits and updates	
1.0.b	Minor datasheet edits and updates	
1.0.a	Updated datasheet to show examples of firmware controlled components.	These were added to show how you can use and implement these components with control registers.