AMBA® Designer (ADR-301)

Revision: r3p0

User Guide

ARM®

ARM DUI 0333J (ID030610)

AMBA Designer (ADR-301)
User Guide

Release Information

The *Change history* table lists the changes made to this book.

Change history

Date	Issue	Confidentiality	Change
18 May 2006	A	Non-Confidential	First release for revision r0p0
19 May 2006	B	Non-Confidential	Minor technical corrections
20 September 2006	C	Non-Confidential	Updated for revision r2p0
21 March 2007	D	Non-Confidential	First release for revision r2p1
24 July 2007	E	Confidential	Second release for revision r2p1
09 January 2008	F	Confidential	First release for revision r2p2
27 November 2008	G	Confidential	First release for revision r2p3
22 April 2009	H	Confidential	Second release for revision r2p3
24 November 2009	I	Confidential	First release for revision r3p0
03 February 2010	J	Non-Confidential	Second release for revision r3p0

Proprietary Notice

Confidentiality Status

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Product Status

The information in this document is final, that is for a developed product.

Web Address

`http://www.arm.com`

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Preface

This preface introduces the *AMBA Designer (ADR-301) User Guide*. It contains the following sections:

About this book

This book is for AMBA Designer (ADR-301).

Product revision status

The r*n*p*n* identifier indicates the revision status of the product described in this book, where:

r*n* Identifies the major revision of the product.

p*n* Identifies the minor revision or modification status of the product.

Intended audience

This book is written for:

- system designers and system integrators using the AMBA Designer tool to either build a design with an AMBA infrastructure, or to configure AMBA components
- system verification engineers who want to verify the generated *Register Transfer Language* (RTL), for the AMBA components.

It is assumed that the intended audience is familiar with the RTL generation, synthesis, and verification processes of an ASIC design flow.

Using this book

This book is organized into the following chapters:

Chapter 1 *Introduction*

Read this for a description of the AMBA Designer tool.

Chapter 2 *Using AMBA Designer*

Read this for a description of how to start, configure preferences, create and add components, generate, simulate, synthesize component RTL, and operate in batch mode.

Chapter 3 *Canvas Reference*

Read this for a description of the Canvas graphical user interface.

Appendix A *Example RTL Design Flow*

Read this for a description of an example RTL design flow.

Appendix B *Keyboard Shortcuts*

Read this for a description of keyboard shortcuts.

Appendix C *Migration Guide*

Read this for a description of how to migrate components and systems from earlier versions of AMBA Designer.

Appendix D *Revisions*

Read this for a description of the technical changes between released issues of this book.

Glossary Read this for definitions of terms used in this book.

Typographical conventions

The typographical conventions are:

italic	Highlights important notes, introduces special terminology, denotes internal cross-references, and citations.
bold	Highlights interface elements, such as menu names. Denotes signal names. Also used for terms in descriptive lists, where appropriate.
`monospace`	Denotes text that you can enter at the keyboard, such as commands, file and program names, and source code.
`mono`space	Denotes a permitted abbreviation for a command or option. You can enter the underlined text instead of the full command or option name.
`monospace italic`	Denotes arguments to monospace text where the argument is to be replaced by a specific value.
`monospace bold`	Denotes language keywords when used outside example code.
< and >	Enclose replaceable terms for assembler syntax where they appear in code or code fragments. For example: `MRC p15, 0 <Rd>, <CRn>, <CRm>, <Opcode_2>`

Additional reading

This section lists publications by ARM and by third parties.

See Infocenter, http://infocenter.arm.com, for access to ARM documentation.

ARM publications

This book contains information that is specific to this product. See the following documents for other relevant information:

- *AMBA Designer (ADR-301) Installation Guide* (ARM DUI 0456)
- *AMBA AXI Protocol Specification* (ARM IHI 0022)
- *AMBA 3 APB Protocol Specification* (ARM IHI 0024)
- *AMBA 3 AHB-Lite Protocol Specification* (ARM IHI 0033)
- *AMBA Network Interconnect (NIC-301) Supplement to AMBA Designer (ADR-301) User Guide* (ARM DSU 0003)
- *PrimeCell® Interconnect (PL301) Supplement to AMBA Designer (FD001) User Guide* (ARM DSU 0003A)
- *AMBA Dynamic Memory Controller DMC-340 Supplement to AMBA Designer (ADR-301) User Guide* (ARM DSU 0005)
- *PrimeCell Static Memory Controller (PL350 series) Supplement to AMBA Designer (ADR-301) User Guide* (ARM DSU 0006)
- *PrimeCell DDR2 Dynamic Memory Controller (PL341) Supplement to AMBA Designer (ADR-301) User Guide* (ARM DSU 0007)
- *PrimeCell Generic Interrupt Controller (PL390) Supplement to AMBA Designer (ADR-301) User Guide* (ARM DSU 0008)

- *AMBA DMA Controller DMA-330 Supplement to AMBA Designer (ADR-301) User Guide* (ARM DSU 0009)
- *PrimeCell Micro DMAC (PL230) Supplement to AMBA Designer (ADR-301) User Guide* (ARM DSU 0010)
- *PrimeCell AHB Bus Matrix (BP010) Supplement to AMBA Designer (ADR-301) User Guide* (ARM DSU 0011)
- *AMBA LPDDR2 Dynamic Memory Controller DMC-342 Supplement to AMBA Designer (ADR-301) User Guide* (ARM DSU 0012)
- *AMBA Level 2 Cache Controller (L2C-310) Supplement to AMBA Designer (ADR-301) User Guide* (ARM DSU 0013)
- *AMBA Design Kit Technical Reference Manual* (ARM DDI 0243)
- *AMBA Design Kit User Guide* (ARM DUI 0183).

Feedback

ARM welcomes feedback on this product and its documentation.

Feedback on this product

If you have any comments or suggestions about this product, contact your supplier and give:

- The product name.
- The product revision or version.
- An explanation with as much information as you can provide. Include symptoms and diagnostic procedures if appropriate.

Feedback on content

If you have comments on content then send an e-mail to `errata@arm.com`. Give:

- the title
- the number, ARM DUI 0333J
- the page numbers to which your comments apply
- a concise explanation of your comments.

ARM also welcomes general suggestions for additions and improvements.

Chapter 1
Introduction

This chapter introduces AMBA Designer. It contains the following sections:

1.1 About AMBA Designer

AMBA Designer tools enable you to:

- create systems based on AMBA interconnects and AMBA devices
- configure AMBA devices and generate RTL for the configurations you require
- stitch interconnects and components together
- generate top-level RTL for systems.

The AMBA Designer suite consists of:

Canvas Canvas is a graphical application that you can use to create new systems and modify existing ones. A system consists of leaf components or other subsystems. You can create and manipulate systems using a graphical representation that shows the components, their ports, and the connections between ports.

Configurators

You can use configurators to configure AMBA components and generate RTL and test benches for these components.

IP-XACT Component Library

Components that you generate and save are stored in the Component Library.You can use these components and stitch them together with interconnects to generate top-level RTL modules for AMBA interconnect-based systems.

Figure 1-1 on page 1-3 shows the main AMBA Designer Canvas window. See Chapter 2 *Using AMBA Designer* for a description of the Configurator and IP-XACT Component Library panes within the Canvas window.

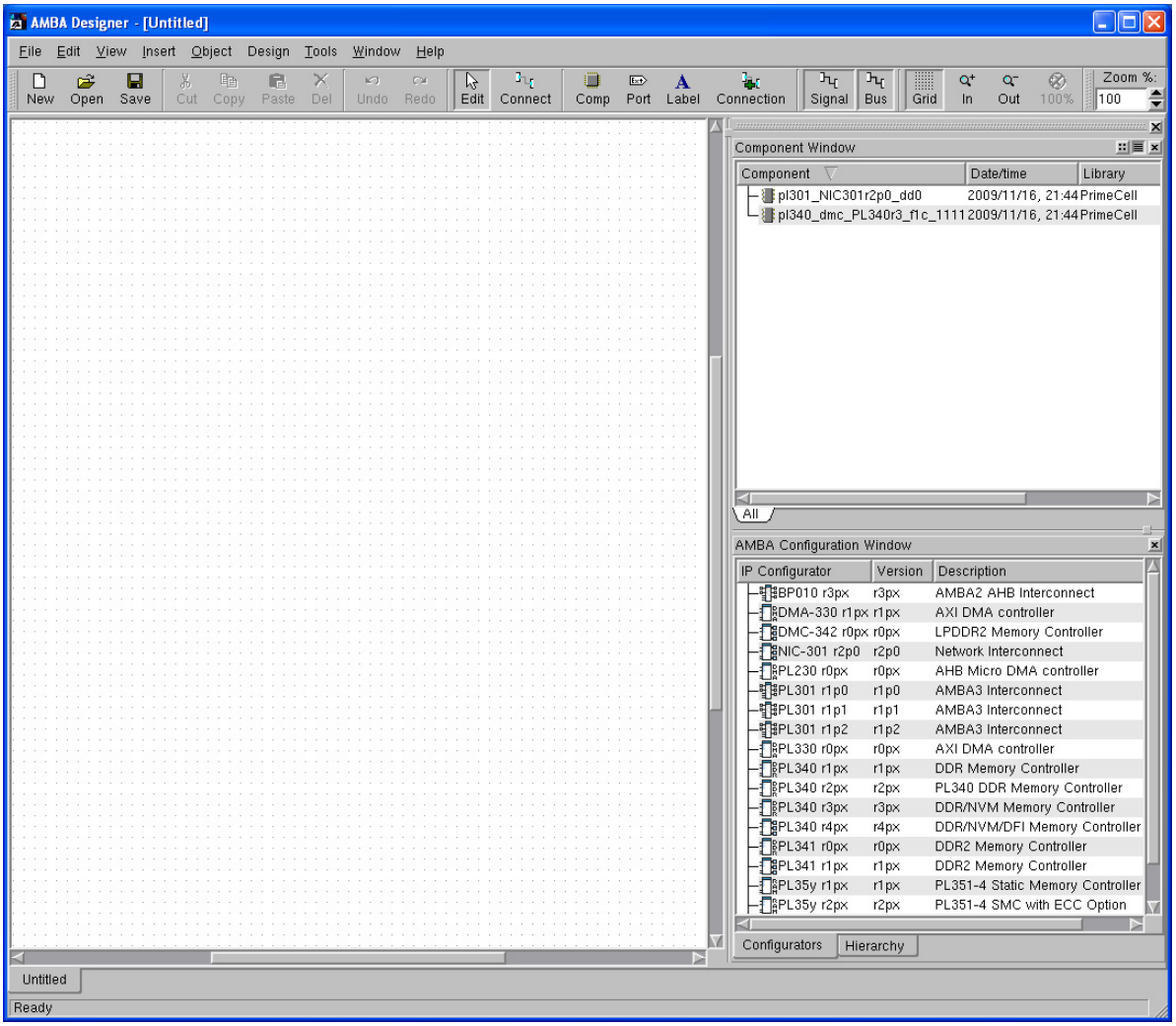

Figure 1-1 AMBA Designer Canvas window

Note

AMBA Designer only runs under UNIX environments.

See the *AMBA Designer (ADR-301) Installation Guide* for information about how to install AMBA Designer.

1.2 Features

The AMBA Designer tools enable you to:

- Configure AMBA components with complex AMBA interconnects.

  Note

  AMBA components can contain configurable IP, and comprise:

  — configurable RTL source code

  — a generator that translates user-defined sets of configuration parameters into any number of instances of the IP.

- Generate RTL and, where applicable, *Out Of Box* (OOB) testbenches for AMBA components. Components within the AMBA Designer Canvas are represented as IP-XACT components.
- Optimize the frequency for AMBA interconnects.
- Stitch together IP-XACT components to generate a top-level RTL module.

The tools generate configurations that are compatible across platforms, and can generate the RTL Verilog files and the associated testbenches for verifying the RTL.

For information about how to use the tools see:

- Chapter 2 *Using AMBA Designer*
- Chapter 3 *Canvas Reference*.

1.3 Resources

AMBA Designer requires the following resources:

- A UNIX *Operating System* (OS), for example, Linux or Solaris.

  Note

  The tools do not run on Microsoft Windows OSs.

- Licensed RTL for your choice of components and interconnects.
- Appropriate *Electronic Design Automation* (EDA) tools. See *EDA tools*.
- Perl.
- Tcl.
- Python.
- *Open Verification Library* (OVL).

See the *AMBA Designer (ADR-301) Installation Guide* for information about installation.

1.3.1 Third-party tools

This section describes third-party tools. It contains information about:

- *EDA tools*
- *Third-party software* on page 1-6.

EDA tools

This guide assumes that you have suitable EDA tools and compute resources. See the product *Release note* for a list of deliverables and any specific tool revisions required.

Table 1-1 shows the EDA tools that you can use.

Table 1-1 EDA tools

Purpose	Vendor	Tool	Command line switch
RTL simulation	Synopsys	VCS	`vcs`
	Cadence	NC-Verilog	`nc`
	Mentor Graphics	ModelSim	`mti`
Synthesis	Synopsys	Design Compiler Physical Compiler	-
Logical Equivalence Checking (LEC)	Synopsys	Formality	-
	Cadence	Conformal LEC	-
Scripting	ActiveState	Perl	-
		Tcl	-
		Python	-
Software development	ARM	*RealView® Compilation Tools* (RVCT) which provide armasm, armlink, fromelf	-

Note

The *AMBA Designer (ADR-301) Release Note*:

- Lists specific tools and tool versions. ARM cannot guarantee that the deliverables are compatible with versions of the development tools other than those that the *AMBA Designer (ADR-301) Release Note* lists.
- Describes any special requirements that might affect the flow.

Third-party software

ARM acknowledges and thanks the respective owners for the Verilog Parser software that AMBA Designer uses:

```
/*
 * Copyright (c) 1992, Bakul Shah <bvs@BitBlocks.com>
 * All Rights Reserved.
 *
 * Permission to use, copy, modify, distribute or sell this software and
 * its documentation for any purpose is hereby granted without fee, subject
 * to the following conditions.
 *
 * 1. The above copyright, this list of conditions and the following
 *    disclaimer must appear UNCHANGED in all copies of the software and
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 *    versions
 *
 * 2. Binary distribution must be accompanied by documentation that
 *    reproduces the above copyright, this list of conditions and the
 *    following disclaimer.
 *
 * 3. Any modifications to the source code must be clearly marked as such.
 *
 * 4. The author's name may not be used to endorse or promote products
 *    derived from this software without specific prior written permission.
 *
 * This software is provided by the author AS IS. The author DISCLAIMS
 * any and all warranties of merchantability and fitness for a particular
 * purpose. In NO event shall the author be LIABLE for any damages
 * whatsoever arising in any way out of the use of this software.
 */
```

1.4 Product revisions

This section describes the differences in functionality between product revisions of AMBA Designer:

r0p0-r2p0 Contains the following differences in functionality:

- Enables you to configure the following devices:
  - DMC (PL340) r1p0
  - SMC (PL350 series) r0p0.
- Updated to support version r1p0 of the High-Performance Matrix (PL301).
- Adds a PrimeCell Interconnect reconfiguration option that enables you to add or remove masters or slaves from a previously generated interconnect.

r2p0-r2p1 Contains the following differences in functionality:

- *Links to Physical* (L2P) functionality
- cascaded interconnect, configuration and RTL stitching
- *Intellectual Property* (IP) and architecture updates
- updated to support versions:
  - r1p1 of the High-Performance Matrix (PL301)
  - r2p0 of the DMC (PL340)
  - r1p1 of the SMC (PL350).
- **r2p1 SP1** Service Pack 1 contains the following changes:
  - updated to support r1p2 and r2p0 of the SMC (PL350)
  - SoC Designer 7 support.

    Note

    All models and previous versions of AMBA Designer are incompatible with SoC Designer 7.

  - An `AMBA_Designer` license feature is no longer taken when run in `sdcanvas` mode.
  - *Bandwidth Monitor Components* (BMC)s are now optionally available when generating a PL301 model. These components collect read and write channel bandwidth and latency figures for model simulation.
  - A global preferences environment variable enables you to define the location from where default user preferences are loaded. You can reset current user preferences to this global file.
  - Option to save an AMBA Designer batch-mode configuration, `.xml` file, after generating the model view of a configured component, `.mxp` file.

    Note

    When you have created *Graphical User Interface* (GUI) configurations, you can run AMBA Designer in batch mode, that is, without the GUI, so that you can create the RTL for, or simulate many designs in serial without requiring user interaction.

- When you open a subsystem that AMBA Designer created, SoC Designer is stable.
- In batch mode operation, an error message is no longer issued when you exit SoC Designer.

r2p1-r2p2 Contains the following differences in functionality:

- enables you to configure the following devices:
  - µDMAC (PL230) r0p0
  - DMAC (PL330) r0p0
  - DMC (PL340) *Non-Volatile Memory* (NVM) option r3p0
  - DDR2 DMC (PL341) r0p0
  - AHB Bus Matrix (BP010) r3p0
- enhanced L2P functionality, enabling you to configure AXI input and output constraints.

r2p2-r2p3 Contains the following differences in functionality:

- enables you to configure the GIC (PL390) r0p0
- improvements to installation scripts
- environment variable `AD_HOME` used for environment setup instead of `MAXSIM_HOME`
- moved preferences to a renamed `$HOME/.ARM/AMBA_Designer_*` directory hierarchy
- merged preferences into single preferences menu
- removed support for cycle-accurate modeling or *Electronic System design Level* (ESL) simulation
- no support for Microsoft Windows OS.

r2p3-r3p0 Contains the following differences in functionality:

- native support for IP-XACT components
- support of IP-XACT 1.4, including ad-hoc signals, tie-offs, and bit-slice connections
- support for configuring and stitching NIC-301 r2 interconnects to other ARM IP
- all IP now has a one to one interface mapping with the RTL, that is, the same exact interfaces as the actual RTL
- support for hierarchical stitching, including support for external ports
- coloring of bus interface ports and connections based on the protocol.

Chapter 2
Using AMBA Designer

This chapter describes how to run AMBA Designer, configure preferences, and operate in batch mode. It contains the following sections:

2.1 About the AMBA Designer flow

This section describes the general flow for the creation of systems. Peripherals and interconnects in SoC systems are highly configurable. To speed up the flow, consider the component and interconnect configurations that you might require before you use the tools.

To create a system with the tools:

1. Start AMBA Designer. See:
   - *How to start a session* on page 2-4.
2. Setup preferences. See:
   - *How to set preferences* on page 2-4
   - *AMBA Designer Preferences dialog* on page 3-50.
3. Create new configurations of components, and generate components. See:
   - *How to create and configure components* on page 2-6
   - *Using components* on page 3-31.
4. Add the generated components to the Component Library. See:
   - *How to generate RTL for a component* on page 2-9
   - Appendix A *Example RTL Design Flow*.
5. Add components to the design. See:
   - *How to create and configure components* on page 2-6
   - *Using components* on page 3-31.
6. Connect components. See:
   - *How to add connections* on page 2-15
   - *Making connections between components* on page 3-36.
7. Stitch components. See:
   - *How to stitch components* on page 2-17
   - *IP-XACT stitching* on page 3-44.

You can use the Canvas interface to open third-party EDA tools to simulate the generated RTL, synthesize the design, and run other EDA tools such as equivalence checkers.

You can run the tools:

- from the GUI
- in batch mode using the command line.

Figure 2-1 on page 2-3 shows a typical design flow.

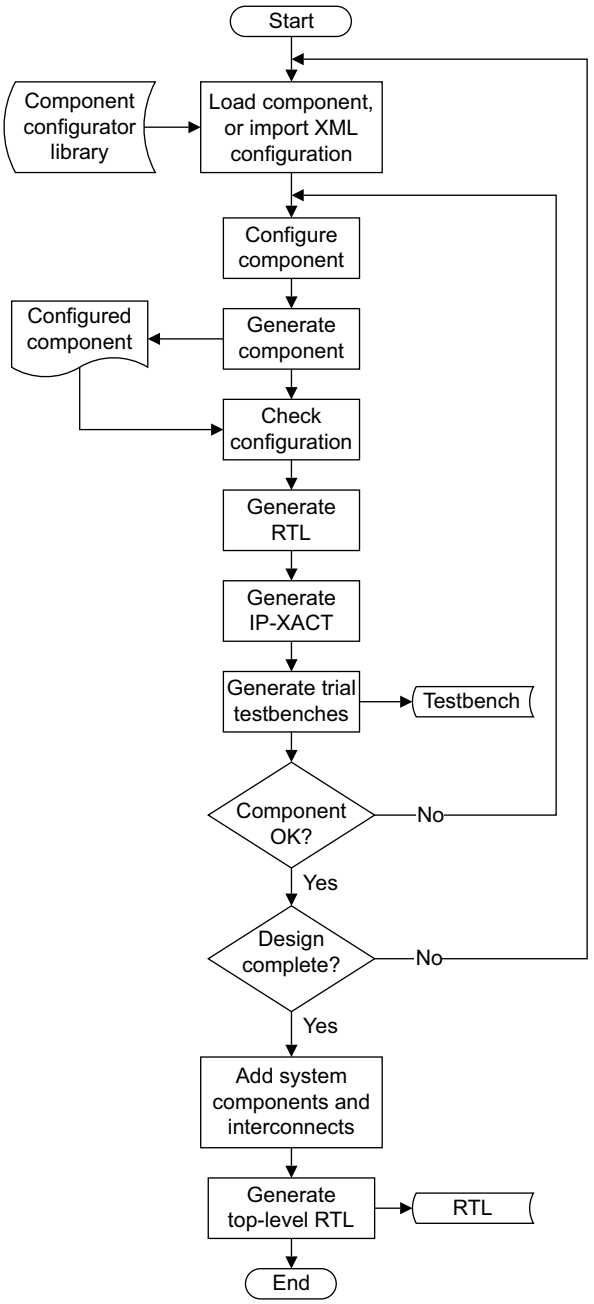


Figure 2-1 Design flow

For information about how to:

- run the tools from the GUI, see *Using the Graphical User Interface (GUI)* on page 2-4
- use batch mode, see *Batch mode operation* on page 2-20
- install the tools, see the *AMBA Designer (ADR-301) Installation Guide*
- use the Canvas, see Chapter 3 *Canvas Reference*.

2.2 Using the *Graphical User Interface* (GUI)

This section describes how to create a design using the GUI.

Note

Commands are available by using the menu bar and the context sensitive pop-up menus. To see a context-sensitive menu, right-click items in the GUI.

This section contains the following subsections:

- *How to start a session*
- *How to set preferences*
- *How to create and configure components* on page 2-6
- *How to generate RTL for a component* on page 2-9
- *RTL Simulation and Synthesis* on page 2-10
- *Synthesis* on page 2-12
- *How to add components to the Component Library* on page 2-13
- *How to add configured components to the design* on page 2-14
- *How to add connections* on page 2-15
- *How to stitch components* on page 2-17.

2.2.1 How to start a session

To start AMBA Designer from a console, type:

`adcanvas <filename>`

See Table 2-1 on page 2-21 for a list of command line options. If you do not specify an option argument then Canvas opens with a blank Diagram Window.

Note

You must set up the environment before you can run AMBA Designer. The command you use depends if your operating system shell is either:

`Bourne` Enter `source <AMBA Designer install directory>/etc/setup.sh`

`C-Shell` Enter `source <AMBA Designer install directory>/etc/setup.csh`

Where `<AMBA Designer install directory>` is the AMBA Designer installation directory.

2.2.2 How to set preferences

You can configure:

- General preferences for:
  - appearance
  - Component Library.
- Canvas preferences for:
  - appearance
  - the Diagram Window
  - IP-XACT.

To set preferences:

1. Select **File → Preferences...**. See Figure 2-2 on page 2-5.

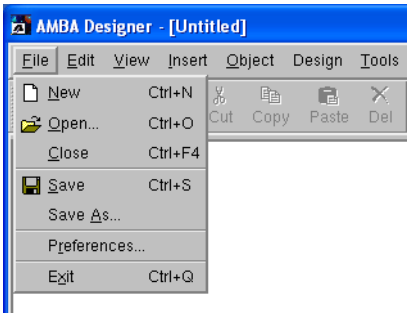


Figure 2-2 Preferences... selection

This opens the AMBA Designer Preferences dialog box. See Figure 2-3.

2. To change settings:
   a. Click an item in the left-hand pane in the AMBA Designer Preferences dialog box.

Note

You can expand and collapse the branches of the hierarchy to show or hide items. To expand or collapse the view, click the triangle symbol to the left of the text label in the hierarchy.

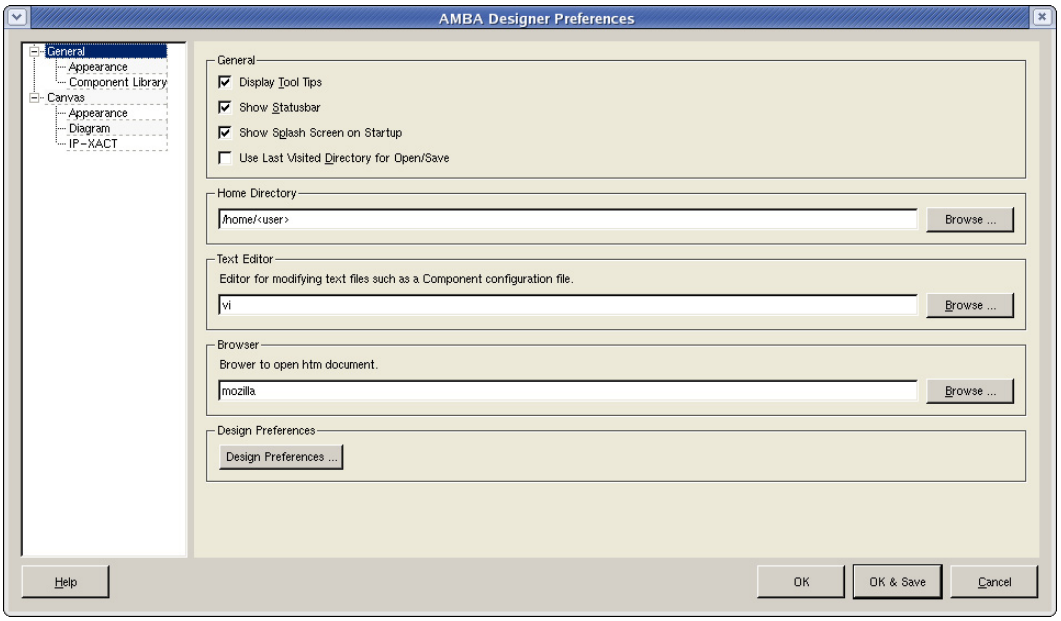


Figure 2-3 AMBA Designer Preferences dialog box

   b. Change the appropriate items in the right-hand pane.

3. Click **OK** to confirm your changes.

   Click **OK & Save** to confirm and save your changes.

   Click **Cancel** to cancel your changes.

   Click **Help** for help with the dialog box.

The hierarchy enables you to change settings for:

General The General area contains settings for General preferences, the Home Directory for your work, your choice of Text Editor, Browser, and Design Preferences.

See *General preferences* on page 3-50.

General Appearance

The General Appearance area contains settings for Tool Bar Options, Magnify Object Delay, and Fonts.

See *General Appearance preferences* on page 3-54.

General Component Library

The Component Library area contains settings for the Working Directory and Additional Component Configuration Files.

See *General Component Library preferences* on page 3-55.

Canvas The Canvas area contains settings for Application Options and Save Options.

See *Canvas preferences* on page 3-56.

Canvas Appearance

The Canvas Appearance area contains settings for the **Hierarchy** tab and the Component Window.

See *Canvas Appearance preferences* on page 3-58.

Canvas Diagram

The Canvas Diagram area contains settings for Double Click on Objects, Grid Options, and Miscellaneous.

See *Diagram Window preferences* on page 3-58.

Canvas IP-XACT

The Canvas IP-XACT area contains settings for IP-XACT Global Preference, IP-XACT Default Values, IP-XACT Repository, and IP-XACT Files.

See *Canvas IP-XACT preferences* on page 3-60.

See *AMBA Designer Preferences dialog* on page 3-50 for more information.

2.2.3 How to create and configure components

You must create specific component configurations to use in your design.

Note

AMBA Designer must contain registered forms of components. The AMBA installation package provides a UNIX script that enables you to register AMBA components with AMBA Designer. See the AMBA <Component> Release Note for information about how to use the script.

To create and configure a new component:

1. Make sure that Canvas shows the AMBA Configuration Window, and **Configurators** tab. See Figure 2-4 on page 2-7.

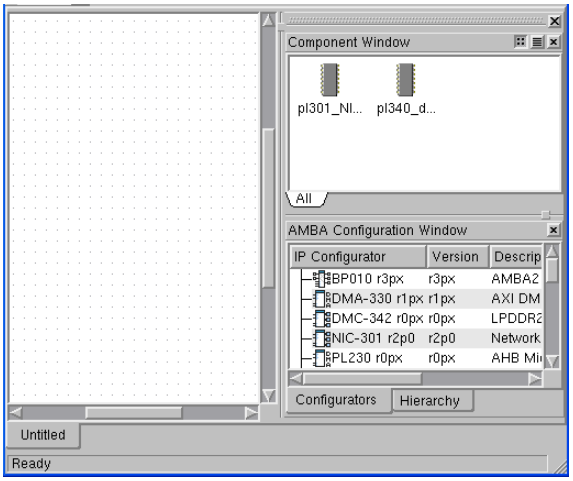


Figure 2-4 AMBA Configuration Window

2. Double-click the name of your chosen component in the AMBA Configuration Window.

   A component Configurator Window appears. Figure 2-5 shows an example of a Configurator Window.

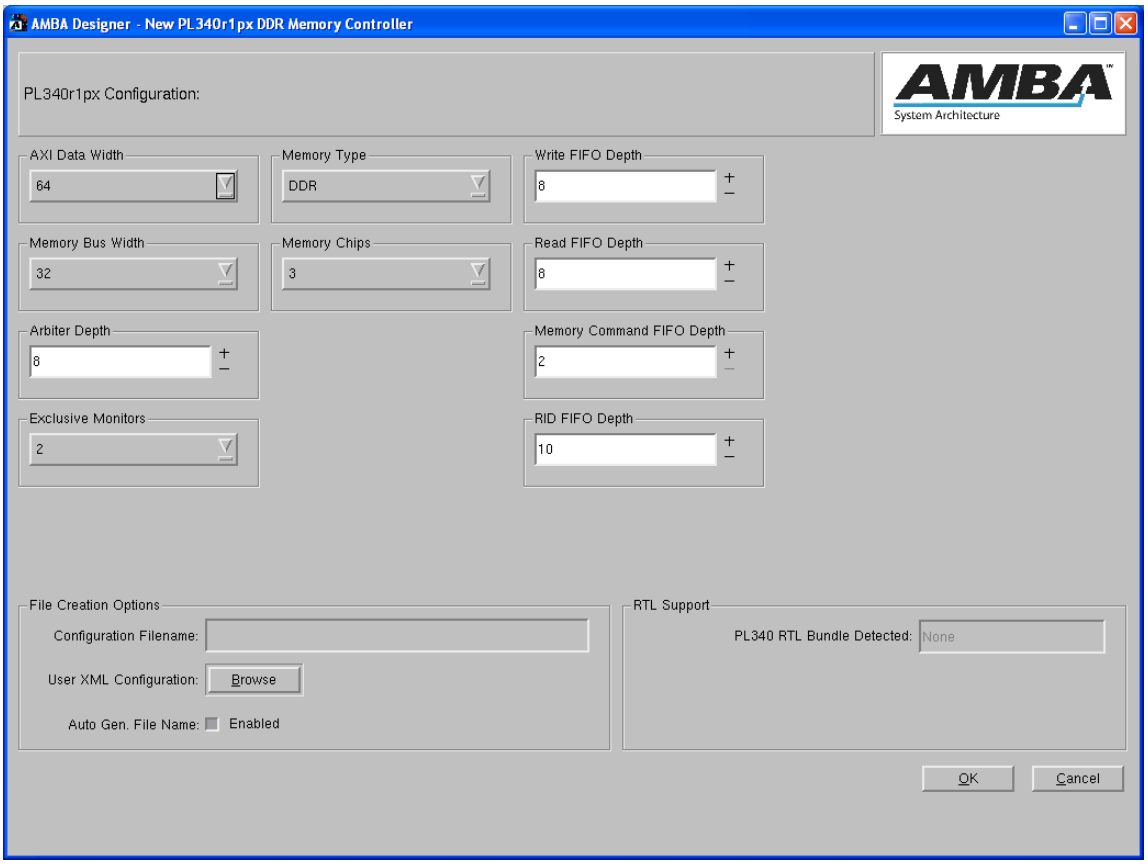


Figure 2-5 Example Configurator Window

3. Fill in the necessary configuration details in the Configurator Window.

Note

Components might have more than one configuration tab or pane in the Configurator Window. Complete each as necessary by selecting the appropriate tabs and buttons to configure all the options.

To complete the configuration, click **OK**. A new tab appears in the Diagram Window with the new component part displayed. See Figure 2-6.

To cancel configuration without creating the component, click **Cancel**.

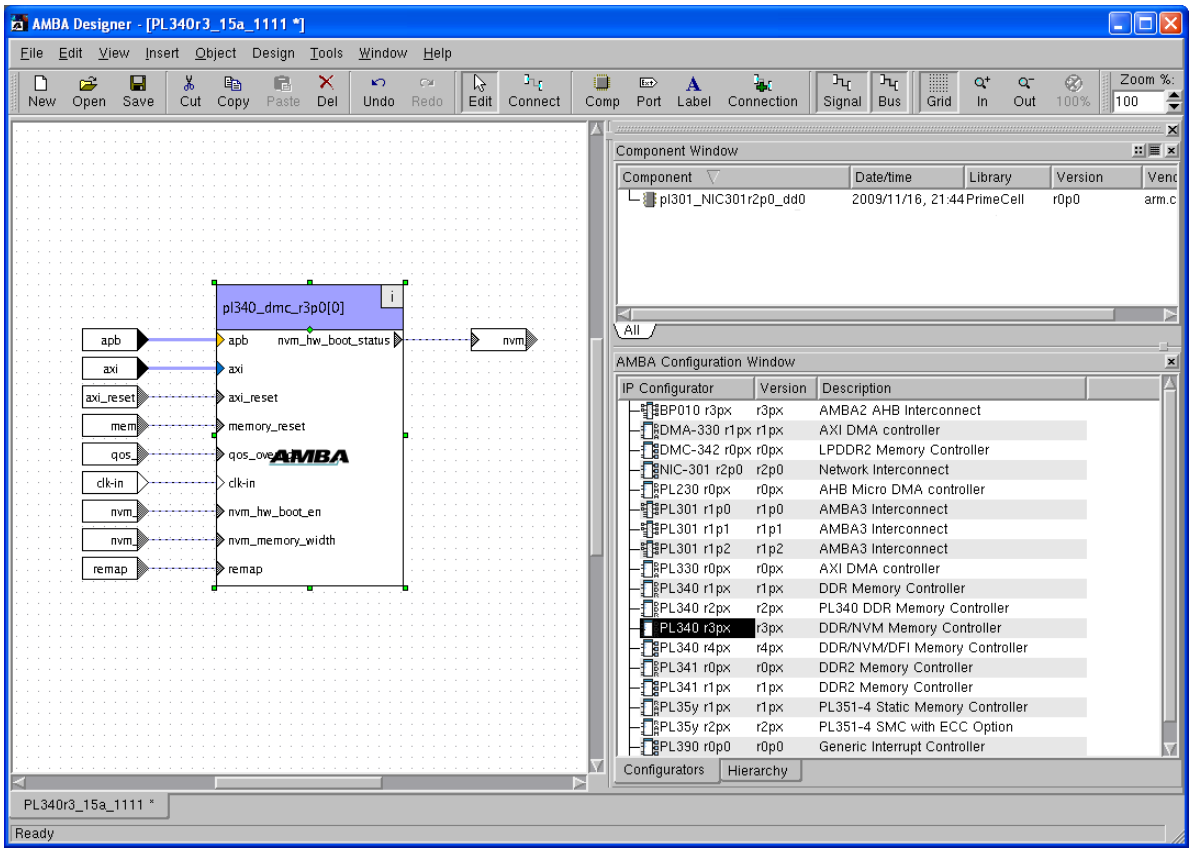


Figure 2-6 Example new component

4. To save the component, either:
   - click **Save** on the main toolbar
   - select **File** → **Save** on the main menu.

   Your component is saved in your work space.

For specific configuration details for your chosen component, see the appropriate AMBA <Component> supplement to the AMBA Designer User Guide.

Note

To add a component to the Component Library and use it in your design, you must first generate the component RTL and then add it to the library. See:

- *How to generate RTL for a component* on page 2-9
- *How to add components to the Component Library* on page 2-13.

See *Using components* on page 3-31 for information about how to use components.

2.2.4 How to generate RTL for a component

To generate RTL for a component:

1. Right-click the component to display the context-sensitive menu.

   Figure 2-7 shows the component context-sensitive menu.

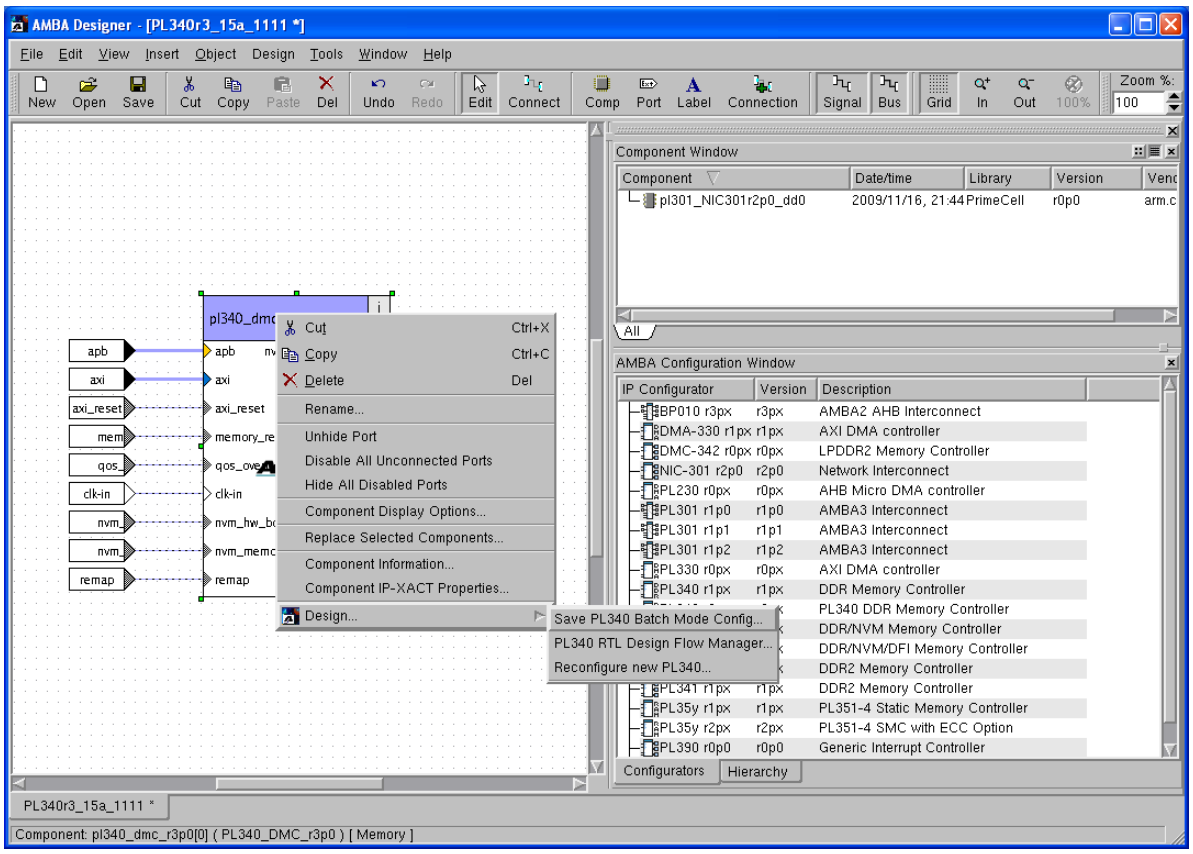


Figure 2-7 Example component generation

2. Select **Design** → ***<component_name>*** **RTL Design Flow Manager...** from the context-sensitive menu.

   The RTL Design Flow Manager dialog box opens. See Figure 2-8.

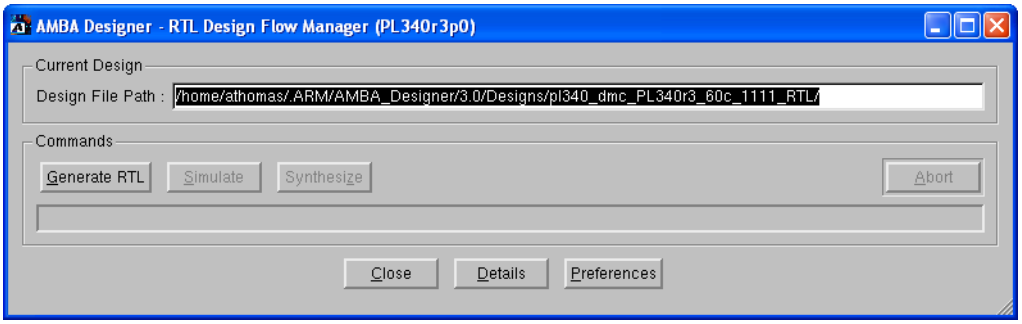


Figure 2-8 Example RTL Design Flow Manager dialog box

3. Click **Generate RTL** to generate the component.

The Commands pane of the RTL Design Flow Manager shows a progress bar in black. When the Generate RTL process has completed, the progress bar changes color to one of the following:

Green To indicate that AMBA Designer simulated the RTL successfully.

Note

If you want to simulate and synthesize the generated component RTL in the current RTL Design Flow Manager session, leave the dialog box open.

Red To indicate that AMBA Designer failed to generate the RTL.

Click **Details** to open the Output Window pane to display information about the status of the process.

4. To end the current RTL Design Flow Manager session, click **Close**.
5. To save the component, either:
   - click **Save** on the main toolbar
   - select **File → Save** on the main menu.

   Your component is saved in your workspace.

Note

You must run a separate instance of the Generate RTL process for each component you require RTL. However, before generating additional components, you must add the generated component to the Component Library. See *How to add components to the Component Library* on page 2-13.

For information about how to use components, see *Using components* on page 3-31.

2.2.5 RTL Simulation and Synthesis

This section describes how to run RTL simulation and synthesis tools from the Canvas interface.

Note

You can only start the Simulate process when the Generate RTL process has completed successfully in the current RTL Design Flow Manager session.

Before you run the simulation, you must verify that the simulation preferences are appropriately configured. The following sections describe the simulation stage:

- *RTL simulation preferences*
- *OVL assertions flag* on page 2-11
- *Simulate* on page 2-11.

See *EDA tools* on page 1-5 for information about the third-party EDA tools that you can use.

RTL simulation preferences

You must set the AMBA Designer simulation preferences for your chosen simulator.

To configure the simulation preferences:

1. Click **Preferences** in the RTL Design Flow Manager dialog box to open the RTL Design Flow Manager Preferences dialog box. See Figure 2-9 on page 2-11.

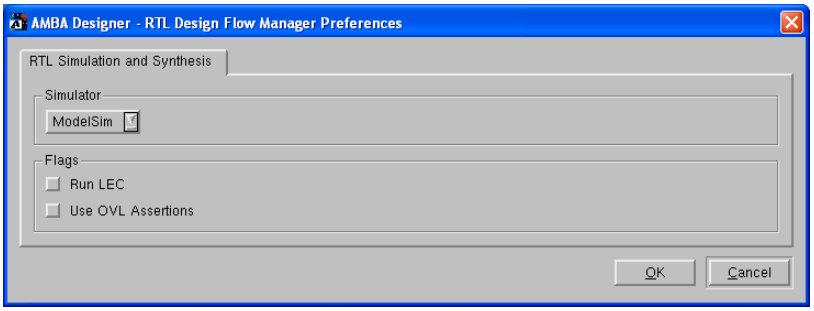


Figure 2-9 RTL Design Flow Manager Preferences dialog box

2. Select the simulator that corresponds to the simulation tool for your device.

OVL assertions flag

If the AMBA device supports *Open Verification Library* (OVL) assertions then you can, if required, simulate using OVL assertions.

For information about how to install OVL, see the *AMBA Designer (ADR-301) Installation Guide*.

Note

It is not necessary to install or enable OVL assertions to simulate any of the examples supplied with the tools.

To enable OVL assertions:

1. Select the **Use OVL Assertions** check box in the Flags pane of the RTL Design Flow Manager Preferences dialog box to enable simulation with OVL assertions.
2. Click **OK** to save the preferences and close the dialog box.

Simulate

To simulate the RTL:

1. Click **Simulate** in the RTL Design Flow Manager dialog box. See Figure 2-10.

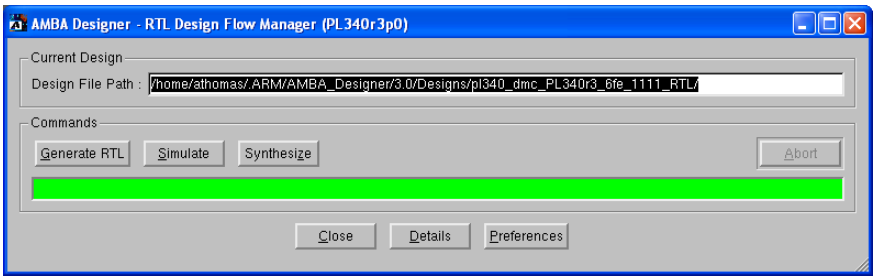


Figure 2-10 Simulate RTL

The simulate RTL process starts. The progress bar in the Commands pane of the RTL Design Flow Manager dialog box displays the progress.

On completion of the simulate RTL process, the progress bar changes color to one of the following:

Green To indicate that AMBA Designer simulated the RTL successfully.

Red To indicate that AMBA Designer failed to simulate the RTL.

Click **Details** to open the Output Window pane to display information about the status of the process.

Note

If you want to also synthesize the generated component RTL in the current RTL Design Flow Manager session, leave the dialog box open.

2. Click **Close** to close the RTL Design Flow Manager dialog box.

2.2.6 Synthesis

For information about the third-party EDA tools you can use, see *EDA tools* on page 1-5.

Note

- You can only start the Synthesize process when the Generate RTL process has completed successfully in the current RTL Design Flow Manager session.
- You must configure your device with the appropriate location for your chosen EDA synthesis tool.
- To synthesize the example created, you must install the appropriate ARM Physical IP libraries.

To synthesize the RTL:

1. Click **Preferences** in the RTL Design Flow Manager dialog box to open the RTL Design Flow Manager Preferences dialog box. See Figure 2-11.

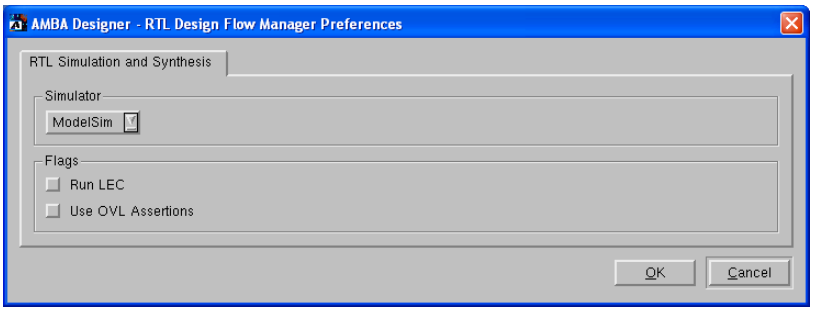


Figure 2-11 RTL Design Flow Manager Preferences dialog box

2. To perform *Logical Equivalence Checking* (LEC) during synthesis, select the **Run LEC** check box in the Flags pane.

Note

You must configure your device with the appropriate location for your chosen LEC tool.

3. Click **OK** to save the preferences.
4. Close the RTL Design Flow Manager Preferences dialog box.
5. Click **Synthesize** in the RTL Design Flow Manager dialog box. See Figure 2-12 on page 2-13.

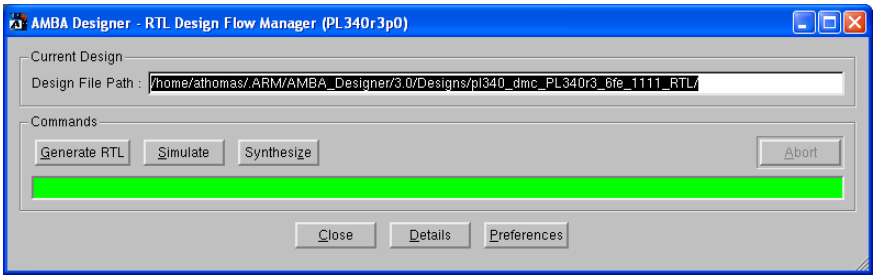


Figure 2-12 Synthesize RTL

The Synthesize process starts. The progress bar in the Commands pane of the RTL Design Flow Manager dialog box displays the progress.

On completion of the synthesize RTL process, the progress bar changes color to one of the following:

Green To indicate that AMBA Designer synthesized the RTL successfully.

Red To indicate that AMBA Designer failed to synthesize the RTL.
Click **Details** to open the Output Window pane to display information about the status of the process.

6. Click **Exit** to close the RTL Design Flow Manager dialog box.

2.2.7 How to add components to the Component Library

This section describes how to add a generated component to the Component Library.

Note

Before you can add the component to the library, you must generate the component RTL. See *How to generate RTL for a component* on page 2-9.

To add a component to the Component Library:

1. Right-click the component to display the context-sensitive menu.
   Figure 2-13 on page 2-14 shows the component context-sensitive menu.

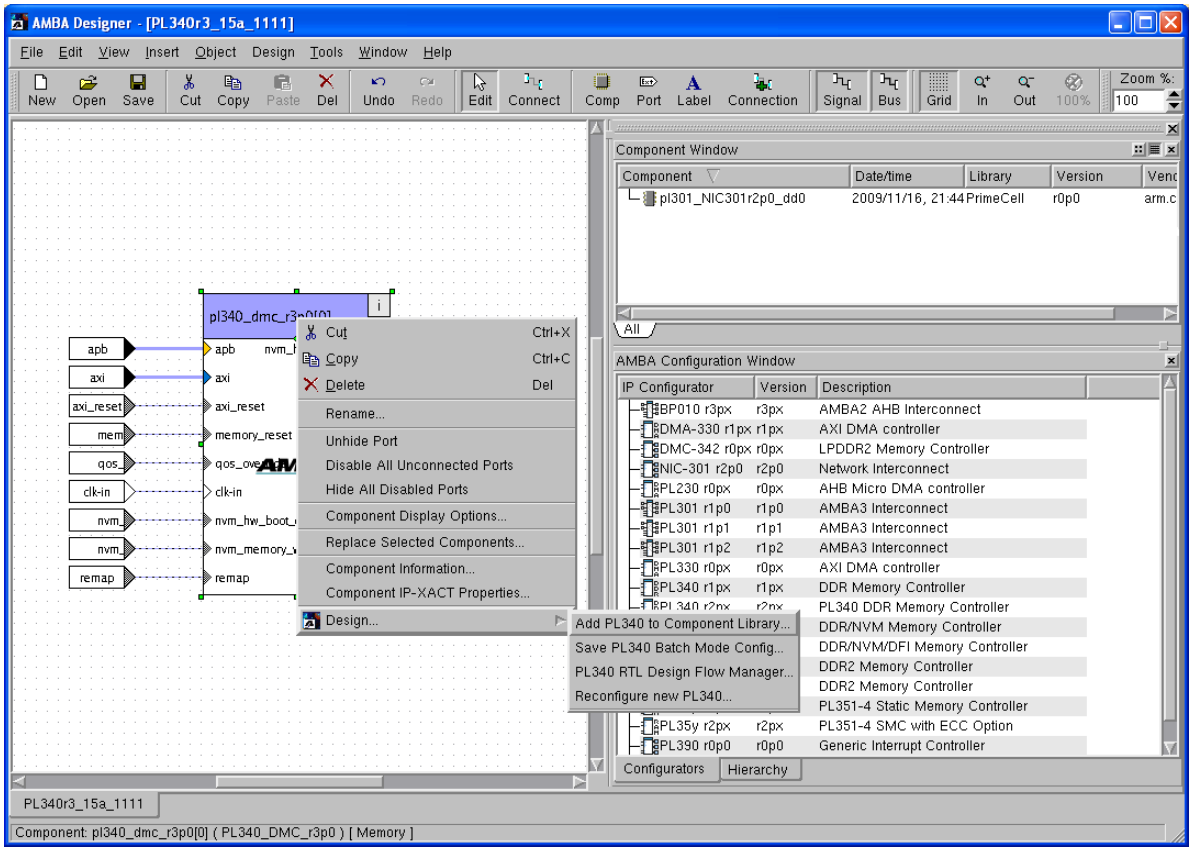


Figure 2-13 Example addition of component to library

2. Select **Design → Add <*component_name*> to Component Library...** from the context-sensitive menu.

   Dialogs appear that show the status of the process. The dialogs disappear with no error messages and the component appears in the Component Window on successful completion.

For information about how to use components, see *Using components* on page 3-31.

2.2.8 How to add configured components to the design

To add a component to a system, either:

- Choose a component in the Component Window and drag it into the Diagram Window.
- Use the Diagram Window context-sensitive menu as follows:
  1. Right-click the Diagram Window to open the context-sensitive menu.
  2. Select **Add Component...** from the list to open the Select Component dialog box. See Figure 2-14 on page 2-15.

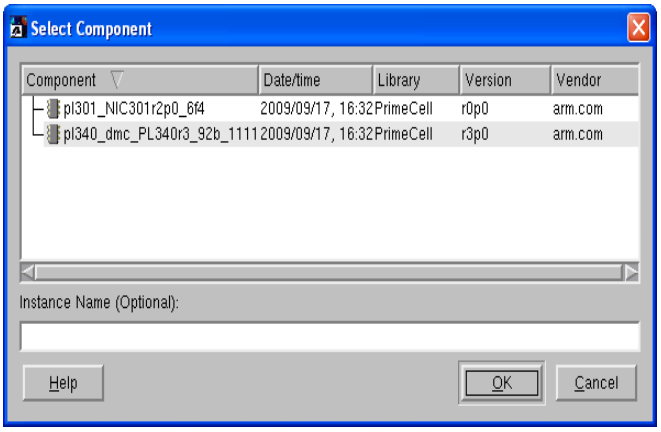


Figure 2-14 Select Component dialog box

3. Choose a component from the list. You can type a name for the component in the Instance Name (Optional): field.
4. Click **OK** and then position the component in the Diagram Window.

- Select **Insert → Add Component...** on the main menu and use the Select Component dialog box to add your chosen component.

2.2.9 How to add connections

To add connections between components, either:

- click **Connect** on the main toolbar
- select **Insert → Add Connection...** on the main menu to display the Create IP-XACT Connection dialog box.

To add connections using the main toolbar:

1. Click **Connect**.
2. Click the start port and then click the end port for each connection.

   If you connect the wrong ports together, immediately select **Edit → Undo** in the main menu to remove the connection.

   Figure 2-15 on page 2-16 shows the port connections for this system.

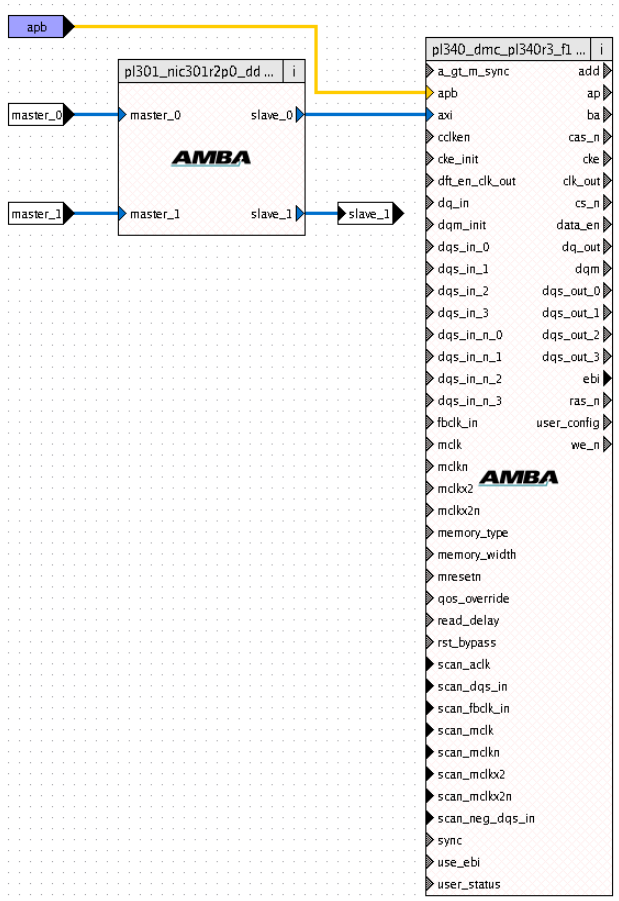


Figure 2-15 Connected system

3. Select **File → Save As...** from the main menu to open the Save As... dialog box.
4. Enter a name in the Project Name field of the Save As... dialog box. See Figure 2-16.

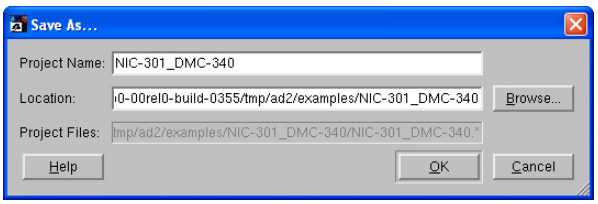


Figure 2-16 Save As... dialog box

5. Click **OK** to close the Save As... dialog box.

Note

The canvas also supports ad-hoc connections and port tie-offs for IP-XACT 1.4 components. See *Making connections between components* on page 3-36 for more information.

2.2.10 How to stitch components

To stitch the IP of a number of components together to create a system, perform the following steps:

Note

You can only stitch one component system at a time.

1. Create external ports for all connections that are to be brought up to the top-level during stitching.

   To create an external port, right-click on a component port and select **Create External Port** from the popup menu. See Figure 2-17.

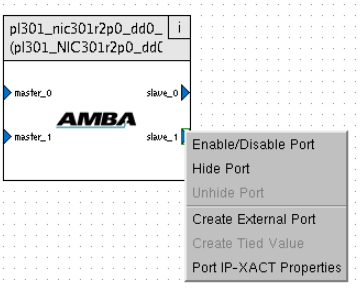


Figure 2-17 Create an External Port

   An appropriately named external port connector and connecting wire are automatically connected to the component port. See Figure 2-18.

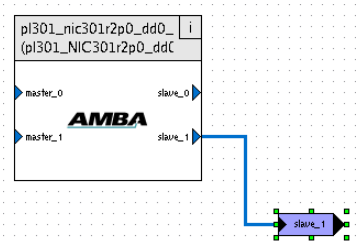


Figure 2-18 External Port connection

   To complete the action, drag the external connector to the position you require and left-click. To cancel the action, press Esc any time before left-clicking.

   Note

   If you want to bring all the unconnected signal ports in the system up to the top-level, select **Export all unconnected** in the AMBA Designer - RTL Design Flow Manager Preferences dialog box. See *IP-XACT_Stitching tab* on page 3-44.

2. Save your design.

3. On the main menu, select **Design → IP-XACT RTL Stitching...**. See Figure 2-19.

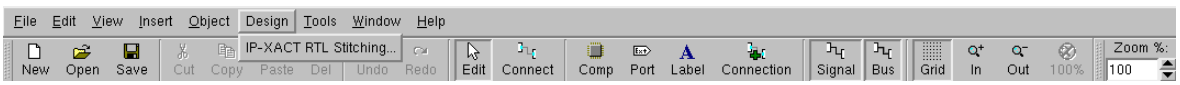


Figure 2-19 IP-XACT RTL Stitching menu item

AMBA Designer displays the AMBA Designer - RTL Design Flow Manager dialog box. See Figure 2-20 on page 2-18.

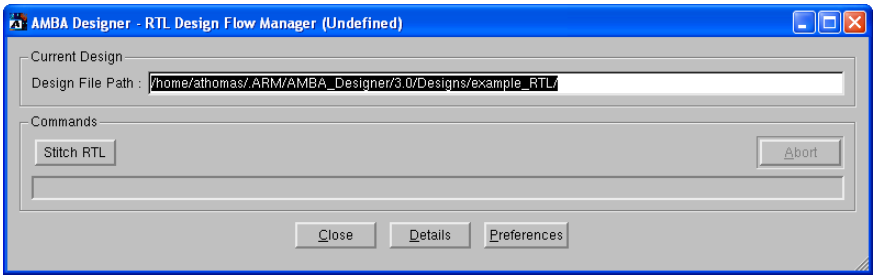


Figure 2-20 IP-XACT RTL Stitching process

4. Click **Preferences** to open the RTL Design Flow Manager Preferences dialog box. See Figure 2-21.

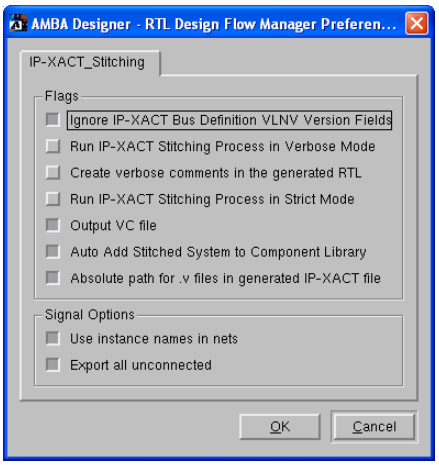


Figure 2-21 RTL Design Flow Manager Preferences dialog - IP-XACT_Stitching tab

Either accept the default IP-XACT stitching preferences or make the necessary changes using this dialog box. See *IP-XACT_Stitching tab* on page 3-44 for more information about the flags and options.

To close the RTL Design Flow Manager Preferences dialog box and save your preferences, click **OK**. To close the dialog box without changing preferences click **Cancel**.

5. In the AMBA Designer RTL Design Flow Manager dialog box, click **Stitch RTL** to start the process.

Note

If you close the dialog box during RTL stitching by using the **Abort** or **X** buttons, the system being stitched, if present, is removed from the Component Library. If the system is not present, no action is taken.

The AMBA Designer - RTL Design Flow Manager dialog box contains the following information:

- the path name to the design file
- a progress bar that indicates:
  - progress, with a moving black bar
  - successful completion, with a solid green bar
  - unsuccessful completion, with a solid red bar.

  To see more information, click **Details**.

6. Click **Close** to close the AMBA Designer - RTL Design Flow Manager dialog box.

Note

If the **Auto Add Stitched System to Component Library** flag is selected in the **IP-XACT_Stitching** tab, then when you close the dialog box, the system is automatically added to the Component Library. Otherwise, no action is taken.

The IP stitching feature generates reports in the following directory during the stitching process:

`/home/<user>/.ARM/AMBA_Designer/<x>.<y>/Designs/`

Where *<x>* is the major revision number and *<y>* is the minor revision number of AMBA Designer, for example, `3.0`.

The reports depend on the components that you include in your design.

See *IP-XACT stitching* on page 3-44 for more information.

2.3 Batch mode operation

AMBA Designer supports batch mode operation so that you can start regression tests without using the GUI.

When you initially invoke the RTL generation process of the RTL Design Flow Manager, it creates an XML configuration file for the configured AMBA component. The RTL generation process then creates the RTL based on the information that the XML file contains. AMBA Designer creates the XML file in a directory under the `Designs` directory. See Figure 2-22.

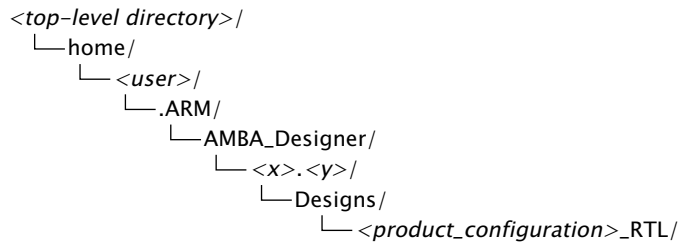


Figure 2-22 Location of XML file

In Figure 2-22, *<x>* represents the major revision number and *<y>* represents the minor revision number of AMBA Designer, for example, `3.0`.

During batch mode, AMBA Designer uses the XML configuration file to perform any of the following functions:

- Generate RTL
- Generate RTL and simulate
- Generate RTL and synthesize
- Generate RTL, simulate, and synthesize.

You can choose:

- the simulator that AMBA Designer uses
- whether or not to enable OVL assertions
- whether or not to use LEC.

See *Batch mode usage and commands* on page 2-21 for a description of batch mode commands.

2.3.1 Saving a batch mode configuration file

Batch mode requires a batch mode configuration file. For each generated component for a configuration, AMBA Designer can save a configuration file for batch mode in XML format.

To generate a configuration file for batch mode:

1. Configure the IP using the Configurator Window. See *How to create and configure components* on page 2-6.
2. Select **Save AMBA Designer Batch Mode XML Configuration File** from the context-sensitive menu of the component.

Note

This option is only available if the AMBA Designer license feature is present.

2.3.2 Batch mode usage and commands

The AMBA Designer batch mode command `-b` covers all supported IP. The syntax is:

`adcanvas -b <filename> [options]`

Table 2-1 lists the available command line options.

Table 2-1 Command line options

Option	Example usage	Description
`--background color`	`adcanvas --background 8000`	Set the default background color and an application palette. Light and dark shades are calculated based on the new palette.
`--button color`	`adcanvas --button 8000`	Set the default button color.
`--cmap`	`adcanvas --cmap`	Install a private color map on an 8-bit display.
`--display display_option`	`adcanvas --display $DISPLAY`	Set the X display. The default is `$DISPLAY`.
`--font new_font`	`adcanvas --font arial`	Set the application font.
`--foreground color`	`adcanvas --foreground 8000`	Set the default foreground color.
`--geometry new_geometry`	`adcanvas --geometry new_geometry`	Set the client geometry of the main window.
`--maxlib component library`	`adcanvas --maxlib mymaxlib.conf`	Start Canvas with the specified library file loaded.
`--ncols count`	`adcanvas --ncols 216`	Limit the number of colors allocated in the color cube on an 8-bit display. If the count is 216, a 6×6×6 color cube is used, that is, six levels of red, blue, and green. For other values, the system uses a cube approximately proportional to a 2×3×1.
`--visual Truecolor`	`adcanvas --visual Truecolor`	Force the application to use TrueColor on an 8-bit display.
`-b`	`adcanvas -b -product <filename> [options]`	Start Canvas in batch mode. `product` is the product code for an AMBA component. See the *AMBA Designer (ADR-301) Release Note* for the list of product codes.
`-gen`, `-generate`	`adcanvas -b -product <filename> [-gen]`	Generate RTL only.
`-sim`, `-simulate`	`adcanvas -b -product <filename> [-sim]`	Generate RTL and simulate.
`-syn`, `-synth`, `-synthesise`	`adcanvas -b -product <filename> [-syn]`	Generate RTL and synthesize.
`-all`	`adcanvas -b -product <filename> [-all]`	Generate RTL, simulate, and synthesize. This is the default behavior.
`-ovl`, `-noovl`	`adcanvas -b -product <filename> [-ovl]`	Enable or disable OVL assertions during simulation. The default is to use predefined preferences.
`-lec`, `-nolec`	`adcanvas -b -product <filename> [-lec]`	Enable or disable LEC of synthesized netlist against RTL. The default is to use predefined preferences.
simulator	`adcanvas -b -product <filename> [options]`	Select simulator. See Table 1-1 on page 1-5 for the simulator options.

Table 2-1 Command line options (continued)

Option	Example usage	Description
-n, --nomaxlib	adcanvas --nomaxlib adcanvas –n	Start Canvas without loading any components.
-v or --version	adcanvas --version	Print the version of the tool without starting it.
<*filename*>	adcanvas *mySystem.adg*	Start Canvas with the specified file open. The specified file must be a *.adg file.
-h, --help	adcanvas --help	Print the usage information.

Chapter 3
Canvas Reference

This chapter provides a reference for AMBA Designer Canvas. It contains the following sections:

3.1 About Canvas

AMBA Designer Canvas is a graphical application that you can use to create new systems and load and modify existing systems.

A system can consist of connected components and previously created systems. You create and edit systems using the Canvas interface. This interface shows the components, ports, and connections between the ports. You can add external ports for a system, and add labels to annotate the diagram. Figure 3-1 shows the main Canvas window.

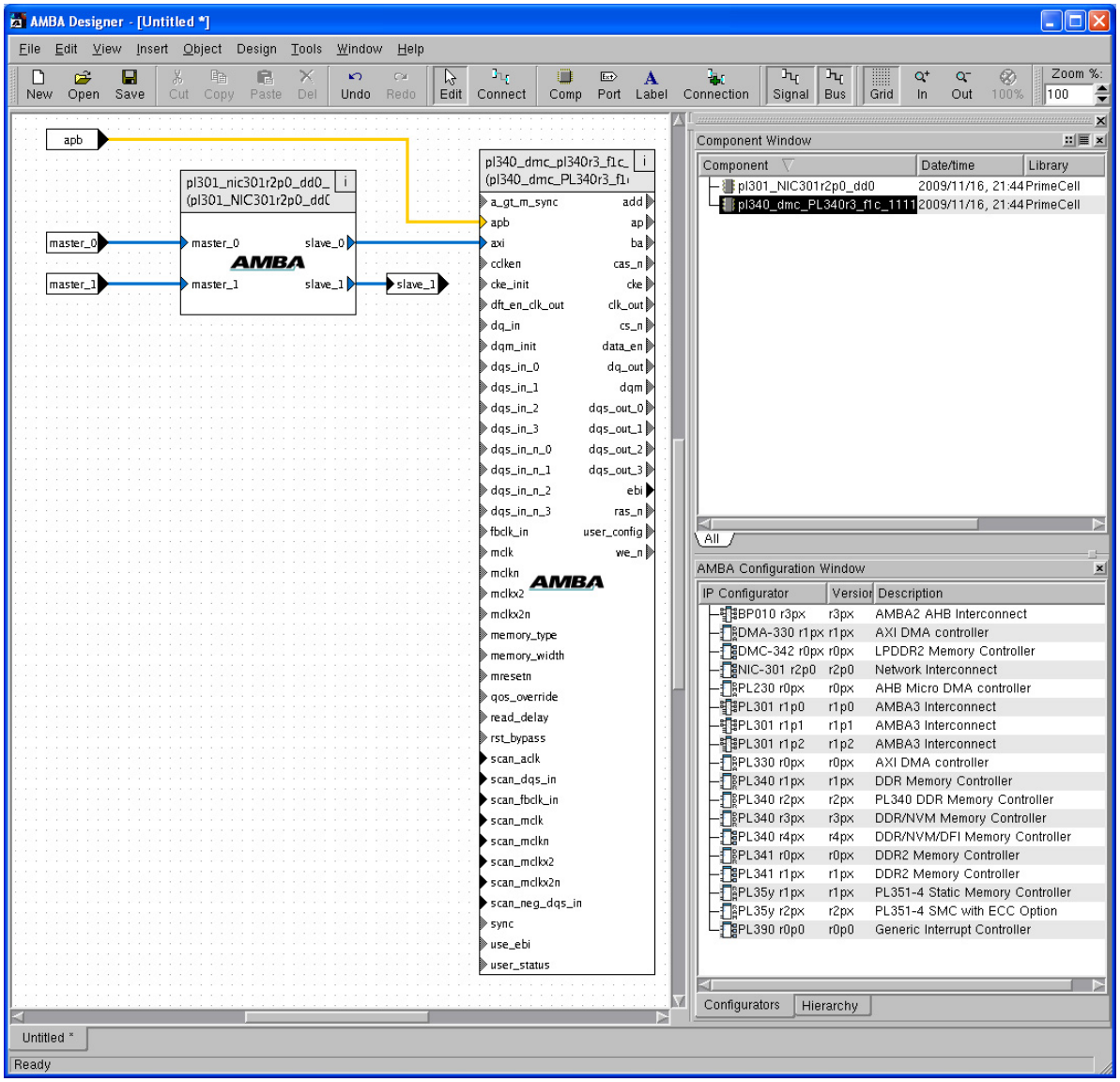


Figure 3-1 Combined Canvas window

Typically, to create a system:

1. Drag components from the Component Window to the Diagram Window. You can also right-click a space in the Diagram Window and select **Add Component** from the context-sensitive menu. See:
   - *Component Window* on page 3-19
   - *Using components* on page 3-31.

2. Connect the components ports together. See:
   - *Making connections between components* on page 3-36
   - *Using components* on page 3-31.
3. Optionally, improve the appearance of the design by moving the component position, rerouting the connections, or adding informative labels. See:
   - *Making connections between components* on page 3-36
   - *Using components* on page 3-31.

3.1.1 Window layout

Table 3-1 shows the main parts of the GUI.

Note

You can select the windows that appear. Not all windows appear in the default view. See *Window menu* on page 3-13.

Table 3-1 User interface elements

Element	Description
Main menu	The main menu presents commands with their corresponding keyboard shortcuts.
Toolbar	The toolbar contains buttons for frequently-used features.
Component Window	This window contains a list of all the components available for use in your system.
AMBA Configuration Window	This window contains tabs for AMBA component configurators and the design hierarchy of the components and external ports in the current system.
Parameter Window	This window contains all the parameters of the selected component. **Note** This applies only to legacy components. This window does not display IP-XACT component parameters.
Diagram Window	This window contains a graphical representation of the system.
Output Window	This window appears below the Diagram Window and displays system console output and system check information.
Status Bar	The status bar displays information about menu items, commands, buttons, and components.
Master Output Window	This window shows the complete system console output and system check information from the start of a session.

The Component Window, AMBA Configuration Window, and Parameter Window comprise the Tools Window. See Figure 3-1 on page 3-2.

Note

You can undock the Tools Window from the main Canvas window.

The Output Window displays system console output and system check information. See Figure 3-1 on page 3-2. If required, you can undock the Output Window from the main Canvas window, to make more efficient use of your console space.

Figure 3-2 shows a Diagram Window with an example system.

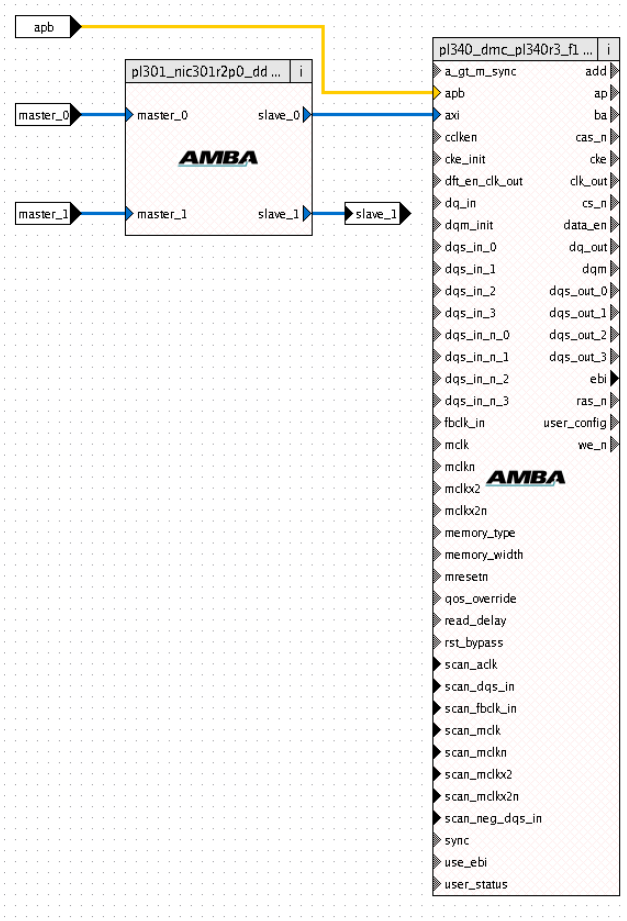


Figure 3-2 Diagram Window with an example system

When you open the Canvas tool, the Diagram Window, Component Window, and AMBA Configuration Window from the Tools Window appear together by default.

Figure 3-3 on page 3-5 shows the Master Output Window with an example of startup information from the console. You access the Master Output Window from the main menu by selecting **Window → Master Output Window**.

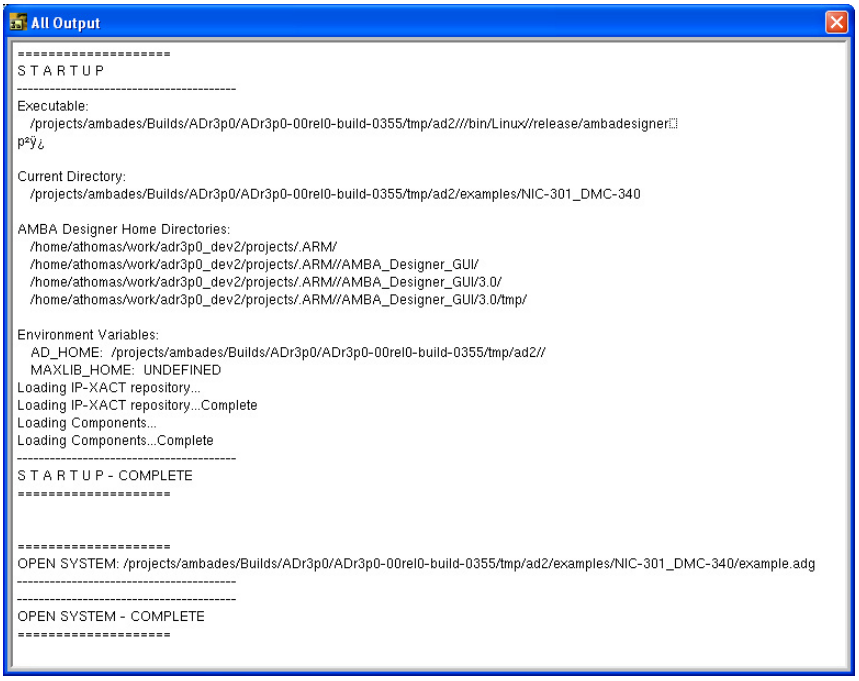


Figure 3-3 Master Output Window

3.2 Canvas application window

This section describes the windows and controls on the application window. It contains the following subsections:

- *System menu and controls*
- *Projects tab*
- *Title bar*
- *Main menu and toolbar*
- *Status bar* on page 3-15
- *Diagram Window* on page 3-15
- *Output Window* on page 3-19
- *Component Window* on page 3-19
- *AMBA Configuration Window* on page 3-26
- *Parameter Window* on page 3-28.

3.2.1 System menu and controls

Canvas supports the following standard system menu and controls:

- move
- size
- minimize
- maximize
- restore
- close.

The appearance and function depends on the operating system. See the operating system help for more information about how these work.

3.2.2 Projects tab

The tabs below the Diagram Window list the projects that are currently loaded. If only one project is open, only one tab is displayed. Clicking on a tab displays the Diagram Window and Tools Window for that project.

3.2.3 Title bar

The title bar of the application window contains the name of the application, the name of the current system being edited, and the state of the project. If you modified the system and did not yet save it, an asterisk is displayed to the right of the system name.

3.2.4 Main menu and toolbar

This section describes the main menu and toolbar. It contains the following sections:

- *Toolbar* on page 3-7
- *File menu* on page 3-7
- *Edit menu* on page 3-8
- *View menu* on page 3-9
- *Insert menu* on page 3-10
- *Object menu* on page 3-11
- *Design menu* on page 3-12
- *Tools menu* on page 3-12
- *Window menu* on page 3-13

- *Help menu* on page 3-14.

Figure 3-4 shows the main menu and toolbar.

Figure 3-4 Menu and toolbar

Toolbar

You can use the toolbar buttons for frequent operations instead of using the main menu. The toolbar contains the following button groups:

New, Open, Save Use these buttons to create, open, or save projects.

See *File menu*.

Cut, Copy, Paste, Del

Use these buttons to cut, copy, paste, or delete components.

See *Edit menu* on page 3-8.

Undo, Redo Click **Undo** to cancel the last change you made in the Diagram Window. Click **Redo** to cancel the last Undo.

See *Edit menu* on page 3-8.

Edit, Connect Use these buttons to change the mode for the Diagram Window.

In edit mode, you can use the cursor to select and move components.

In connect mode, you can use the cursor to connect the ports of components together.

Comp, Port, Label, Connection

Use these buttons to specify the type of object that you are adding to the Diagram Window.

Signal, Bus Use these buttons to hide or display the specified ports and connections in the Diagram Window.

Grid Click **Grid** to display or hide the grid in the Diagram Window.

In, Out, 100% Use these buttons to change the zoom level in the Diagram Window.

Zoom % AMBA Designer contains a Zoom % Toolbar that displays the current zoom level and has a spin control that you can use to increase or decrease the zoom level. The Zoom % Toolbar is displayed by default to the right of the main toolbar. You can also select **Zoom Toolbar** from the Windows menu. If the toolbar is not displayed, you can also change the zoom level by selecting **Zoom In** or **Zoom Out** from the context-sensitive menu of the Diagram Window.

File menu

New You can create a new system at any time. If you have already loaded systems, they remain loaded. To redisplay them, select the system from the appropriate project tab.

Open… You can open a previously saved system at any time. If you have already loaded systems, they remain loaded. To redisplay them, select the system from the appropriate project tab.

Close You can close the system at any time. If you have modified the system and not saved it, Canvas prompts you to save the current system.

Save You can save the current system at any time. After you save a modified system, the title bar no longer shows an asterisk.

Save As… You can save the current system under a new name at any time. When you use the standard file Save As dialog box, Canvas prompts you to enter the name of the new system. After you change the system name, the title bar is updated to reflect the new name and saved status.

Note

You can save read-only files under a new name and then load and modify the newly-named system.

Print… You can print the contents of the Diagram Window. Use the Print dialog box to select your printer configuration.

Preferences…

The Preferences dialog box enables you to configure and customize all the AMBA Designer features.

See *AMBA Designer Preferences dialog* on page 3-50.

File list Canvas displays a list of the recently opened `*.adg` project files near the bottom of the file menu. Select a file to reopen the project.

Exit Exit Canvas. If you have modified the system and not saved it, AMBA Designer prompts you to save the current system. If you click **Cancel**, Canvas remains open and does not delete the modified system.

Edit menu

Undo, Redo Canvas supports the standard undo and redo editing features. The menu item shows what type of undo or redo is available. For example, if you cut a component out of the diagram, the undo menu item shows **Undo – Cut Component**. There are no limits to the number of undo or redo actions other than the operating system limitations.

Note

Undo and **Redo** do not support:

- external port creation, deletion, or connection
- **Hide Port**, **Unhide Port**, or **Disable Port** options
- changes made to user preferences.

Cut, Copy, Paste, Duplicate, Delete

Canvas supports the standard cut, copy, paste, duplicate, and delete editing features. You can only paste connections if the two ends of the connection are part of the pasted, cut, or copied selection. For example, if you copy one component and its connections, you can only paste the component itself.

Select All This option selects all the objects in the diagram.

Edit Mode, Movement Mode, Connect Ports Mode

AMBA Designer operates in the following modes:

- Edit Mode for normal editing, for example, adding, moving, cutting, copying, pasting, and deleting.
- Movement Mode for moving the system around within the Diagram Window using the mouse.
- Connect Mode for connecting ports of components and external ports.

  Note

  To exit Connect Mode and return to Edit Mode, press Esc. To temporarily enter Connect Mode while in Edit Mode, hold down Shift, with no component selected, and make a connection.

The cursor appearance changes to indicate the mode. In Connect Mode for example, moving the cursor over a valid connection port outlines the port in a green shaded pattern, and the cursor changes to the connect icon.

View menu

This menu controls the view options such as the zoom, grid, and display options.

Signal Connections, Bus Connections

These options toggle the display of the specific connection type. When off, the ports and connections are not displayed.

You can also toggle the display by clicking **Signal** or **Bus**, in the toolbar.

Grid This option toggles the display of the grid.

You can also toggle the display by clicking **Grid** in the toolbar.

Note

The movement of objects is bound by the Snap to Grid flag, not the display of the grid.

Grid Options…

Figure 3-5 shows the Grid Options dialog box with the default values.

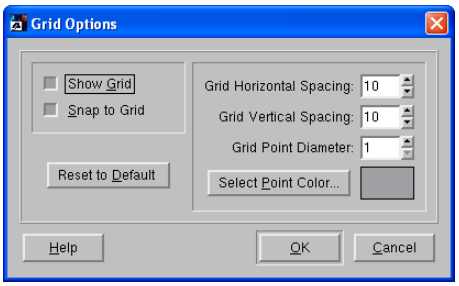


Figure 3-5 Grid Options dialog box

The Grid Options dialog box contains the following options:

Show Grid

Show the grid in the diagram with the specified options.

Default = off.

Snap to Grid

When moving or resizing, snap the object to the grid boundary.

Default = on.

Grid Horizontal Spacing, Grid Vertical Spacing

The horizontal and vertical distance between grid points, in pixels, with a zoom of 100%.

Default = 10.

Grid Point Diameter

The diameter of the grid points in pixels with a zoom of 100%.

Default = 1.

Select Point Color…

The color of the grid points. Click **Select Point Color...** to display the Select color dialog box. You can choose a basic color or define your own custom color for the grid points.

Default = gray.

Reset to Default

Click **Reset to Default** to reset all the values back to the default settings.

Zoom In, Zoom Out

These options zoom in and out of the diagram. The step size change depends on the current zoom level.

Set Zoom to 100%

Resets the zoom level to the default of 100%.

Zoom to Fit Sets the zoom level so that the entire diagram fits into the Diagram Window.

Set Zoom… Opens the Set Zoom dialog box that enables you to set the amount of zoom. You can set the zoom in the range 10%-500%.

Center on Selected Object(s)

Centers the Diagram Window over the selected object or objects.

Center Diagram

Centers the Diagram Window over the center of the system component.

Insert menu

Add Component…

Displays the Select Component dialog box that contains all the available components that you can add to the diagram.

See *Adding a component to the Diagram Window* on page 3-32.

Add External Port…

Opens the External Port dialog box. Use this dialog box to name and specify the type of port to add. The tools remember the last port and type of port you select so that the next time the dialog box opens, it displays your previous choice.

See *Adding an external port to a system* on page 3-41.

Add Label Sets the mouse cursor to a default label. To add a label, move the label to the location you require, and left-click. Canvas displays the Label Properties dialog box to enable you to change the label text and properties.

See *Label Properties dialog* on page 3-63.

Add Connection...

Opens the Create IP-XACT Connection dialog box. To add a connection, select the component instances and the ports to be connected using the drop-down lists. You can choose to:

- include only unconnected ports in the drop-down lists
- generate the connection name automatically or enter your own.

See *Create IP-XACT Connection dialog* on page 3-65.

Object menu

Auto Route Connection

Removes any points you placed manually, or any line segment end points you moved manually from the connection, and reroutes the connection using the auto-routing features.

Mirror External Port

Switches the direction of drawing the external port. However, it does not reverse the signal direction, so a master port remains a master port.

See *External ports* on page 3-40.

Enable/Disable Port

In some cases, you might not use certain ports, or you might not require connections to certain ports. Because the tools check that all ports are connected, these ports cause an error or warning message. Using this option, you can disable such ports and avoid the error or warning messages. Canvas displays a disabled port in gray.

Hide Port, Unhide Port

Hide Port disables the selected port and makes it invisible in the Diagram Window. To recover a hidden port, select **Object → Unhide Port**.

Component Display Options…

AMBA Designer contains the following options for displaying components:

- **Display Title Bar**
- **View Component Name**
- **View Logo**.

The component name option affects how the title bar portion of the component appears. Figure 3-6 shows an ARM component with all options enabled.

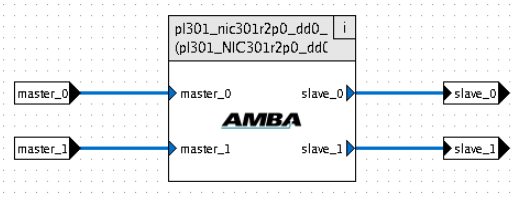


Figure 3-6 All component display options enabled

Figure 3-7 on page 3-12 shows the ARM component with all display options disabled.

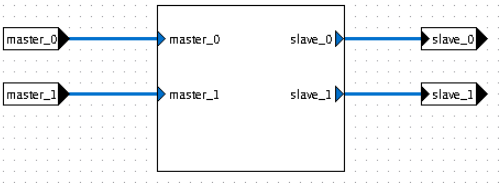


Figure 3-7 All component display options disabled

Rename… Opens a dialog box in which you can enter a name for the object. Each object in the system must have a unique name. The system checks that the name of the object is unique, and notifies you if it is not.

Component Information…

Opens a Component properties information box listing the component name and library path.

Design menu

IP-XACT RTL Stitching...

Opens the RTL Design Flow Manager dialog box for RTL stitching. See Figure 3-8.

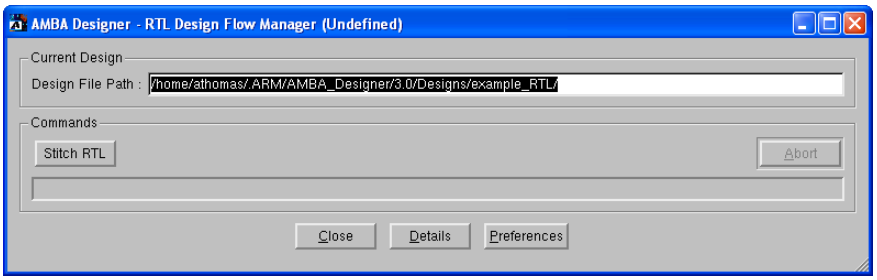


Figure 3-8 IP-XACT RTL Stitching process

See *How to stitch components* on page 2-17 for details of the stitching process.

Tools menu

Auto Route All Connections

Performs the autoroute for every connection in the diagram.

IP-XACT Connections...

Lists all of the IP-XACT connections in the system.

Add IP-XACT Component to Component Library...

Opens the Component Library Repository Wizard that Figure 3-9 shows.

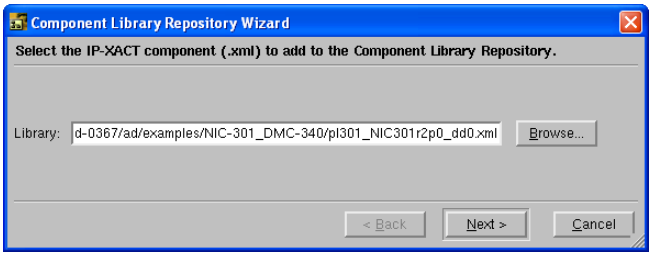


Figure 3-9 Component Library Repository Wizard

Enter or browse to the directory where the IP-XACT (`xml`) source for the component is located and click **Next** to display the next dialog box in the Wizard. Select the Component Library Repository to add the component to. You can choose to enter either the absolute or relative path to the Component Library Repository location or click **Browse** to locate it. See Figure 3-10.

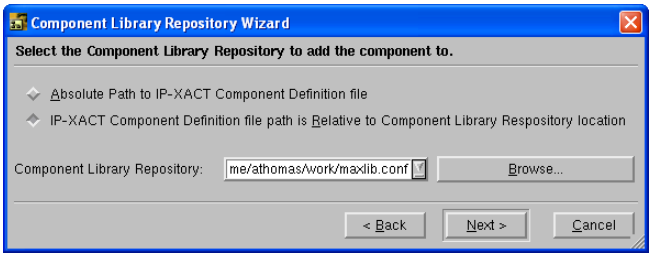


Figure 3-10 Component Library Repository selection dialog box

Click **Next** to display the next dialog box in the Wizard. This provides a summary of the source and destination to be used. See Figure 3-11.

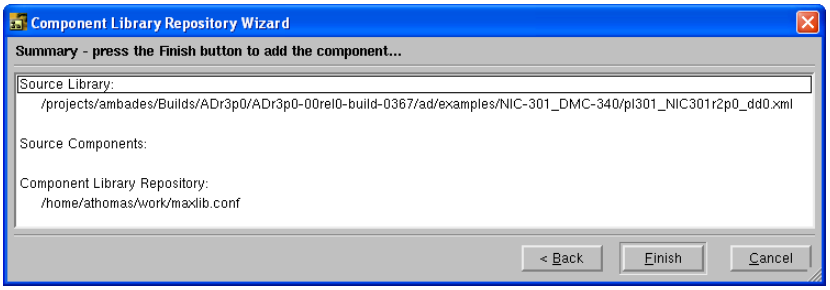


Figure 3-11 Component Library Repository summary dialog box

If the details are correct, click **Finish** to add the IP-XACT component to the Component Library. If it is necessary to change any entries, click **Back** to display the required dialog box. You can cancel the Wizard at any time by clicking **Cancel** in any of the dialog boxes.

Note

If the destination is a new Component Library, you are given the option to add the library to your preferences.

Manage Component Library…

Opens the Component Library category of the Preferences dialog box. See:

- *File menu* on page 3-7
- *General Component Library preferences* on page 3-55.

Window menu

Main ToolBar, Zoom ToolBar

The **Main ToolBar** option toggles all toolbars on or off. The **Zoom ToolBar** option toggles the zoom toolbar on or off.

Tools Window, Component Window, Hierarchy Window, Parameter Window

These options toggle the specific tool window on or off.

Note

The **Hierarchy Window** option toggles the display of the AMBA Configuration Window.

The **Tools Window** option shows or hides all selected tool windows. This option must be on to enable you to view any of the tool windows.

Output Window

Toggles the Output Window for the current system on or off.

Master Output Window

Opens a separate dialog box that shows all the output of all the systems in a single window.

Next Window, Previous Window

If more than one project is open, use these options to navigate between them.

Help menu

Help Enables you to choose from a list of PDF files to open with Acrobat Reader, depending on the add-ons you have licensed. The *AMBA Designer (ADR-301) User Guide* PDF file is always present in the list. When you click **Help** and select one of the files from the list, Acrobat Reader opens the file in a new window. If you press F1, or select the help option anywhere within the AMBA Designer tool, Acrobat Reader opens the *AMBA Designer (ADR-301) User Guide* document. Figure 3-12 shows an example of the Help menu options.

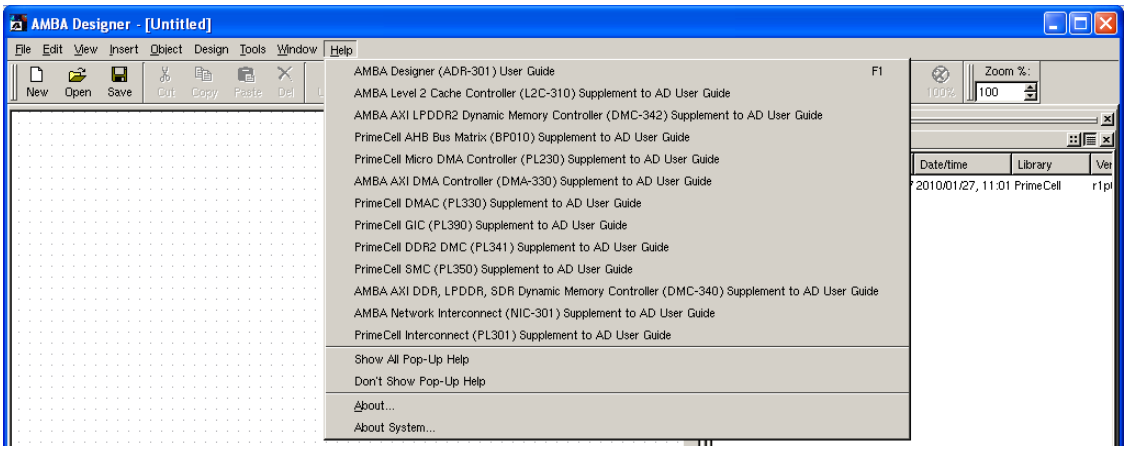


Figure 3-12 Help menu options

Note

If a document that you click on is not located in the `$AD_HOME/doc/` directory, AMBA Designer issues an error message stating that it cannot find the document.

Show All Pop-Up Help

This option resets all the flags to show all the pop-up help that you have turned off.

Don't Show Pop-Up Help

This option sets all the flags not to show any pop-up help.

About… Opens the standard About dialog box to display version and license information.

About System…

This displays information about the tools, Component Library, and system.

3.2.5 Status bar

The status bar displays information about menu items, toolbar buttons, and objects under the mouse cursor.

If you:

- Select a menu on the menu bar and use the up and down keys to select a menu item, Canvas displays a short description of what the action does in the status bar.
- Place the cursor over a toolbar button, Canvas displays a short description of the button action in the status bar.
- Place the cursor over a component in the Diagram Window, the status bar shows the instance name, the component name, and the type of component. See Figure 3-13.

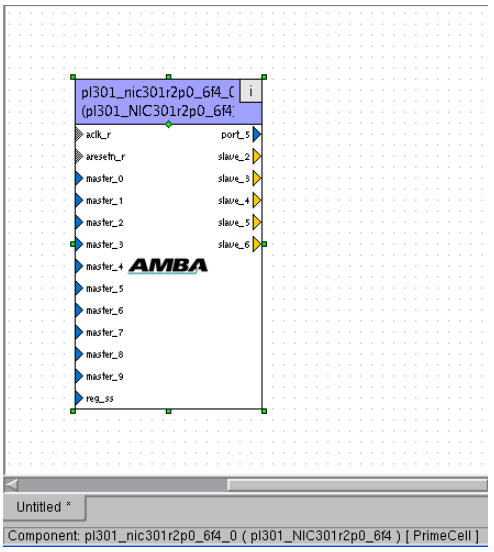


Figure 3-13 Status bar showing component details

3.2.6 Diagram Window

This section describes the contents of the Diagram Window. Figure 3-2 on page 3-4 shows the Diagram Window.

The Diagram Window behaves in a similar way to a block diagram editor, or flow-charting tool. Use this window to:

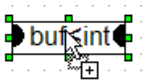
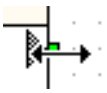
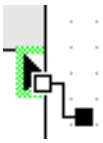
- place components
- place external ports
- connect the objects together.

The Diagram Window displays a view of the total system diagram. If the system is small, the window can display the entire system. For large systems, the view is of a small portion of the total system. There is no limit to the size of the system other than the limits imposed by the operating system or computer hardware.

Mouse cursors, tool tips, and status information

Table 3-2 shows all the cursors that the Diagram Window uses. The cursor column shows what the actual cursor looks like. The typical usage column shows how the cursor looks in typical use.

Table 3-2 Mouse cursors

Cursor	Typical usage	Description
	-	This is the standard selection cursor. Moving this cursor over an object and clicking on the object selects that object. You can also use this cursor to lasso multiple objects.
		This is the drag-and-drop cursor. If the component is in the Diagram Window, Canvas displays the object under the cursor.
	-	This is the cursor for movement mode.
		This is the general cursor for actions that are invalid or not applicable.
		This is one of the eight resize cursors. There is one cursor for each of the compass points and corners.
		This is the cursor for selecting ports. Clicking on a port of a component selects that port and deselects all other ports.
		This is the start connection cursor. If in connection mode, before you start a connection, this cursor appears when over a valid port.
		This is the end connection cursor. When you have started a connection and not yet completed it, this cursor appears over a valid end port.
		This cursor appears when you move a connection end point. This cursor appears when you select and place items.
		This is the move connection line cursor. This cursor appears when you select points and manually place them.

Canvas displays the standard tool tips and status information in the Status Bar whenever you select a menu item using the up-down keys, or hover the cursor over a toolbar button. Hovering the cursor over an object in the Diagram Window displays detailed information in the Status Bar.

Scroll bars and scrolling the view port

The part of the scroll bar that moves is called the puck. The size of the scroll bar pucks for the Diagram Window is proportional to the amount of total system diagram within the view port, plus an amount equal to half the view port width around the edge of the system. You can quickly scroll the system mostly off the edge of the view port and add new objects into the empty portion revealed around the edge.

When you use the scroll bars to scroll the view port, Canvas continuously repaints the view.

Moving the view port

When Canvas is in Movement Mode, left-click and hold the mouse to move the view port within the system diagram. The limits to the movement are the same as the limits for the scroll bars. The scroll bars track the movement.

If Canvas is in edit mode, press and hold Ctrl to temporarily switch to movement mode.

Zoom

You can zoom the diagram in or out within the range of 10%-500%. When zooming out, the contents of the components change as the size of the components become smaller. Canvas attempts to display the most important information about objects when zooming out. You can hover the mouse cursor over an object to display its name in the status bar.

To access the zoom feature, press Shift + Ctrl, and use the left or right mouse buttons to zoom in or out.

Selecting objects

To select a single object, left-click the object in the Diagram Window. To select multiple objects, make selections while holding down Ctrl.

You can also use the lasso feature to select objects. Click and drag the mouse to select all objects within the lasso rectangle. Canvas includes any object that is partially contained within the bounding rectangle in your selection.

To clear the selection list, click in the background area of the Diagram Window. To remove a single object from the selection list, hold down Ctrl, and left-click the object.

To select all objects, select **Edit → Select All** or lasso the entire system.

Context-sensitive menus

When you right-click in the Diagram Window, a context-sensitive menu appears. The menu depends on what you have selected before you right-click.

If you have not selected a component, the general context-sensitive menu appears. See Figure 3-14 on page 3-18. The entries duplicate the functionality of the main menus.

See *Main menu and toolbar* on page 3-6.

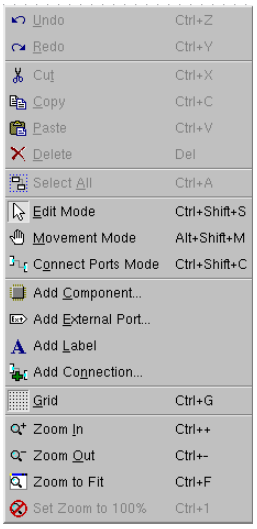


Figure 3-14 General context-sensitive menu for the Diagram Window

If you have selected a component, the component context-sensitive menu appears. See Figure 3-15.

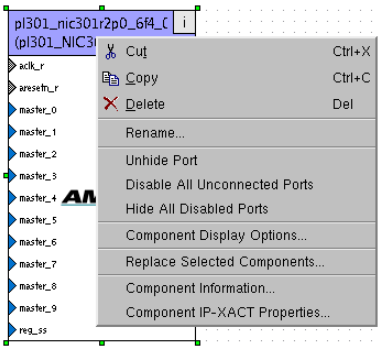


Figure 3-15 Component context-sensitive menu for the Diagram Window

See *Component context-sensitive menu* on page 3-33 for more information.

Display options

You can disable the display of the object type, port list, and sub-component list in the Canvas preferences settings. See:

- *Tools menu* on page 3-12
- *General Appearance preferences* on page 3-54
- *Canvas Appearance preferences* on page 3-58.

Updating tool windows

When you perform an action in one window, all the other windows reflect the action, if applicable. For example, if you select a component in the Diagram Window, the AMBA Configuration Window updates with the selection, and the Parameter Window shows the parameters of the component you selected.

Resizing windows

You can move the vertical separator horizontally between the Diagram Window and the tool windows. You can move the horizontal separators vertically between the individual windows of the tool windows, or between the Diagram Window and the Output Window.

3.2.7 Output Window

Canvas prints log information in the Output Window. The Output Window contains the following tabs:

Output The **Output** tab shows the status and error text related to loading systems or Component Libraries.

System Check The **System Check** tab shows status and error text related to system validation. Select the tab and then select **Tools → Check System** to validate the system. The Output Window might display error messages if, for example, a port is not connected or a library is missing.

3.2.8 Component Window

This section describes the Component Window. This window contains a list of all the available components that you can place in the Diagram Window.

Each component has an icon that best represents the component type and the name of the component. The Component Window can show either an:

Icon view Shows a grid of icons with the component name below the icon. See Figure 3-16.

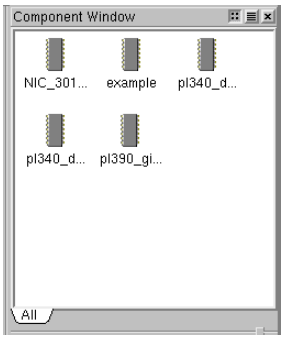


Figure 3-16 Component Window icon view

In Figure 3-17, the `NewP` component has a NOT symbol around the component icon. This indicates that the component is not available for use. This can occur if the component is missing from the Component Library, or AMBA Designer cannot create it.

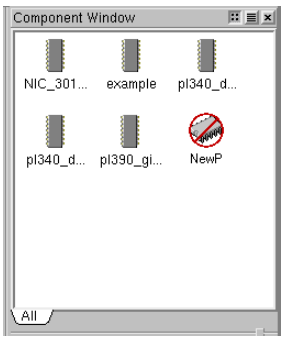


Figure 3-17 Component Window with bad component

List view Shows each component on a single line with the icon and the component name on the left-hand side, and the component type on the right-hand side. See Figure 3-18.

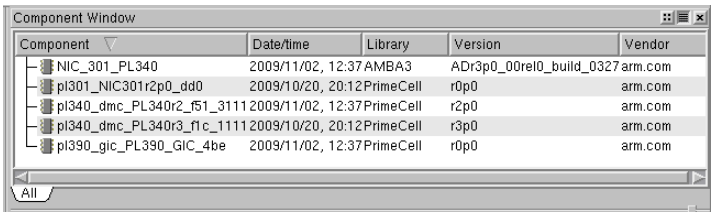


Figure 3-18 Component Window list view

To switch between icon view and list view, right-click in the background, not over a component icon, in the Component Window and select the option you want from the context-sensitive menu. A scroll bar appears if the components do not fit in the current window size. You can also use the buttons in the Component Window title bar to switch between the icon view and list view.

The Component Window, by default, contains a single **All** tab that displays all the available components. You can add additional tabs by using the Component Window Tab Manager. See *Customizing the tabs in the Component Window* on page 3-25.

Drag-and-drop from the Component Window

To drag-and-drop a component from the Component Window:

1. Click the component you want to add to the Diagram Window.
2. Move the component over the Diagram Window to the location you want to add the component.
3. Release the mouse button to add the component to the diagram. Canvas prevents you from dropping a component on top of an object that already exists in the system.

Component Window context-sensitive menu

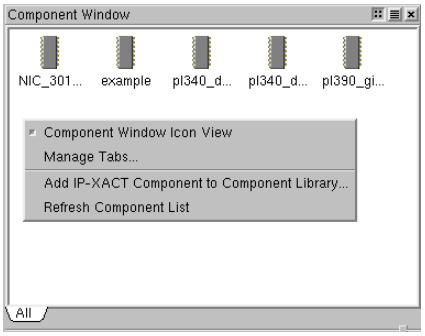


Figure 3-19 Context-sensitive menu for the Component Window

In the Component Window icon view, right-click the background, not over a component icon, to display a context-sensitive menu containing the following options:

Component Window Icon View

Use this to toggle between the icon view and list view for the Component Window.

You can also toggle this view in the AMBA Designer Preferences, and by using the buttons in the title bar of the Component Window.

See *Main menu and toolbar* on page 3-6 and *General preferences* on page 3-50.

Manage Tabs…

Use this dialog box to organize the components using tabbed windows.

See *Customizing the tabs in the Component Window* on page 3-25.

Add IP-XACT Component to Component Library...

This option displays the **Component Library Repository Wizard**.

Use this wizard to add an IP-XACT component to the Component Library Repository.

You can also start the wizard if you select **Tools → Add IP-XACT Component to Component Library...** from the main menu.

Refresh Component List

This option clears the current component list in the Component Window, re-parses the Component Library file, and repopulates the Component Window. Use this to make changes related to the Component Library appear without restarting the tools.

Note

The system diagrams that are currently open are not updated automatically. You must close and reload affected systems to see changes in the Component Library components.

Component context-sensitive menu

Right-click over a component in the Component Window to display the Component context-sensitive menu. Figure 3-20 shows the Component context-sensitive menu.

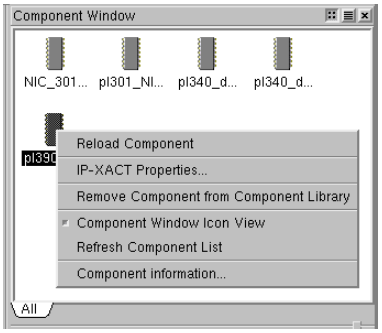


Figure 3-20 Component context-sensitive menu

The Component context-sensitive menu contains the following options:

Reload Component

Select this option to reload the component selected in the Component Window.

Note

Instances of the component in an opened system diagram are not updated automatically. You must close and reload the system to see the new component properties.

IP-XACT Properties...

Select this option to display the IP-XACT Properties dialog box for the selected component. Figure 3-21 shows the IP-XACT Properties dialog box.

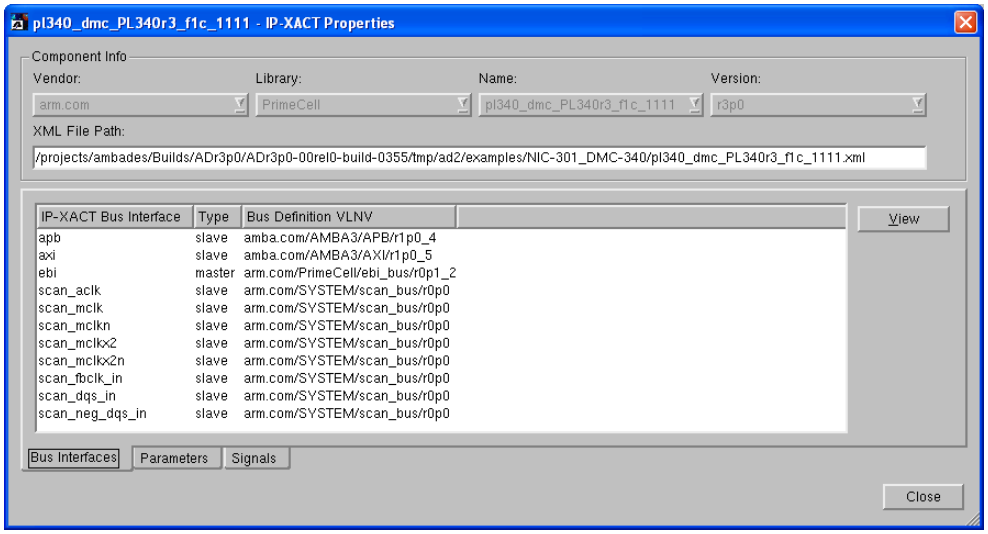


Figure 3-21 IP-XACT Properties dialog box

The Component Info panel provides the following information:

Vendor The company providing the IP-XACT component.

Library The name of the library in which the component is located.

Name The unique name assigned to the generated component.

Version The version number of the component.

XML File Path The absolute path to the directory where the component XML file is located.

The window pane below the Component Info panel contains the following tabs:

Bus Interfaces

This tab provides information about the generic name, type, and the VLNV of the component buses. See Figure 3-22.

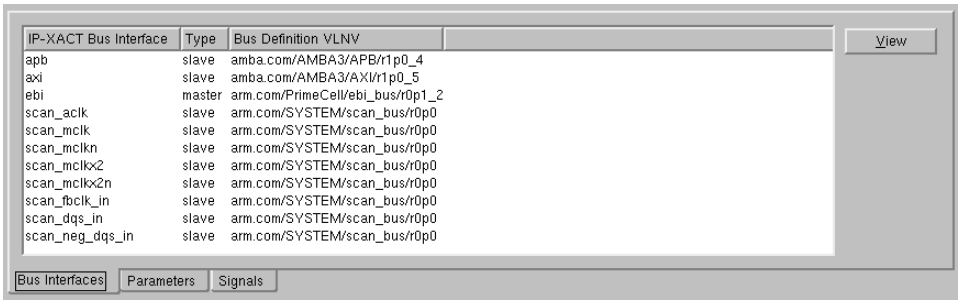


Figure 3-22 IP-XACT Properties Bus Interfaces tab

Select a component bus and click **View** to display the IP-XACT Bus Interface dialog box.

The IP-XACT Bus Interface dialog box lists the specific properties and signal map for the selected bus. See Figure 3-23 on page 3-23.

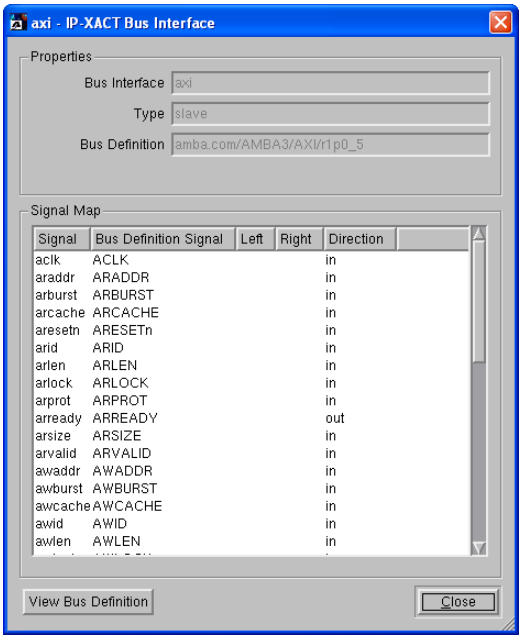


Figure 3-23 IP-XACT Bus Interface dialog box

Click **View Bus Definition** to display the IP-XACT Bus Definition dialog box.

The IP-XACT Bus Definition dialog box lists the generic properties and bus signals for the selected bus. See Figure 3-24.

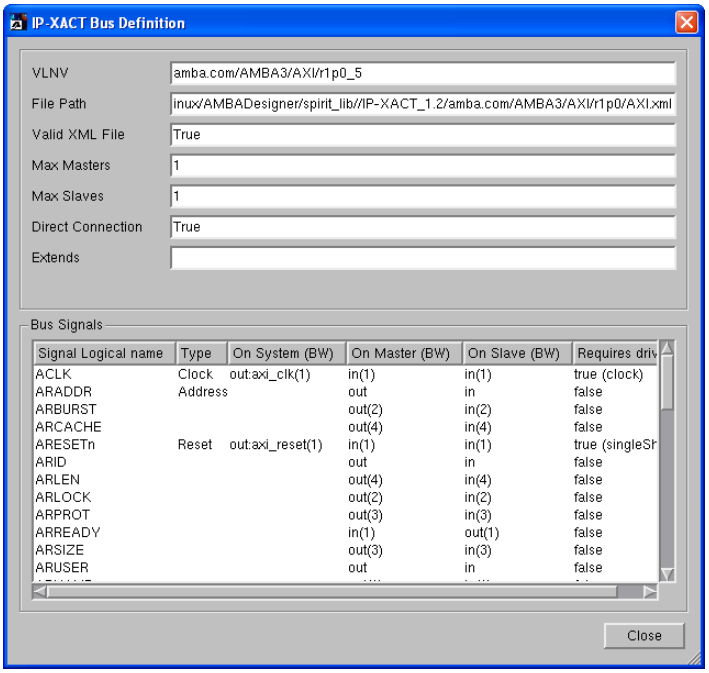


Figure 3-24 IP-XACT Bus Definition dialog box

Parameters

This tab provides information on parameters that have been assigned to the IP-XACT library component. See Figure 3-25 on page 3-24.

The **Parameters** tab lists the IP-XACT Parameter name, Range, and Default Value as applicable.

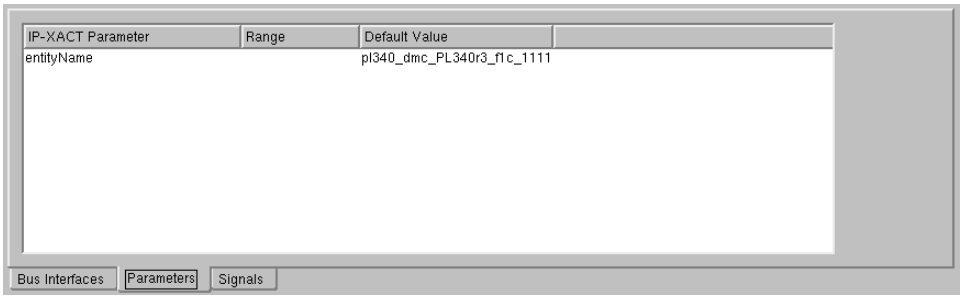


Figure 3-25 IP-XACT Properties Parameters tab

Note

You cannot edit library component parameters. See *Parameter Window* on page 3-28 for information on editing parameters for an instance of a component in the Diagram Window.

Signals This tab provides information about the component signals. See Figure 3-26.

The window lists the component signal name, direction, left and right connection widths, the export state, and whether the signal is assigned to a bus interface. Check the **Show Unassigned Signals Only** option to show unassigned signals only, in the dialog box.

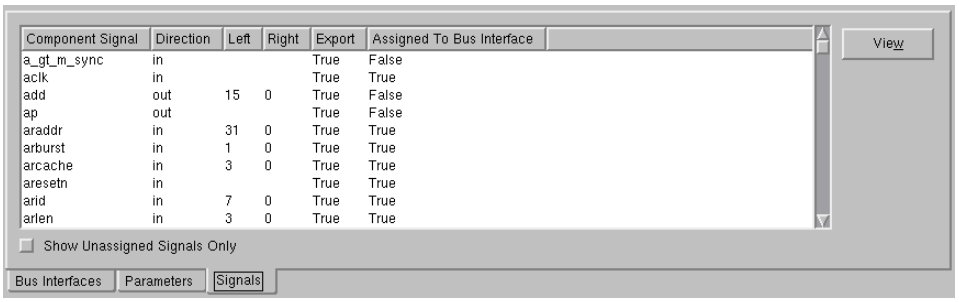


Figure 3-26 IP-XACT Properties Signals tab

Select a component signal and click **View** to display the IP-XACT Signal Mapping dialog box, see Figure 3-27.

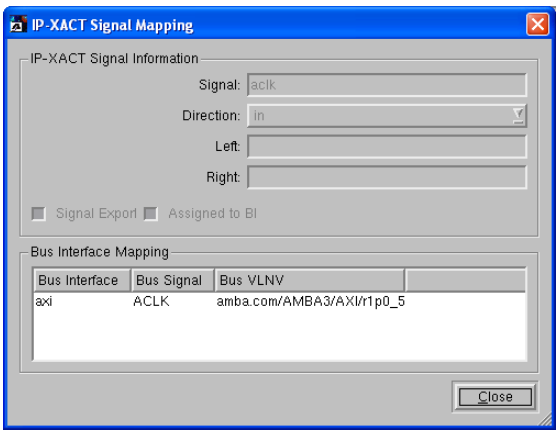


Figure 3-27 IP-XACT Signal Mapping dialog box

The IP-XACT Signal Mapping dialog box contains the following panels:

IP-XACT Signal Information

Provides information about a signal's assigned name, direction, left and right widths, and whether the signal is to be exported and assigned to a bus interface.

Bus Interface Mapping

Provides information about the bus interface to which the signal belongs, the bus signal name within the bus, and the bus VLNV.

Remove Component from Component Library

This option removes the selected component from its Component Library file.

Note

- If multiple components with the same identification exist in the active Component Library files then only the first one is deleted.
- Instances of the component in an opened system diagram are not updated automatically.

Component Window Icon View

Use this switch to toggle between the icon view and list view for the Component Window.

You can also toggle this view in the AMBA Designer Preferences, and by using the buttons in the title bar of the Component Window.

See *Main menu and toolbar* on page 3-6 and *General preferences* on page 3-50.

Refresh Component List

This option reloads the component by rescanning the various Component Library files specified in the Preferences dialog box.

Component information…

Select this option to display the Component properties information box that lists the component name and the library path to the `maxlib.conf` library file.

Customizing the tabs in the Component Window

Canvas enables you to configure the Component Window tabs to organize the components. You can configure each tab to display certain types of components, modify or remove existing tabs, and add new ones. *Component Window* on page 3-19 describes the default **All** tab.

Right-click the background of the Component Window, or next to the tabs, and select **Manage Tabs...** from the context-sensitive menu. See Figure 3-19 on page 3-20.

Figure 3-28 on page 3-26 shows the Component Window Tab Manager which contains the following list views:

- The Window Tabs panel is the left-hand list and shows all the existing tabs. The checkboxes represent the active options.
- The Component Types panel is the central list and shows the component types of the currently-selected tab.

- The right-hand list shows all available component types that do not already appear in the center list view. Canvas generates this list automatically from all components that are currently loaded.

  It is possible to create new component types, for example, to add a component type that you have not yet used to an existing tab. Use the arrow buttons to add and remove component types to the selected window tab.

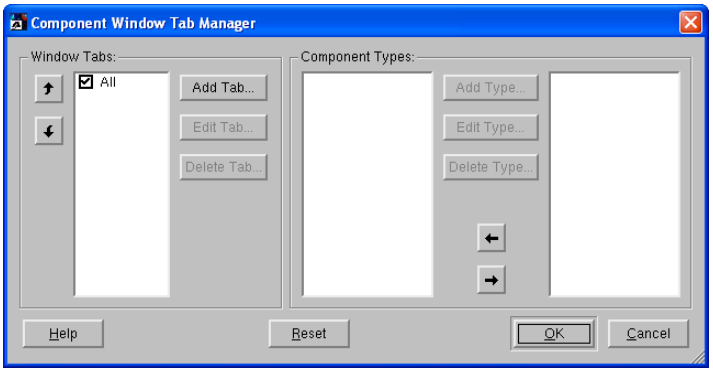


Figure 3-28 Component Window Tab Manager

Use the buttons in the Window Tabs panel to delete existing tabs, edit their names, or create new ones. Use the up and down arrows to change the order of the tabs in the Component Window.

Note

- You cannot edit or delete the **All** tab. You can disable the **All** tab, and any custom tab, so that they do not appear in the Component Window, by unchecking them in the Window Tabs panel.
- Click **Reset** to set the component tabs back to their original configuration. If you have added custom tabs, **Reset** disables them without deleting them.

Component versions

AMBA Designer does not support switching between multiple versions of the same IP-XACT component. To use different versions of the same component, include the version string in the component name to differentiate them. For example, Figure 3-29 shows two versions of the DMC (PL340) in the Component Window.

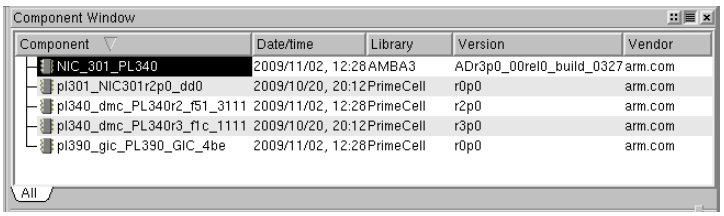


Figure 3-29 Component Window with versions in list view

3.2.9 AMBA Configuration Window

The AMBA Configuration Window contains the following tabs:

Configurators Use this tab to view the list of components available for configuration. See *Configurators tab* on page 3-27.

Hierarchy Use this tab to view the hierarchy of the current design. See *Hierarchy tab*.

Configurators tab

The **Configurators** tab lists all the component configurators that are available for the configuration. This tab shows the IP Configurator, Version, and Description for the components. Click a column heading to sort the list for that column.

The **Configurators** tab contains a context-sensitive menu. To open the context-sensitive menu, right-click an IP Configurator in the **Configurators** tab. See Figure 3-30. Use the context-sensitive menu to view the full Tools Window, undock the Tools Window, or show the Component Window, Hierarchy Window, Parameter Window, and Output Window independently.

Note

The **Hierarchy Window** option toggles the display of the AMBA Configuration Window.

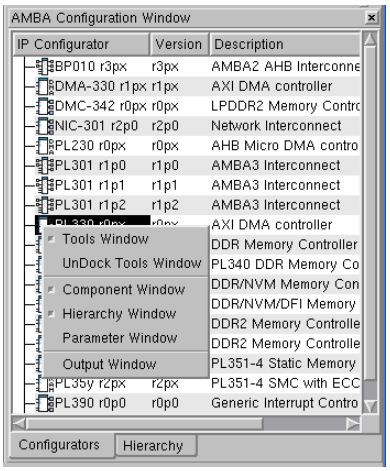


Figure 3-30 Configurators tab context-sensitive menu

Hierarchy tab

The **Hierarchy** tab contains a list of all the components and external ports in the system that the Diagram Window displays. For each component, a sub-list of all the ports and sub-components exists. Selecting an object in the Diagram Window also selects the object in the **Hierarchy** tab.

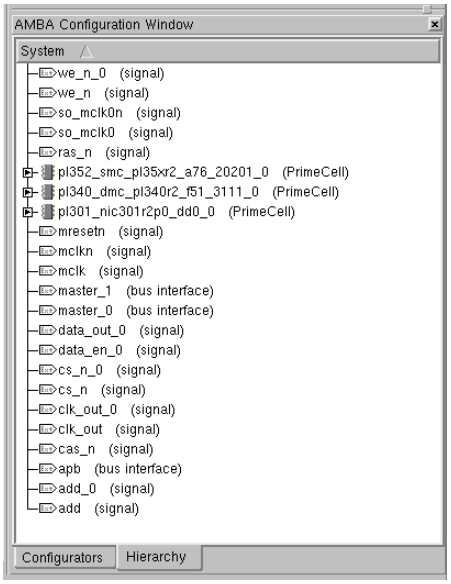


Figure 3-31 Hierarchy tab

Left-click an object in the **Hierarchy** tab to highlight and center the object in the Diagram Window for easy location.

Right-click an object in the **Hierarchy** tab to display a context-sensitive menu containing command options specific to the object type.

Note

The context-sensitive menu displayed is the same as the menu displayed if you click a component in the Diagram Window. See Figure 3-15 on page 3-18.

3.2.10 Parameter Window

The Parameter Window is not displayed by default. To display it, either:

- select **Window → Parameter Window** on the main menu
- right-click in the open area of the AMBA Configuration Window and select **Parameter Window** from the context-sensitive menu.

The Parameter Window contains all the parameters you can edit for the selected legacy component. See Figure 3-32.

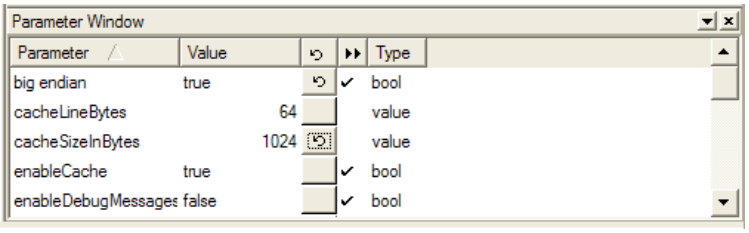


Figure 3-32 Parameter Window

Note

- If more than one object is selected, or the selected object is not a legacy component, the Parameter Window is blank.

- To view the parameters assigned to an IP-XACT component, right-click the component instance in the Diagram Window and select **Component IP-XACT Properties...** from the context-sensitive menu. The assigned parameters for the component are listed in the **Parameters** tab of the IP-XACT Properties dialog box.

The Parameter Window contains the following columns:

- The Parameter column lists all the parameters that you can edit.
- The Value column contains the current values for all the components.
- The default column contains a button to reset the value back to the default value. If the value is currently default, the button is disabled and the window displays a tilde symbol, ~. Otherwise, the button displays **Reset**.
- Parameters that you can edit are represented by a check in the fourth column.
- The Type column indicates whether the parameter is a Boolean or numerical variable.

Note

- To see all the read-only parameters, and parameters that you can edit associated with a legacy component, right-click the component and select **Component Information…** from the context-sensitive menu.
- Not all components contain parameters that you can modify. If you select **Component Information...** for a component that does not have parameters you can modify, AMBA Designer displays the No properties available dialog box.

Editing parameters

For legacy components, display the Parameter Window and double-click the parameter value you want to modify. See Figure 3-32 on page 3-28. Modify the parameter value, and press Enter to accept the value, or press Esc to cancel the change.

For IP-XACT components, right-click the component instance in the Diagram Window and select **Component IP-XACT Properties...** from the context-sensitive menu to open the IP-XACT Properties dialog box. Select the **Parameters** tab. See Figure 3-33.

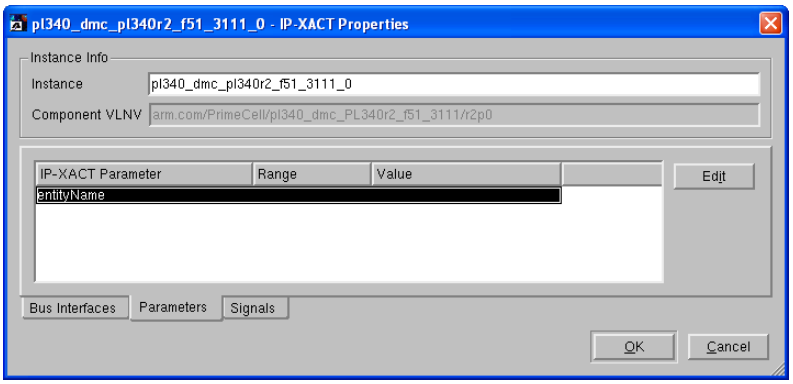


Figure 3-33 IP-XACT Properties dialog box, Parameters tab

Select the parameter to edit and click **Edit**. The Enter IP-XACT Parameter dialog box opens. See Figure 3-34 on page 3-30.

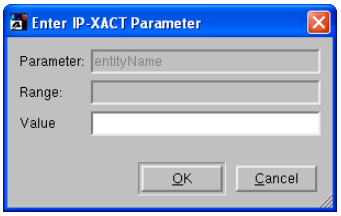


Figure 3-34 Enter IP-XACT Parameter dialog box

Edit the attribute that applies to the selected parameter and either click **OK** to save the changes and close the dialog box, or click **Cancel** to close the dialog box without saving the changes.

Note

IP-XACT parameters are not supported for IP-XACT 1.2 component definition files.

3.3 Using components

This section describes components and how to use them in a system. It contains the following sections:

- *Adding a component to the Diagram Window* on page 3-32
- *Component info box* on page 3-33
- *Component context-sensitive menu* on page 3-33
- *Ports* on page 3-35
- *Making connections between components* on page 3-36
- *External ports* on page 3-40
- *Component icons displayed in the tool windows* on page 3-43.

Figure 3-35 shows a component as it appears in the Diagram Window.

The title bar shows the instance name of the component and the component name in parentheses.

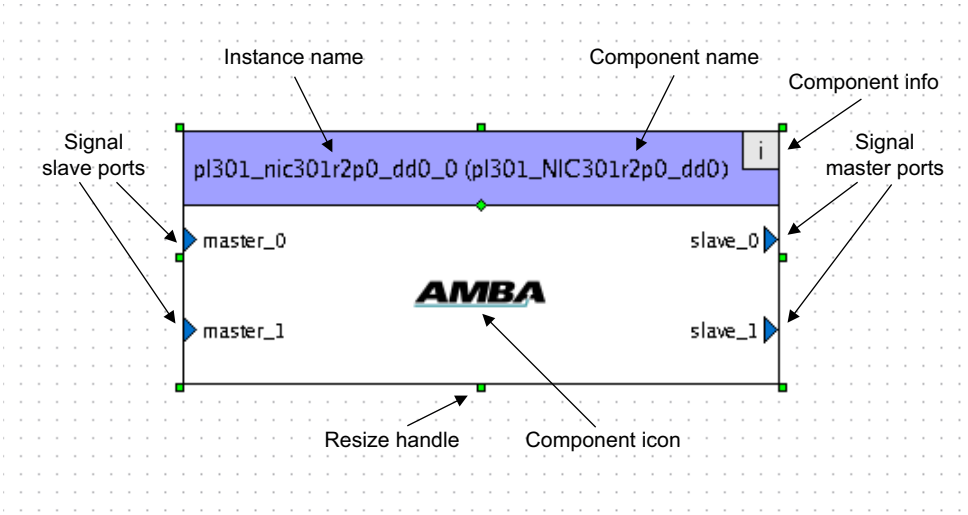


Figure 3-35 Component description

Figure 3-36 on page 3-32 shows an unselected and a selected component. The selected component has a different colored title bar area, and resize control points.

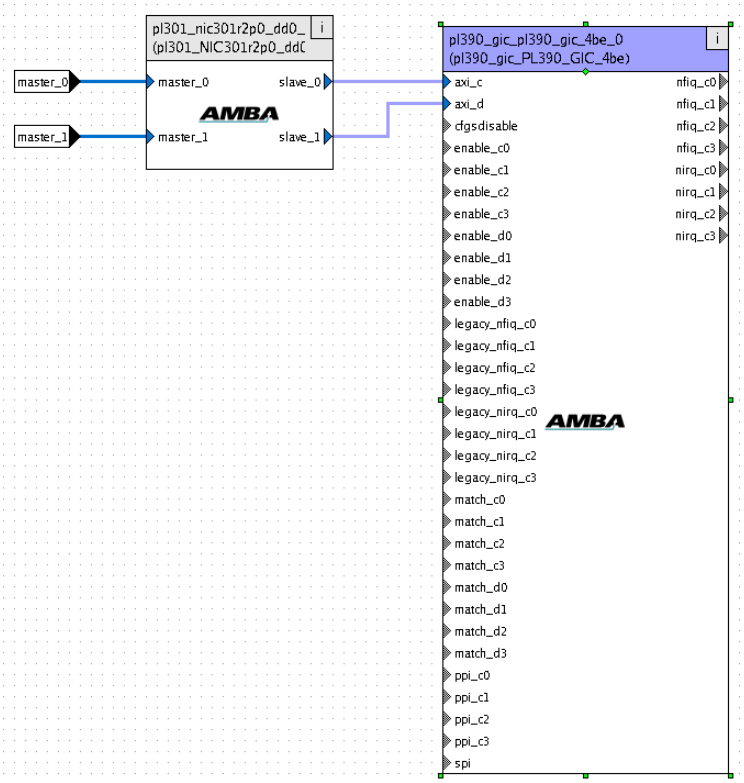


Figure 3-36 Component and selected component

3.3.1 Adding a component to the Diagram Window

To add a component to the Diagram Window, perform one of the following actions:

- drag a component from the Component Window to the Diagram Window
- copy and paste an existing component in the Diagram Window
- click **Comp** in the toolbar
- right-click the Diagram Window and select **Add Component...** from the context-sensitive menu
- select **Insert** → **Add Component...** from the main menu.

The last three methods display the Select Component dialog box. See Figure 3-37.

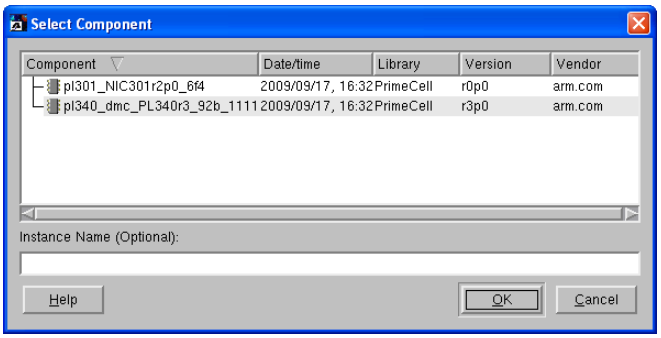


Figure 3-37 Select Component dialog box

The Select Component dialog box contains an Instance Name field where you can enter the instance name of the component. If you do not enter a name, Canvas creates a unique name for the component. Make a selection and click **OK** to close the dialog box.

After the Select Component dialog box closes, the component appears in the Diagram Window at the mouse cursor. Move the mouse to position the component in the Diagram Window and left-click to place the component.

Note

You cannot place a component on top of another object in a system. If you attempt to do this, a Help box opens that contains details of the error and help information.

3.3.2 Component info box

When the mouse hovers over the **i** box in the top right-hand corner of a component, the cursor changes to a question mark. See Figure 3-38. This simplifies finding the info box in large diagrams at small zoom factors.

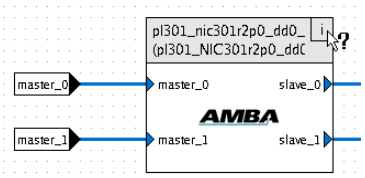


Figure 3-38 i box focus

Click on the info box to display the main properties of the component. See Figure 3-39.

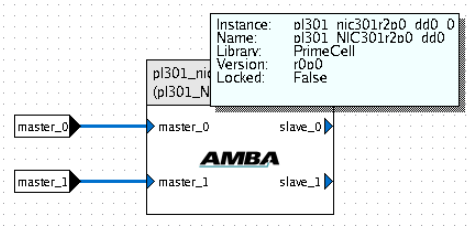


Figure 3-39 Component info box

The information in the info box is displayed with the same font size regardless of the zoom factor of the diagram.

3.3.3 Component context-sensitive menu

Right-click on a component to display a context-sensitive menu. See Figure 3-40 on page 3-34.

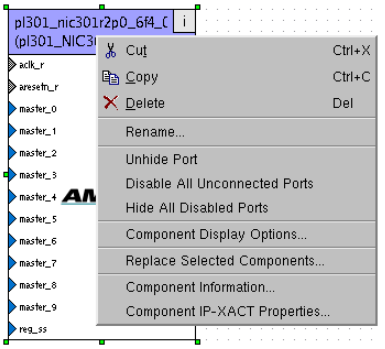


Figure 3-40 Component context-sensitive menu in the Diagram Window

The following entries perform the same functions as the corresponding entries in the Edit menu:

- **Cut**
- **Copy**
- **Delete**.

See *Edit menu* on page 3-8.

The following entries perform the same functions as the corresponding entries in the Object menu:

- **Rename…**
- **Unhide Port**.

See *Object menu* on page 3-11.

Disable All Unconnected Ports

Disables every unconnected port for the component.

Note

If a hidden port has been revealed by using the **Unhide Port** option, the port is shown in gray.

Hide All Disabled Ports

Hides disabled ports in the component.

Note

You can override this action for specific ports by using the **Unhide Port** option.

Component Display Options…

This entry performs the same function as the corresponding entry in the Object menu. See *Object menu* on page 3-11.

Replace Selected Component…

Replace selected objects with other similar objects. AMBA Designer attempts to reconnect all connections to the same ports of the new component. If the same port does not exist, AMBA Designer deletes the connection. The tool preserves the size of the component, but not the name.

Caution

Use this option with care. It might adversely affect the design of your system.

Component Information…

- For legacy components, this option displays the Edit Component Properties dialog box that enables you to view and edit the object parameters. See *Edit Parameters dialog* on page 3-66.
- For IP-XACT components, this option displays the Component properties information box that lists the Component name and Library path where the component configuration is located.

3.3.4 Ports

Figure 3-41 shows the component port types.

Note

AMBA Designer does not support IP-XACT Phantom ports.

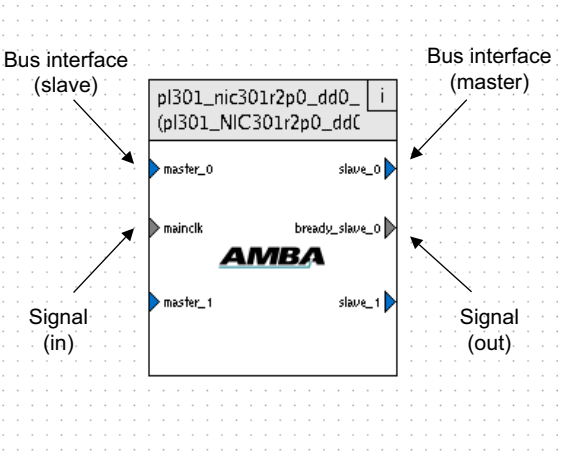


Figure 3-41 Component port types

Master ports always point out of the component and slave ports always point into the component.

You can move master and slave ports around the edges of the component as Figure 3-42 shows.

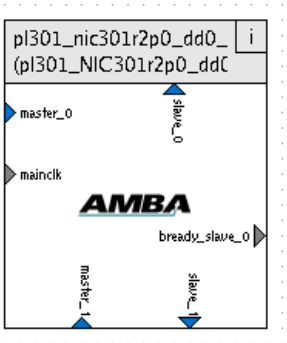


Figure 3-42 Permitted port locations

Bus interface connections appear with thick lines, and signal and clock connections appear with thin lines. See Figure 3-43 on page 3-36. You must connect:

- bus interface port outputs to bus interface port inputs of the same type
- signal port outputs to signal port inputs.

3.3.5 Making connections between components

Figure 3-43 shows how to make a connection to an external port or a port on another component. Click **Connect** on the main toolbar, or select **Edit → Connect Ports Mode** from the main menu. Place the cursor over the first port to be connected. The cursor changes to the Connect Ports Mode cursor and the port is highlighted. Left-click the port and move the cursor to the second port to be connected. The Canvas automatically creates an orthogonal wire as the cursor is moved to the second port. To control the points at which the orthogonal wire changes direction, left-click the wire to create anchor points. To complete the connection, place the cursor over the second port to be connected, and when the port is highlighted, left-click the mouse to complete the connection. You can cancel the connection by pressing Esc any time before left-clicking the second port connection.

Note

- If you attempt to connect together ports that are not of the correct types, the connection is not made, and a Help box appears listing the error and help information.
- Bit-slice connections and tie-offs are supported through the use of IP-XACT 1.4 ad-hoc connections. See *Ad-hoc connections*.

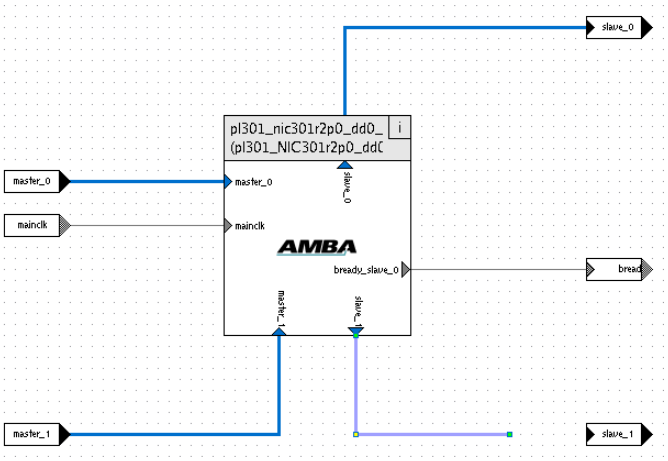


Figure 3-43 Making a new connection

Ad-hoc connections

The tool supports IP-XACT 1.4 for:

- bit-slice connections, see *Bit-slice connections*
- tying off input ports, see *Tying off input ports* on page 3-38
- unhiding ports within a bus interface, see *Unhide ports* on page 3-39.

Bit-slice connections

To make a bit-slice connection from a signal port to other component or external ports, perform the following steps:

1. In the Canvas, select **Connection Mode**. Make all the necessary bit-slice connections from the signal port to be split to the corresponding components or external ports. See Figure 3-44 on page 3-37.

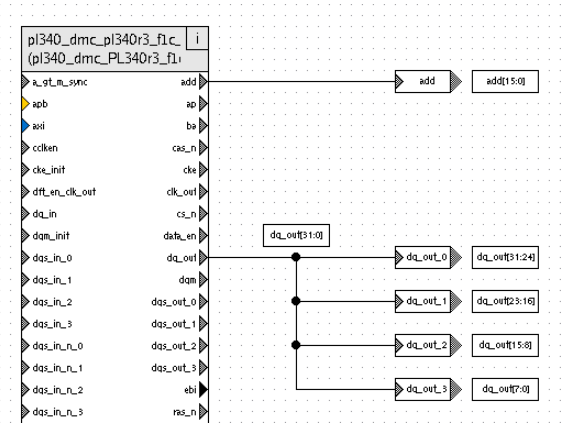


Figure 3-44 Multiple bit-slice connections

2. In the main menu, select **Tools → IP-XACT Connections...**. The IP-XACT Connections dialog box opens listing all the IP-XACT connections for the system. Figure 3-45 shows the listing for the system that Figure 3-44 shows, before editing. By default, the port signals are full bit-width connections, that is, no bit-slices have been specified.

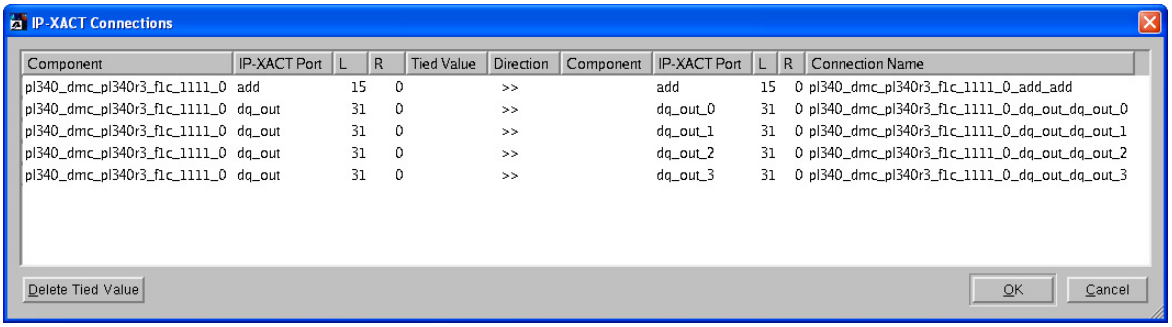


Figure 3-45 IP-XACT Connections listing before editing

3. To create a bit-slice, edit the L and R values in the port listing to define the bit range required for each bit-slice.

Note

The following ad-hoc connections are not supported:

- signals from external bus interfaces
- non-contiguous bit-slicing of two ad-hoc signals connected together.

Figure 3-46 shows the edited IP-XACT connections for the system that Figure 3-44 shows.

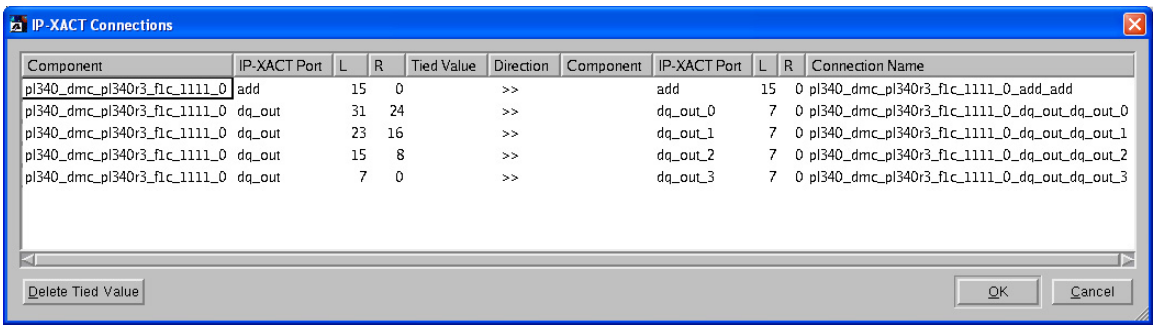


Figure 3-46 IP-XACT Connections listing after editing

4. Click **OK** to save the new L and R signal port values and close the IP-XACT Connections dialog box. Click **Cancel** to close the dialog box without saving the changes.

Tying off input ports

Note

For an input port that is tied-off, the port color changes to solid light green.

To tie-off an input port, right-click the input port to display the port context-sensitive menu. See Figure 3-47.

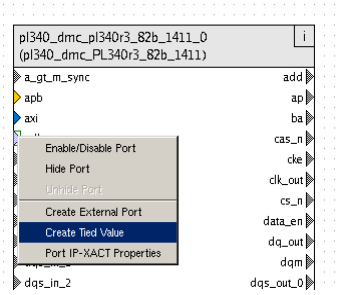


Figure 3-47 Port context-sensitive menu

Select **Create Tied Value** from the menu to display the IP-XACT Connections dialog box that Figure 3-48 shows.

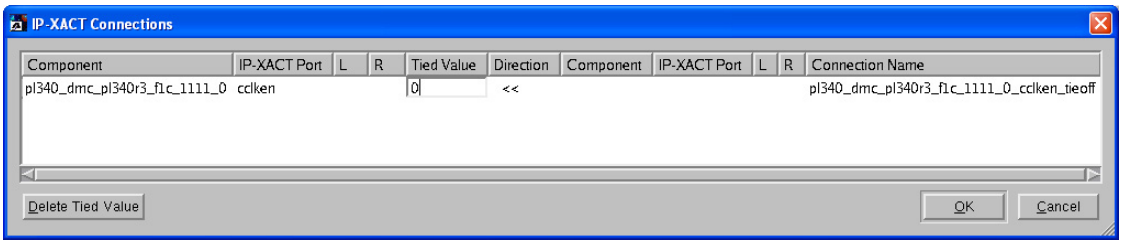


Figure 3-48 IP-XACT Connections dialog box

By default, the port is given a tied value of 0. To apply the default value, close the dialog box by clicking either **OK** or **Cancel**.

To change the default tied value for a port, left-click the port listing below the Tied Value header. In the text entry field that appears, enter the new tied value, and click **OK** to apply the new value and close the dialog box. To close the dialog box without changing the default tied value, click **Cancel**.

To delete a port tied value, from the main menu select **Tools → IP-XACT Connections...** to display the IP-XACT Connection dialog box. Left-click the port listing and click **Delete Tied Value**. Click **OK** to delete the tied value and close the dialog box. To close the dialog box without deleting the tied value, click **Cancel**.

Unhide ports

Note

By default, all the signals that are part of a component bus interface are hidden. You can use, connect, and tie-off such signals in an ad-hoc manner by first unhiding the required signal port, and then using the normal connection and tie-off methods. For an unhidden port, the color is solid dark grey. The unhiding is a GUI-only feature because the signal port that was hidden can now be seen on the Canvas. The port connectivity at this stage remains unchanged.

You can access, and either tie-off or connect as an ad-hoc connection to other component ports and external ports, ports that are normally hidden as part of a bus interface. To unhide a port, either right-click on a component in the Diagram Window, or in the **Hierarchy** tab in the AMBA Configuration Window, and select **Unhide Port** from the component context-sensitive menu. The Select port to show dialog box appears as Figure 3-49 shows.

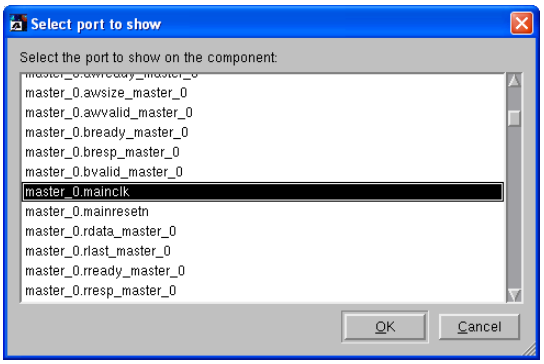


Figure 3-49 Select port to show dialog box

Note

If a component has both a bus interface and a signal with the same name, then you cannot unhide the signal to show it on the Canvas for use as an ad-hoc connection.

Select the port required from the port list and click **OK** to unhide the port and close the dialog box. Click **Cancel** to close the dialog box without unhiding a port. The port appears in the component outline and you can reposition it by clicking and dragging it to the new position. You can now make an ad-hoc connection or tie-off to the port. See Figure 3-50.

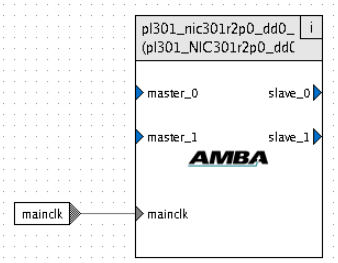


Figure 3-50 Ad-hoc connection to an external port

Note

If a single physical port is mapped to multiple bus interfaces in a component IP-XACT file, then when using the **Unhide Port** option, the component that represents this IP-XACT file in the Canvas shows this physical port mapped to the first bus interface to which it is mapped, and displays the physical port only once.

You can also expand the component view in the **Hierarchy** tab of the AMBA Configuration Window and right-click an individual port to display the component context-sensitive menu, then select **Unhide Port**.

If the unhidden port is a signal that is part of a bus interface then:

- if the port is left unconnected, but the bus interface is connected, then the signal is connected according to the original bus interface connection
- if the port is connected, then the resulting Verilog code connects the signal both according to this new connection, and the original bus interface connection
- if the port is tied-off, then the new tie-off takes precedence over the original bus interface connection and the resulting Verilog code ties off the signal.

3.3.6 External ports

External ports connect hierarchical systems. A system that you intend to instantiate within a higher-level system must have external ports. A top-level system or a flat system typically does not have external ports.

The external ports are arranged and marked as follows:

- **Bus interface ports**

  These appear solid black.

  Signal ports

  These appear shaded.

- The left-hand side ports are slave ports, and the right-hand side ports are master ports. Master ports have a triangular port symbol within the rectangular portion of the external port symbol.

Figure 3-51 shows the external port types.

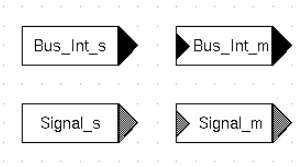


Figure 3-51 External port types

When you instantiate a stitched system as a component, each external port appears as a port symbol inside the component. See Figure 3-52 on page 3-41.

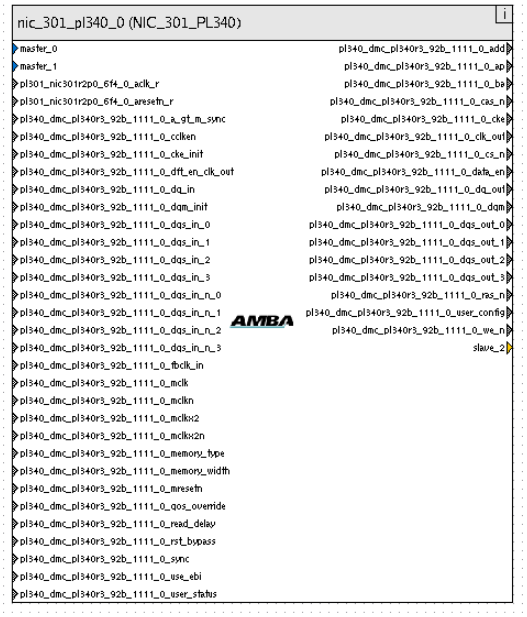


Figure 3-52 Stitched system showing external ports

When you add a stitched system to the Component Library, it appears in the Component Window with a system icon and the name you gave it when you saved it. Figure 3-53 shows the example system saved as `NIC_301_PL340`.

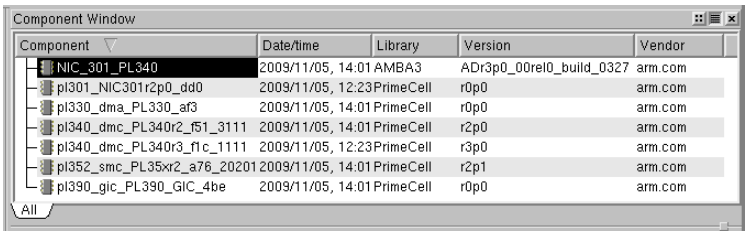


Figure 3-53 Saved stitched system in Component Window

Adding an external port to a system

To add an external port to a system that matches the component you have selected:

1. Click **Edit** on the toolbar, or select **Edit → Edit Mode**.
2. Select a port on the component by hovering the mouse cursor over it. The cursor changes to a hand symbol when the port is in focus.
3. Right-click to display the context-sensitive menu for ports.
4. Select **Create External Port**.

   Canvas automatically creates an external port and connection with the same type, name, and orientation in the Diagram Window.
5. Drag the external port symbol to the required position in the Diagram Window and left-click to complete the action. Press Esc at anytime before left-clicking to cancel the action.

To add a new port to a system, and to specify the name and the type:

1. Open the External Port dialog box by performing one of the following actions:
   - click **Port** on the toolbar
   - select **Insert → Add External Port**
   - right-click in the Diagram Window and select **Add External Port** from the context-sensitive menu.

   AMBA Designer displays the External Port dialog box. See Figure 3-54.

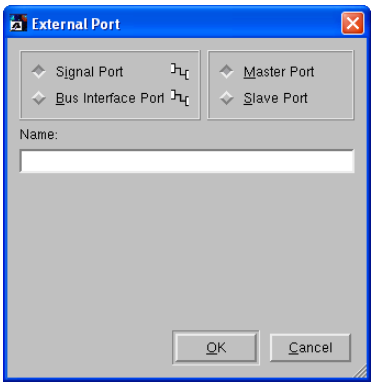


Figure 3-54 External Port dialog box

2. Select the type of port from the radio buttons on the left-hand side of the dialog box.
3. Select the direction for the port from the radio buttons on the right-hand side of the dialog box.
4. Enter a name for the port in the Name text box.
5. Click **OK** to create the port and display it in the Diagram Window.
6. To change the direction of the port, right-click the external port and select **Mirror External Port** from the context-sensitive menu. See Figure 3-55.

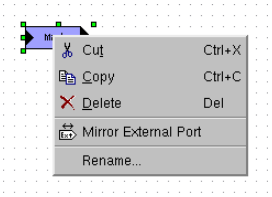


Figure 3-55 External Port context-sensitive menu

Figure 3-56 shows a master port and the resulting mirrored version.

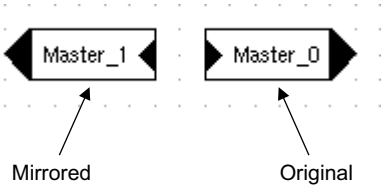


Figure 3-56 Original and mirrored external port

7. To change the name of an external port either, double-click the port, or right-click the port and select **Rename...** from the context-sensitive menu to display the Rename Object dialog box. Enter the new name and click **OK** to save the new name and close the Rename Object dialog box, or click **Cancel** to close the Rename Object dialog box without saving the changes.

8. Change to connect mode and connect the new external port to a component port in the system.

Note

Each port must have a unique instance name. You can use the normal copy and paste actions to duplicate a port and then Canvas assigns it a unique name by adding an underscore and numerical suffix to the original port name.

3.3.7 Component icons displayed in the tool windows

Figure 3-57 shows the icons that are used in the **Hierarchy** tab of the AMBA Configuration Window.

Figure 3-57 Icons used in the Hierarchy tab

The icons in Figure 3-57 represent, from left to right:

- component
- external port
- port.

Figure 3-58 shows the icons that the Component Window uses.

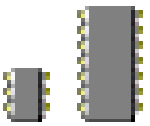


Figure 3-58 Icons used in the Component Window

The icons in Figure 3-58 are used as follows:

- the smaller component icon appears to the left of the component name in the Component Window list view
- the larger icon appears above the component name in the Component Window icon view.

3.4 IP-XACT stitching

AMBA Designer supports the stitching of ARM components that have IP-XACT descriptions. This section describes IP-XACT stitching.

It contains the following subsections:

- *About IP stitching*
- *Using IP-XACT stitching*
- *Directory structure* on page 3-46.

Note

AMBA Designer does not support the stitching of third-party IP-XACT components.

3.4.1 About IP stitching

The IP stitching feature enables you to take AMBA components from the Component Library, place them on the Diagram Window and define their bus interconnections at a high level. AMBA Designer generates a top-level Verilog RTL file as a result. This means that you are not required to interactively connect each of the interfaces together, and it eliminates a labor-intensive and error-prone task.

To ease system integration, you can select the **Export all unconnected** option and AMBA Designer shows any unresolved connections in the top-level file interface. See *Signal Options* on page 3-45 for more information.

All new ARM AMBA IP is validated before release to ensure that it is compatible with the AMBA Designer IP stitching design flow.

3.4.2 Using IP-XACT stitching

This section describes how to use IP-XACT stitching and contains the following subsections:

- *IP-XACT_Stitching tab*
- *Limitations* on page 3-46.

IP-XACT_Stitching tab

Figure 3-59 shows the AMBA Designer - RTL Design Flow Manager Preferences dialog box.

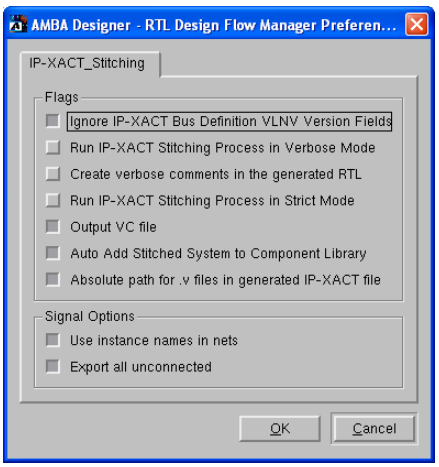


Figure 3-59 RTL Design Flow Manager Preferences dialog - IP-XACT_Stitching tab

The configuration options are:

Flags

Ignore IP-XACT Bus Definitions VLNV Version Fields

When selected, bus interface version fields on components are not compared against bus definition versions when checking for bus compatibility.

Run IP-XACT Stitching Process in Verbose Mode

When selected, an extended messaging mode is used that provides additional progress information.

Create verbose comments in the generated RTL

When selected, basic comments are added to the RTL during the stitching process.

Run IP-XACT Stitching Process in Strict Mode

When selected, forces a strict strategy to be used when stitching. This is useful for IP-XACT design verification, and the following policies apply:

- failure when ID widths do not match in NIC-301-only designs
- failure when an invalid default value is detected for input or bidirectional signals, in IP-XACT component definitions
- failure when connected signals do not have the same size, or the same left and right bits
- additional warning messages are output.

Output VC file

When selected, a `<design name>.vc` file is generated at the same location as the top-level `<design name>.v` file. The `.vc` file contains references to all the `.v` files, directories, and other directory dependencies, and you can use it to compile the entire design.

Auto Add Stitched System to Component Library

When selected, AMBA Designer adds the stitched system to the Component Library.

Absolute path for .v files in generated IP-XACT file

When selected, the generated IP-XACT file includes the absolute path to the `.v` files instead of the relative path.

Signal Options

Use instance names in nets

When selected, the instance name of the components being connected are used as part of the net name.

Export all unconnected

When selected, all the unconnected signal ports are exported to the top-level of the design. This is equivalent to manually creating external ports for all the unconnected signal ports in the design.

Note

Only signal ports, not bus interface ports, are exported to the top-level of the design.

Limitations

In accordance with IP-XACT rules, connections are supported only between master and slave interfaces.

Note

Connections must be wired point-to-point connections and no bus interface fanout is supported. For example, on the NIC-301 AMBA Interconnect APB master interfaces, AMBA Designer extracts each individual APB slave slot so that each of these slots can be stitched individually.

3.4.3 Directory structure

Since the release of AMBA Designer r2p1, a fixed, internal directory structure stores IP-XACT files. Information stored under this structure can be different, depending on the nature of the design.

This section describes the directory structures for the following design types:

- *Configurable ARM AMBA IP*
- *Stitched ARM AMBA IP designs* on page 3-47.

Configurable ARM AMBA IP

AMBA Designer creates the directory structure that Figure 3-60 shows, under your `designs` directory when the following are true:

- you invoke the RTL Design Flow Manager on ARM configurable AMBA IP, for example, the AMBA Interconnect NIC-301, or the AMBA DMC-340
- the RTL generation process has completed successfully.

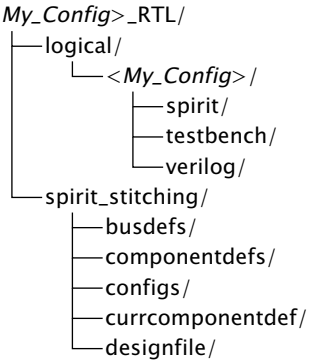


Figure 3-60 Directory structure

Note

- The directory structure in Figure 3-60 assumes that you have created a component called <*My_Config*>.

- The output of each configurable IP generator might be different to the structure that Figure 3-60 on page 3-46 shows, and additional directories might be present. However, only the directories that this section describes are important when working with IP-XACT.

`<My_Config>_RTL/`

This directory is named after the component, followed by `_RTL`, for example, `NIC-301_RTL`, and stores all the generated information for this component.

`logical/` Contains the generated RTL for the <*My_Config*> component.

`logical/<My_Config>/spirit/`

Contains the IP-XACT definitions of the <*My_Config*> component.

`spirit_stitching/`

Top-level output directory for the IP-XACT files corresponding to the configuration.

`spirit_stitching/currcomponentdef/`

Contains the IP-XACT definition of the <*My_Config*> component.

Note

For legacy purposes only. For new stitched designs, the top-level IP-XACT is now generated in the `logical/<My_Config>/spirit/` directory.

Example 3-1 IP-XACT definition of a PL301 component

```
<?xml version="1.0" encoding="UTF-8"?>
<spirit:component xmlns:spirit="http://www.spiritconsortium.org/XMLSchema/SPIRIT/1.2"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:xalan="http://xml.apache.org/xalan"
xsi:schemaLocation="http://www.spiritconsortium.org/XMLSchema/SPIRIT/1.2
http://www.spiritconsortium.org/XMLSchema/SPIRIT/1.2/component.xsd">
    <spirit:vendor>arm.com</spirit:vendor>
    <spirit:library>AMBA3</spirit:library>
    <spirit:name>pl301_a3bm_My_Config</spirit:name>
    <spirit:version>r1p1</spirit:version>
    <spirit:busInterfaces>
      <spirit:busInterface>
        <spirit:name>s00_axi_64</spirit:name>
        <spirit:busType spirit:vendor="amba.com" spirit:library="AMBA3" spirit:name="AXI" spirit:version="r1p0"/>
        <spirit:slave/>
.
.
```

Stitched ARM AMBA IP designs

The IP stitcher uses the standard directory structure that Figure 3-60 on page 3-46 shows to store the required IP-XACT input files, before they are processed. The IP-Stitcher output is stored in the structure that Figure 3-61 on page 3-48 shows, and this section describes it.

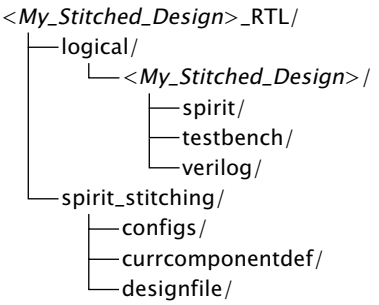


Figure 3-61 Directory structure for stitched designs

*<My_Stitched_Design>*_RTL/

This directory is named after the design, followed by _RTL, for example, my_design1_RTL, and stores all the generated information.

logical/ Top-level directory of the IP-Stitcher RTL output.

logical/*<My_Stitched_Design>*/spirit/

Contains the top-level IP-XACT component definition file (.xml).

verilog/ Contains the RTL for this design that the IP-Stitcher generates.

Example 3-2 RTL for a design

```
////////////////////////////////////////////////////////////////////////////////
// **** Top-Level Verilog file auto-generated by AMBA Designer ****
// Created: Mon Apr 20 19:19:16 2009
////////////////////////////////////////////////////////////////////////////////
module My_Stitched_Design (
// Exports from module for My_Config_1_0_
CLKfuj_1_1_0_,
RESETnfuj_1_1_0_,
TZPROTfuj_1_1_0_,
ARADDRs00_axi_64fuj_1_1_0_,
ARLENs00_axi_64fuj_1_1_0_,
.
.
```

spirit_stitching/

Top-level directory for all IP-XACT files.

configs/ Contains all the configuration files from configurable AMBA IP components that might be present in the design, but not IP-XACT.

Example 3-3 Configuration file for a PL301 component

```
<!DOCTYPE cfgfile SYSTEM "cfgfile.dtd">

<cfgfile>
    <product_version_info
        component_name = "pl301_a3bm_My_Config"
        product_code = "pl301"
        major_group = "bu"
        minor_code = "00000"
        major_revision = "1"
```

```
        minor_revision = "0"
        major_version = "00"
        part_quality = "rel"
        minor_version = "1">
    </product_version_info>
.
.
```

`currcomponentdef/`

For legacy purposes only.

Note

For new stitched designs, the top-level IP-XACT is now generated in the `logical/<My_Config>/spirit/` directory.

Example 3-4 IP-XACT description of current design

```
<spirit:component xsi:schemaLocation="http://www.spiritconsortium.org/XMLSchema/SPIRIT/1.2
http://www.spiritconsortium.org/XMLSchema/SPIRIT/1.2/component.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:spirit="http://www.spiritconsortium.org/XMLSchema/SPIRIT/1.2" >

    <spirit:vendor>arm.com</spirit:vendor>
    <spirit:library>AMBA3</spirit:library>
    <spirit:name>My_Stitched_Design</spirit:name>
    <spirit:version>r2p2_00rel0</spirit:version>
.
.
```

3.5 AMBA Designer Preferences dialog

Use the AMBA Designer Preferences dialog box to configure preferences. To open the AMBA Designer Preferences dialog box, select **File → Preferences...** from the main menu. Figure 3-62 shows the AMBA Designer Preferences dialog box.

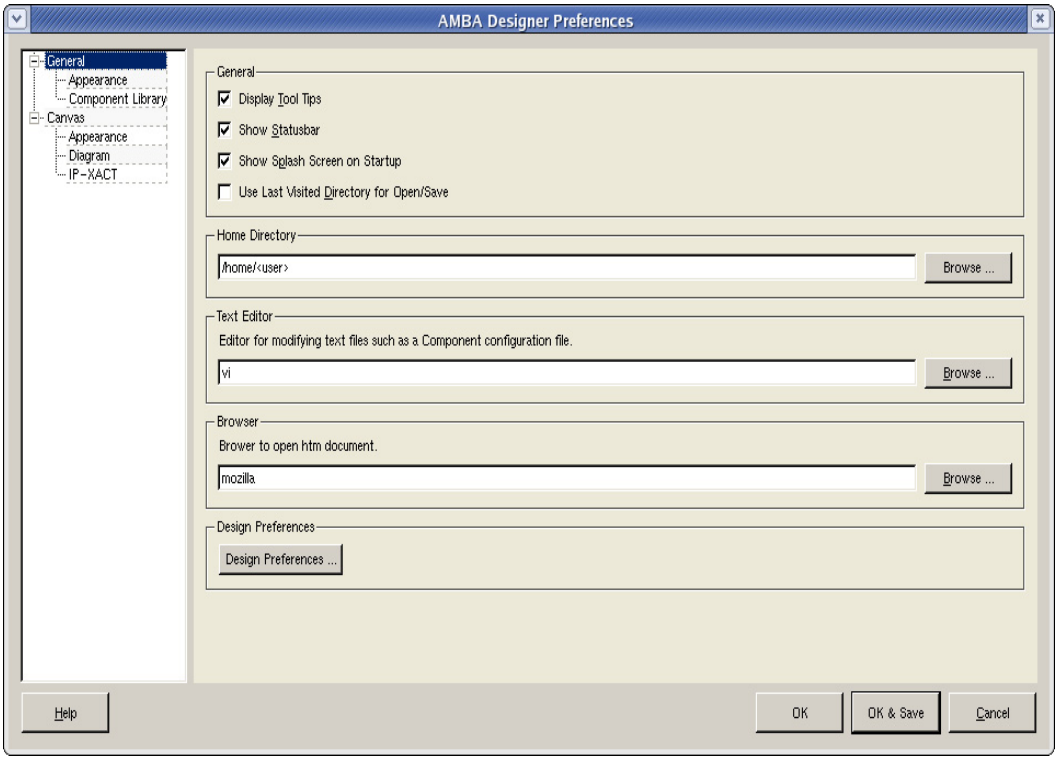


Figure 3-62 AMBA Designer Preferences dialog box

The AMBA Designer Preferences dialog box is a standard tree view dialog box, with major features on the left-hand side, and details of the major features on the right-hand side.

The preferences are grouped as follows:

- General. See *General preferences*:
  - Appearance. See *General Appearance preferences* on page 3-54.
  - Component Library. See *General Component Library preferences* on page 3-55.
- Canvas. See *Canvas preferences* on page 3-56:
  - Appearance. See *Canvas Appearance preferences* on page 3-58.
  - Diagram. See *Diagram Window preferences* on page 3-58.
  - IP-XACT. See *Canvas IP-XACT preferences* on page 3-60.

3.5.1 General preferences

In Figure 3-62, the General preferences contains the following panes:

- *General* on page 3-51
- *Home Directory* on page 3-51
- *Text Editor* on page 3-51
- *Browser* on page 3-51
- *Design Preferences* on page 3-51.

General

The General pane contains the following options:

Display Tool Tips

This option enables or disables all the tool tips in the application.

Default = on.

Show Statusbar

This option toggles the display of the status bar at the bottom of the Canvas window.

Default = on.

Show Splash Screen on Startup

This option enables you to show or hide the splash screen on startup.

Default = on.

Use Last Visited Directory for Open/Save

Select this option to automatically return to the last directory you used to open or save a file.

Default = off.

Home Directory

The Home Directory pane enables you to specify the path to your home directory. This directory is part of the AMBA Designer search path.

Text Editor

The Text Editor pane enables you to specify the text editor that AMBA Designer invokes when you select **Edit Configuration File…** from the context-sensitive menu of a component.

Browser

The Browser pane enables you to specify the web browser AMBA Designer invokes when you open hypertext documents.

Design Preferences

Click **Design Preferences...** to edit the design preferences. This opens the Design Preferences dialog box. See Figure 3-63 on page 3-52.

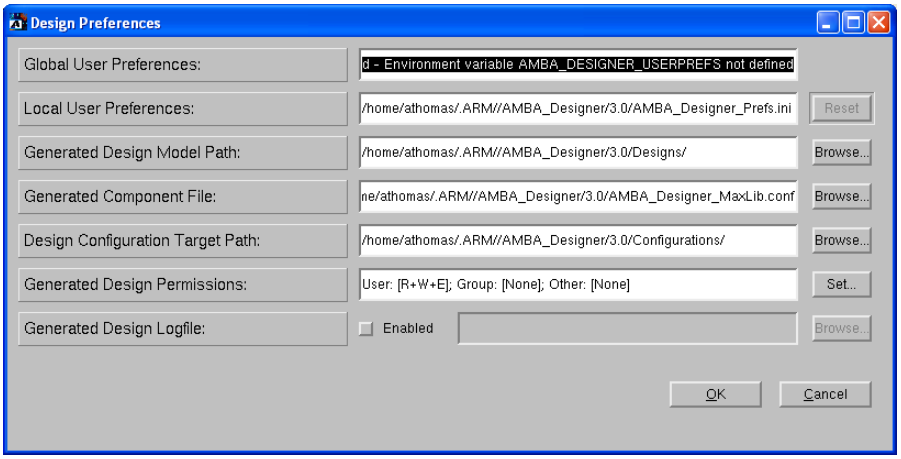


Figure 3-63 General Design Preferences dialog box

To change the defined paths or file, perform one of the following actions:

- Enter the new directory path in the associated field then click **OK** to save the preferences and close the Design Preferences dialog box.
- Click **Browse...** to open a file browser dialog box. Use this dialog box to:
  1. Navigate to the appropriate directory or file.
  2. Select the appropriate directory or file.
  3. Click **OK** to close the file browser dialog box.
  4. Click **OK** to save the preferences, and close the Design Preferences dialog box.

AMBA Designer saves the preferences in the `AMBA_Designer_Prefs.ini` file. Figure 3-64 shows the location of the `.ini` file.

```
<top-level directory>/
└─home/
   └─<user>/
      └─.ARM/
         └─AMBA_Designer/
            └─<x>.<y>/
```

Figure 3-64 Location of AMBA Designer preferences file

In Figure 3-64, <*x*> represents the major revision number and <*y*> represents the minor revision number of AMBA Designer, for example, `3.0`.

The preferences are:

Global User Preferences

The path to the location of the global preferences.

Local User Preferences

The path to the location of your local preferences.

Generated Design Model Path

After you configure an AMBA component, AMBA Designer generates the IP-XACT component and saves it in this directory.

During the RTL generation process, the tools create the relevant RTL directory structure for the AMBA component in this directory. AMBA Designer uses this directory structure to save the RTL files that it generates.

Generated Component File

AMBA Designer uses the Component Library file to store the configured components in the AMBA Designer Component Library. The configuration process for AMBA components consists of the tools writing the resultant IP-XACT and Verilog files to the Generated Design Model Path directory.

This file contains the library configuration entry information for generated components that you have added to the IP-XACT Component Library.

Design Configuration Target Path

This directory contains the design configuration files. These files contain the parameter, address, and sparse information that AMBA Designer uses to generate the AMBA component.

Generated Design Permissions

This field enables you to apply file protection bits, and optionally, assign a default group. The tools use these settings each time you generate new RTL for a component or system. The field provides a summary of the permissions for the following categories:

- User
- Group
- Other.

It also shows the name of the user group. To change these permissions, click **Set...**. This opens the AMBA Designer - Generated Design File Permissions dialog box. See Figure 3-65.

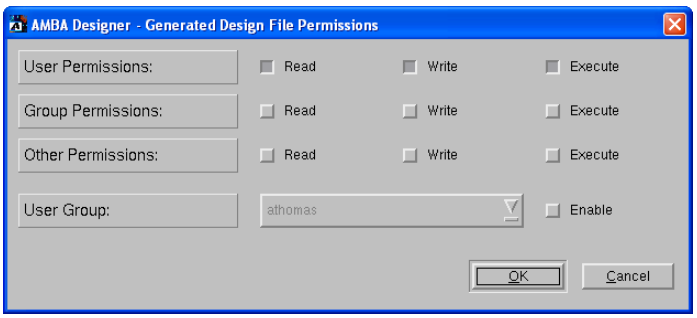


Figure 3-65 Generated Design File Permissions dialog box

Use this dialog box to change:

- The permissions for each of the categories.
- The user group. You can select this from the drop-down list.

Note

- For Linux, the OS restricts the list of groups available to those groups that you, the current user, are subscribed to.

  For Solaris, all these tools list all the user groups, but you might not be able to make selections outside your subscribed groups.
- These settings only apply to newly-generated IP. If you change these settings between sessions for RTL generation, the tools do not apply them retrospectively.

Generated Design Logfile

The path to the location of the generated logfile. To enable this option, select the check box.

3.5.2 General Appearance preferences

Figure 3-66 shows the Appearance area under the General area of the AMBA Designer Preferences dialog box. Use this dialog box to control the appearance of text and icons on the application windows.

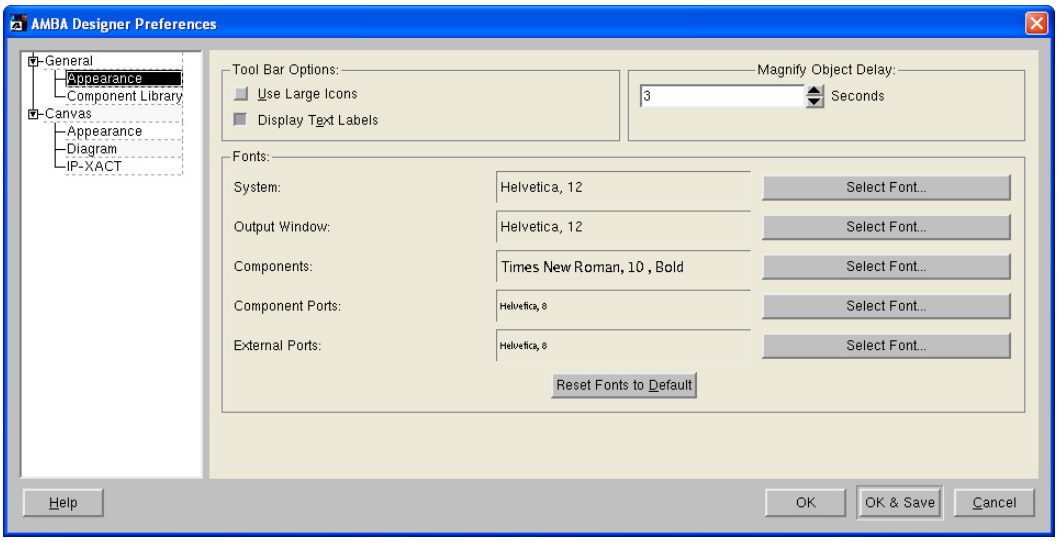


Figure 3-66 General Appearance Preferences dialog box

The Appearance area contains the following panes:

- *Tool Bar Options*
- *Magnify Object Delay*
- *Fonts* on page 3-55.

Tool Bar Options

The toolbar options are:

Use Large Icons

Select this option to use the large version of the toolbar icons instead of the small versions.

Default = off.

Display Text Labels

Display the name of the toolbar button below the icon of the button.

Default = on.

Magnify Object Delay

If the zoom level is set to less than 70%, hovering the cursor over a component in the Diagram Window magnifies the component to its original size, after a delay. Use this setting to adjust the delay before the component appears magnified.

Fonts

Use the controls in the Fonts pane to select the font type and size for text displayed in the application windows:

Select Font…

Click **Select Font...** to select the display fonts for the System, Output Window, Components, Component Ports, and External Ports.

The system font is the font that appears in the application window. The other fonts correspond to the fonts that appear in the objects in the diagram.

Note

The appearance of fonts in the interface depends on the fonts available on your system.

Reset Fonts to Default

Use this button to reset all the fonts to their original default settings.

3.5.3 General Component Library preferences

Figure 3-67 shows the Component Library area under the General area of the AMBA Designer Preferences dialog box.

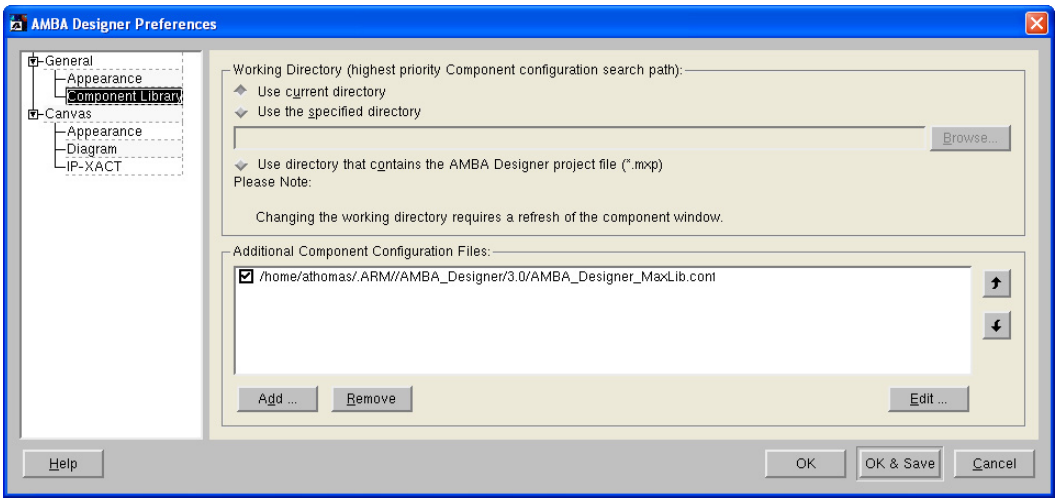


Figure 3-67 General Component Library Preferences dialog box

Working Directory

Specify where the tools search for the Component Library files. AMBA Designer uses the components in these files to fill the list in the Component Window. You can choose from the following options:

- Use current directory. This is the directory in which AMBA Designer starts. This is the default setting.
- Use the specified directory.
- Use the location of the current AMBA Designer project, `*.adg`, file for the working directory.

Note

Changing the working directory requires a refresh of the Component Window.

Additional Component Configuration Files

You can manually add component configuration files. The tools search for these files when they initialize a component. To change the priority of a file, highlight the file and click the up and down arrows to the right of the file list. Files near the top of the list have a higher priority than those near the bottom.

Note

If duplicate components exist, only the first one is available.

Search order for Component Library (CONF) files

The tools search the available Component Library files for components in the following order:

1. Files specified in the script file for batch mode.
2. Files specified on the command line when you started AMBA Designer.
3. Files in the specified working directory. By default, this is the current directory.

   Use the **Working Directory** option to specify the current working directory.
4. Files added in the **Additional Component Configuration Files** pane of the Component Library area of the AMBA Designer Preferences dialog box.

   Use the **Additional Component Configuration Files** options to add or delete search paths, or to change the search order.

3.5.4 Canvas preferences

Figure 3-68 shows the Canvas area of the AMBA Designer Preferences dialog box.

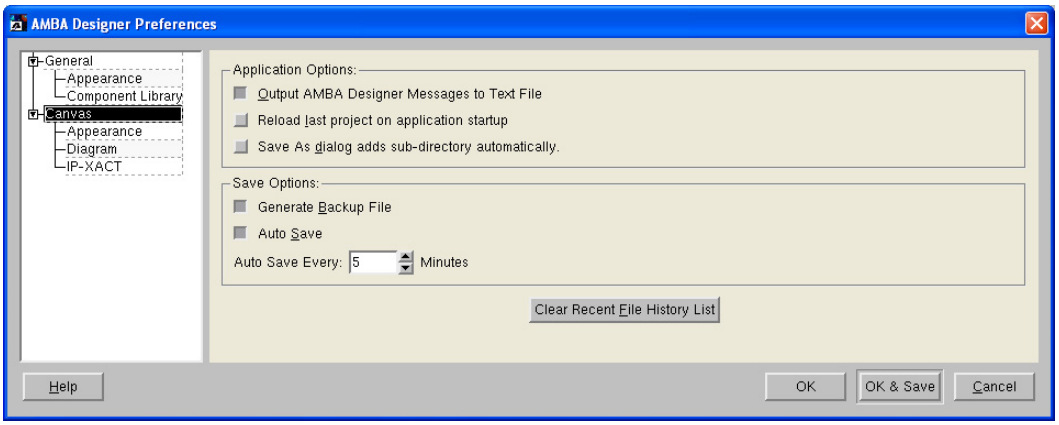


Figure 3-68 Canvas Preferences dialog box

Application Options

The Application Options pane contains the following options:

Output AMBA Designer Messages to Text File

Turn on the logging of messages to the application output file. The name of the file is `AMBA DesignerMessageOutput.txt`.

Default = on.

Reload last project on application startup

Reload the last project. The last project is the first project in the history list in the File menu.

Default = off.

Save As dialog adds sub-directory automatically

Automatically add a sub-directory to the current directory so that all the project files go into the sub-directory by default.

For UNIX and Linux, default = off.

Save Options

The Save Options pane contains the following options:

Generate Backup File

Create backup files when you save the current file. If this option is active when you save a file:

- the tools compare the current file name with the existing list of files
- if the current file has the same name as an existing file, the tools save the current files with the name `file name.~bc` in the same directory.

Default = on

Auto Save Set the tools to schedule automatic saves for the current system. If the application did not shut down properly, the next time it runs, it prompts you to choose to load the automatically saved file.

Default = on

Auto Save Every: [ ] Minutes

This option enables you to specify the interval for automatic saves in minutes. The minimum time is one minute.

Default = 5.

Clear Recent File History List

Click **Clear Recent File History List** to clear the recent file list that appears under the main File menu.

Note

You cannot cancel this operation after you have clicked **Clear Recent File History List**.

3.5.5 Canvas Appearance preferences

Figure 3-69 shows the Appearance area under the Canvas area of the AMBA Designer Preferences dialog box.

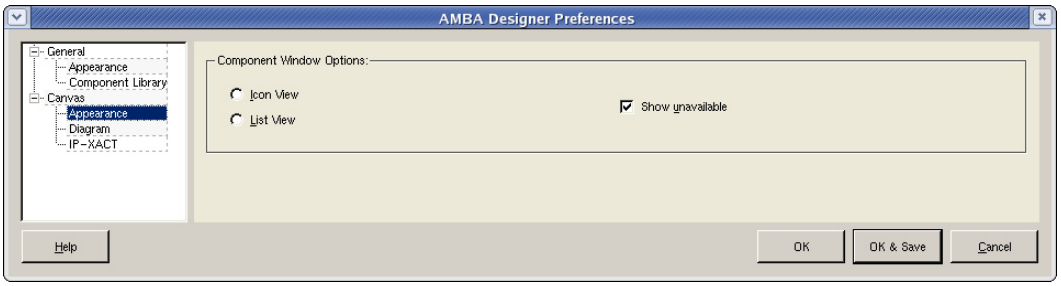


Figure 3-69 Canvas Appearance Preferences dialog box

Component Window Options

The Component Window Options pane contains the following options:

Icon View or List View

Use **Icon View** to show all the available components in the Component Window in a grid.

Use **List View** to show the components in a list.

The two views show the icon and the text name.

Default = icon view with the icons on a grid.

Show unavailable

Show or hide components that are part of the Component Library, but are not currently available.

Default = on.

3.5.6 Diagram Window preferences

Figure 3-70 on page 3-59 shows the Diagram area under the Canvas area of the AMBA Designer Preferences dialog box.

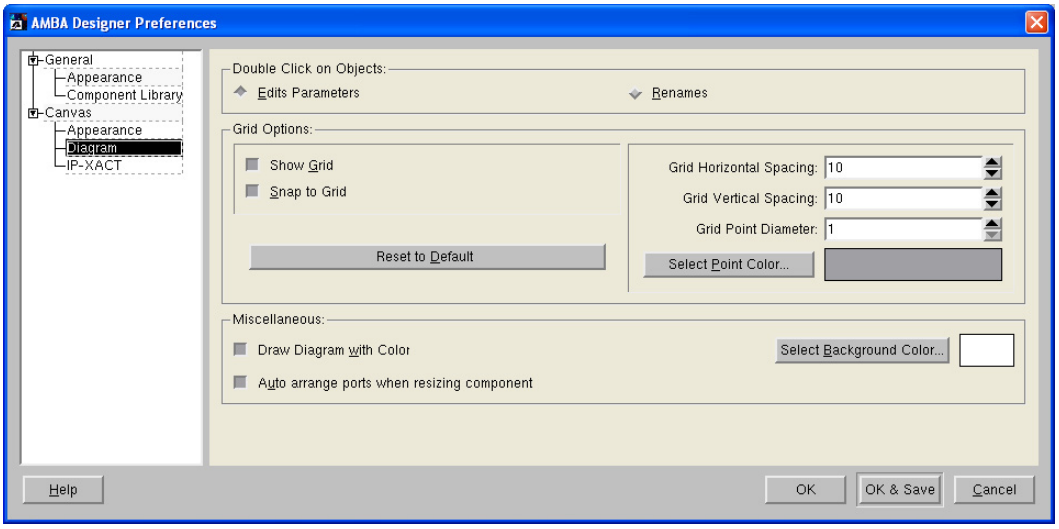


Figure 3-70 Canvas Diagram Preferences dialog box

This section describes how to set the preferences for the Diagram Window.

Double Click on Objects

Double-clicking on objects can have the following effects:

Edits Parameters

Set the double-click action, on an object that has parameters, to open the Edit Parameters dialog box. Otherwise, the double-click action opens the Rename dialog box.

Renames Set the double-click action, on an object that can be renamed, to open the Rename dialog box. Otherwise, the double-click action opens the Edit Parameters dialog box.

Grid Options

The Grid Options pane contains the following controls:

Show Grid Toggle the display to show or hide the grid.

Default = on.

Snap to Grid

Toggle the cursor and objects to snap to the grid or move off the grid.

Reset to Default

Click this button to reset all Grid Options to the default values.

Grid Horizontal Spacing

Set the horizontal spacing between grid points in pixels.

Default = 10.

Grid Vertical Spacing

Set the grid points in pixels.

Default = 10.

Grid Point Diameter

Set the diameter of grid points in pixels.

Default = 1.

Select Point Color...

Select the color of grid points.

Default = Gray.

Miscellaneous

The Miscellaneous pane contains the following controls:

Draw Diagram with Color

Force Canvas to draw the diagram only using black, gray, and white.

Default = on.

Auto arrange ports when resizing component

Set the tools to automatically move ports if the component is made smaller. Ports move back to their original positions when the component is made larger.

Default = on.

Select Background Color...

Set the background color.

Default = White.

3.5.7 Canvas IP-XACT preferences

Figure 3-71 on page 3-61 shows the IP-XACT area under the Canvas area of the AMBA Designer Preferences dialog box.

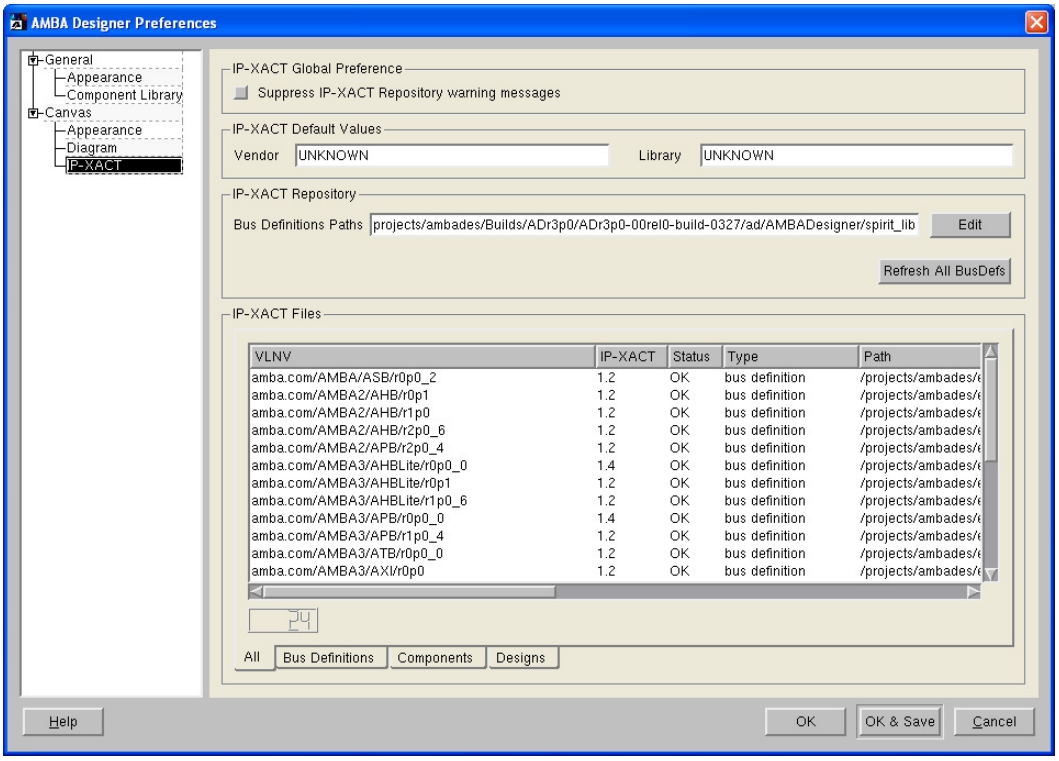


Figure 3-71 Canvas IP-XACT Preferences dialog box

This section describes how to set the IP-XACT preferences.

IP-XACT Global Preference

The IP-XACT Global Preference pane contains the following controls:

Suppress IP-XACT Repository warning messages

Select this option to force Canvas to suppress all IP-XACT Repository warning messages.

Caution

Use this option with care.

IP-XACT Default Values

The IP-XACT Default Values pane contains the following entry boxes:

Vendor The default Vendor entry for the VLNV identifier of IP-XACT object descriptions.

Library The default Library entry for the VLNV identifier of IP-XACT object descriptions.

IP-XACT Repository

The IP-XACT Repository pane contains the following entry box:

Bus Definitions Paths

Specifies where the tool searches for the Bus Definition files. Click **Edit** to display the IP-XACT Directories dialog box and enter the directory paths. See Figure 3-72.

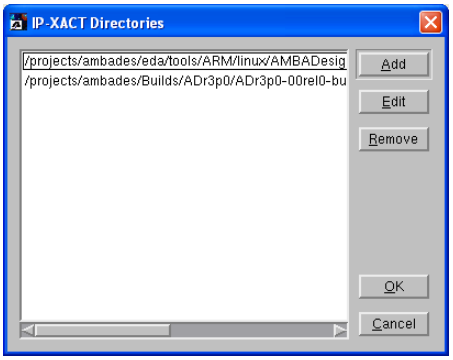


Figure 3-72 IP-XACT Directories dialog

The options available in the dialog box are:

Add This opens the Add/Edit IP-XACT Repository directory dialog box. You can directly type in a new directory or click **Browse...** to select a new directory entry. Click **OK** to close the Add/Edit IP-XACT Repository directory dialog box. Click **Cancel** to close the Add/Edit IP-XACT Repository directory dialog box without adding a new directory entry.

Edit This opens the Add/Edit IP-XACT Repository directory dialog box. You can select and edit an existing directory entry. Click **OK** to close the Add/Edit IP-XACT Repository directory dialog box. Click **Cancel** to close the Add/Edit IP-XACT Repository directory dialog box without editing a directory entry.

Remove To remove a directory entry, select an item from the list and click **Remove**. Click **OK** to close the IP-XACT Directories dialog box. Click **Cancel** to close the IP-XACT Directories dialog box without removing any directory entries.

To refresh the entries in the IP-XACT Files pane, click **Refresh All BusDefs**.

IP-XACT Files

The IP-XACT Files pane contains a tabbed window that lists the IP-XACT files available in the IP-XACT Repository. The tabs are:

All Select this tab to list all the IP-XACT file types available in the IP-XACT Repository.

Bus Definitions Select this tab to list all the Bus Definition files available in the IP-XACT Repository.

Components Select this tab to list all the Component files available in the IP-XACT Repository.

Designs Select this tab to list all the Design files available in the IP-XACT Repository.

3.6 Label Properties dialog

To add a label to the Diagram Window you can either:

- click **Label** on the main toolbar
- select **Insert → Add Label** from the main menu
- right-click on an empty section of the Diagram Window and select **Add Label** from the context-sensitive menu.

After you select one of these options, click on the Diagram Window where you want to place the label. After you place the label then the Label Properties dialog box appears. Figure 3-73 shows the Label Properties dialog box.

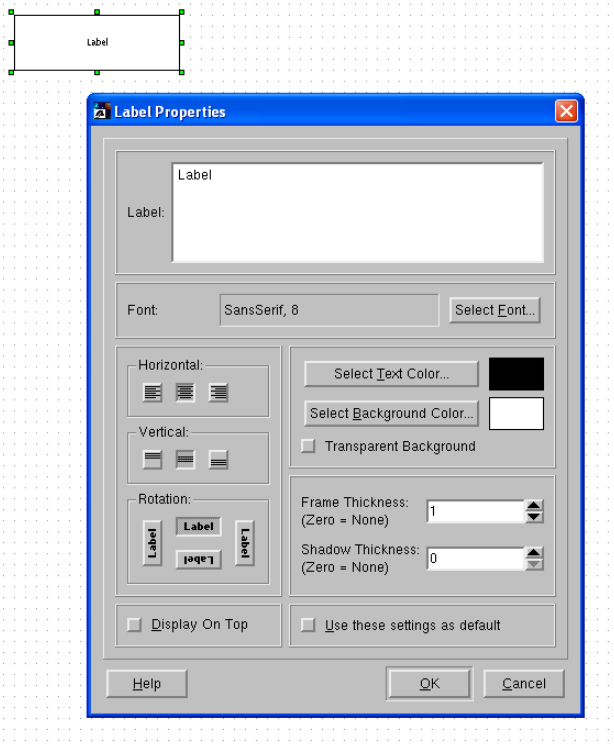


Figure 3-73 Label Properties dialog box

Use the dialog box to control how the label appears in the Diagram Window. The dialog box contains the following options:

Label Enter the text for the label in the multi-line edit box. You can use carriage returns.

Font Select the font for the entire label.

Horizontal Use the controls to set the horizontal alignment of the text in the label. You can choose left, center, or right alignment. The default is center.

Vertical Use the controls to set the vertical alignment of the text in the label. You can choose top, center, or bottom alignment. The default is center.

Rotation Use **Rotation** to rotate text through 90, 180, or 270 degrees.

Default = no rotation.

Colors Use the color controls to select colors for the text and background. Check the **Transparent Background** option for no background color.

Frame Thickness

Use the controls to adjust the frame border around the label. You can specify the thickness of the border with values in the range 1-99, or 0 for no border.

Default = 1.

Shadow Thickness

Use the controls to adjust the shadow effect around the label. You can specify the amount of shadow with values in the range 1-99, or 0 for no shadow. The shadow appears below and to the right of the label.

Default = 0.

Display On Top

Check this option to make labels appear on top of other items in the diagram.

Default Settings

Check this option to save the current settings for all subsequent labels.

3.7 Create IP-XACT Connection dialog

To add a connection to the Diagram Window you can either:

- click **Connection** on the main toolbar
- select **Insert** → **Add Connection...** from the main menu
- right-click on an empty section of the Diagram Window and select **Add Connection...** from the context-sensitive menu.

After you select one of these options then the Create IP-XACT Connection dialog box appears. See Figure 3-74.

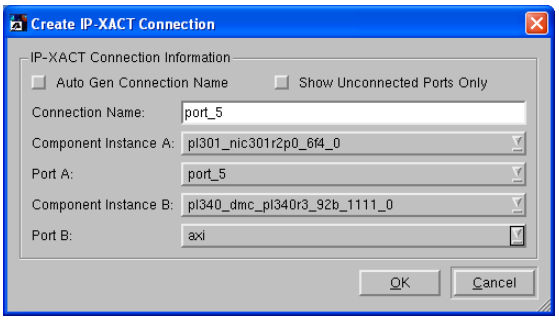


Figure 3-74 Create IP-XACT Connection dialog box

To define the Connection Name you can:

- use the default selection **Auto Gen Connection Name** to force Canvas to generate the connection name for you
- deselect the **Auto Gen Connection Name** option and enter a name in the Connection Name entry box.

To select the component ports to connect:

- use the **Component Instance A** drop-down list to select the first component that is to be connected
- use the **Port A** drop-down list to select the port on component instance A that is to be connected
- use the **Component Instance B** drop-down list to select the second component that is to be connected
- use the **Port B** drop-down list to select the port on component instance B that is to be connected
- click **OK** to connect the two ports or click **Cancel** to close the Create IP-XACT Connection dialog box without making the connection.

Note

You can choose to display only unconnected ports in the drop-down lists by selecting the **Show Unconnected Ports Only** option.

If the connection you have chosen is not valid, an Error box appears that provides a brief description of the error, and the connection is not made.

3.8 Edit Parameters dialog

Use the Edit Parameters dialog box to view legacy component object properties and ports, and to modify object parameter information.

Note

This dialog box only supports legacy devices. Use the component configurators to view and modify devices.

To open this dialog box, select an object from the Canvas or **Hierarchy** tab and select **Object → Component Information…** from the main menu. See Figure 3-75. The dialog box contains the following panes:

Properties This pane contains all the properties of the component object. Depending on the state of the object, some fields might be read-only. Reported properties include:

- Component Library name and location
- configuration file where the Component Library has been specified
- component type, version, and description
- file extension of support object files, if any
- supported debuggers, typically *RealView Debugger*
- component parameters
- component port list.

Ports List This pane lists the name and type of all the ports of the component object.

Parameters This pane contains all the parameters you can edit for the legacy component object. Double-click in the Value column to edit the parameter, and enter the new value. Press Enter or click in the background of the list box to accept the change.

If you edit a parameter value, the button to the right of the value field changes to **Reset**. Clicking this button resets the value to the original default value.

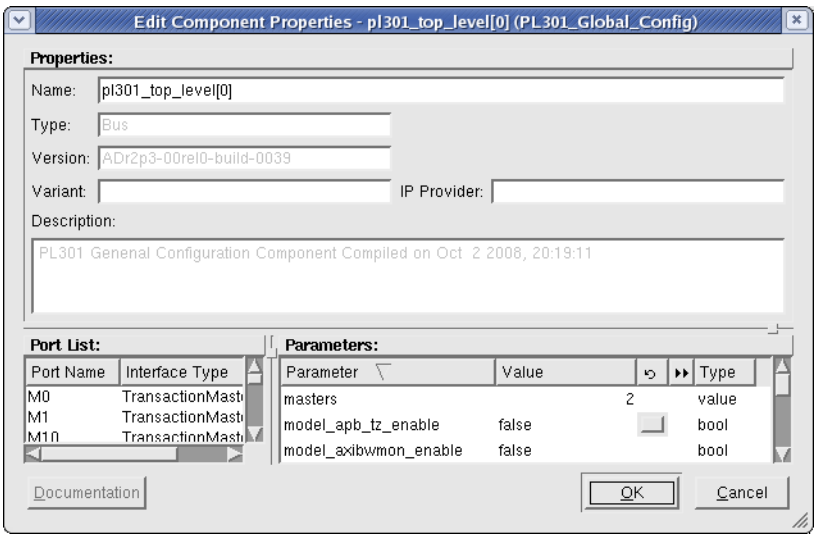


Figure 3-75 Example Edit Parameters dialog

Appendix A
Example RTL Design Flow

This appendix describes an example RTL design flow. It contains the following section:

- *RTL design flow* on page A-2.

A.1 RTL design flow

You must register the AMBA component with AMBA Designer to enable AMBA Designer to generate, simulate, or synthesize the RTL.

The AMBA component installation package provides a UNIX script that enables you to register the AMBA component with AMBA Designer. See the *Release note* of the AMBA component for information about how to use the script.

Note

The RTL generation facility is not available if:

- no AMBA Designer license feature is installed
- no corresponding IP bundle is installed.

The RTL Design Flow Manager dialog box that Figure 2-8 on page 2-9 shows controls the RTL design flow process. Figure A-1 shows the RTL Design Flow Manager process.

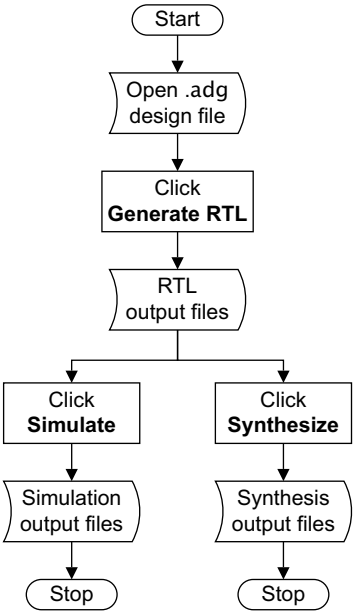


Figure A-1 RTL Design Flow Manager process

Note

The RTL Design Flow Manager always executes the Generate RTL process before it permits the simulation or synthesis processes to start.

This section describes how to generate the RTL for an AMBA component by using the 4×3 example that the AMBA Interconnect supplement to AMBA Designer describes.

Note

To generate RTL, you must have the following development tools installed:

- Perl
- TCL.

See the *AMBA Designer (ADR-301) Release Note* for information about the tool versions that you require.

To generate the RTL:

1. Click **Open** on the main toolbar to open a file browser dialog box.

2. Load the example 4×3 AMBA Interconnect that the HPM (PL301) supplement to AMBA Designer describes. The file is named `PL301_xxx_4x3_1.adg` and is located in the default location:

   `/home/<user>/.ARM/AMBA_Designer/<x>.<y>/Designs/`

   Note

   You must enter `/home/<user>/.ARM` in the file browser dialog box because the dialog box does not display the `.ARM` directory. Where:

   - *<user>* is the login name of the current person running AMBA Designer
   - *<x>* is the major revision number and *<y>* is the minor revision number of AMBA Designer, for example, `3.0`.

   Figure A-2 shows the AMBA Interconnect that the Diagram Window displays.

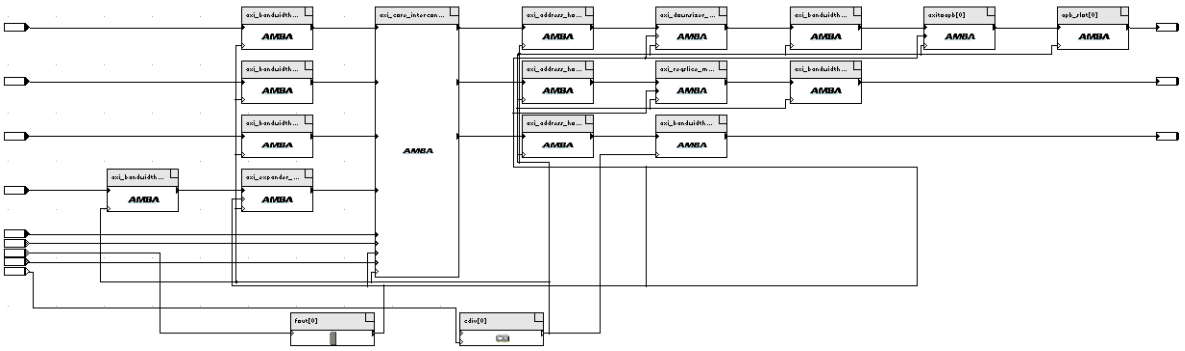


Figure A-2 AMBA Interconnect

3. Right-click the `axi_core_interconnect[0]` component to display the context-sensitive menu.

4. Select **AMBA Designer → PL301 RTL Design Flow Manager...** from the context-sensitive menu. See Figure A-3 on page A-4. This opens the RTL Design Flow Manager dialog box.

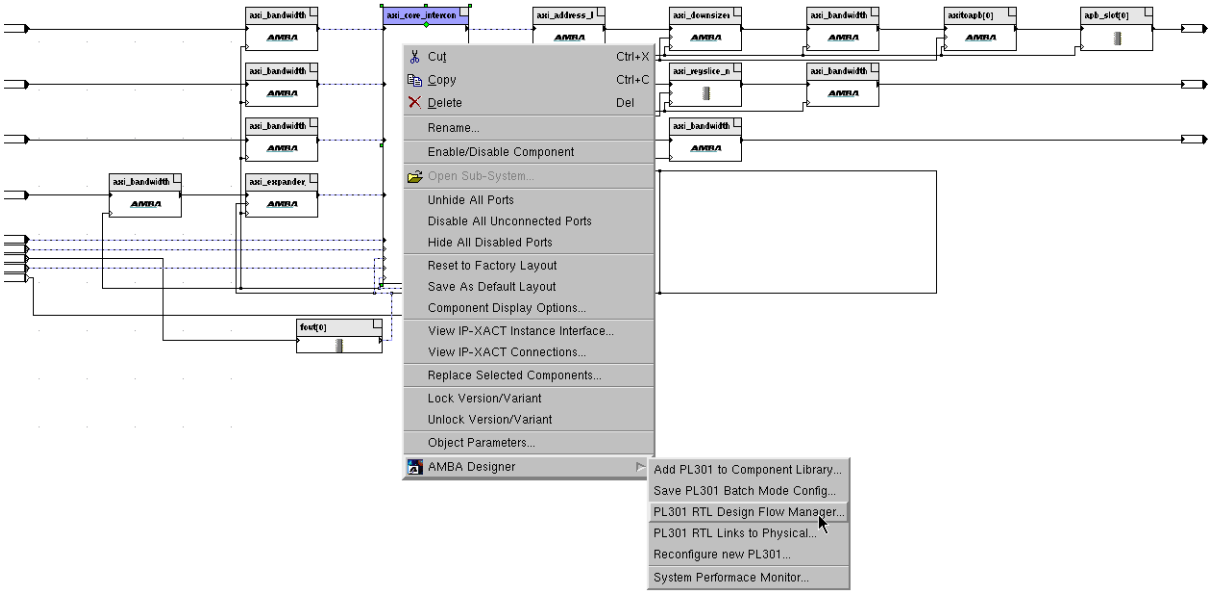


Figure A-3 RTL Design Flow Manager

AMBA Designer creates an XML configuration file. Figure 2-22 on page 2-20 shows the location of the XML configuration file.

Note

AMBA Designer also uses the XML configuration file during batch mode operation. See *Batch mode operation* on page 2-20 for more information.

5. Click **Generate RTL** in the RTL Design Flow Manager dialog box. See Figure A-4.

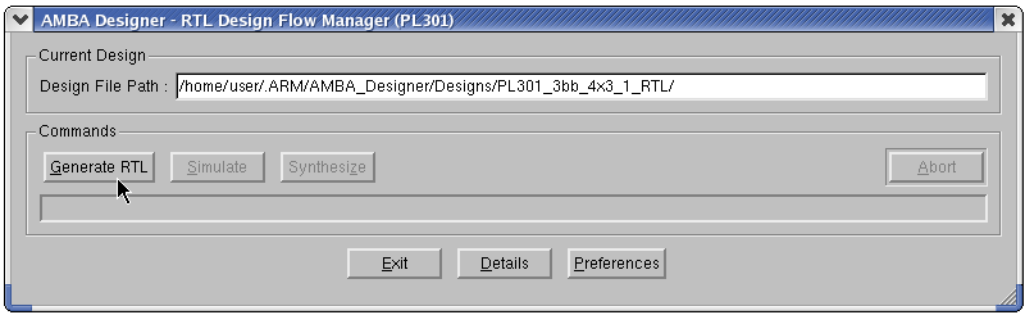


Figure A-4 Generate RTL

AMBA Designer reads in the XML configuration file and the RTL generation process starts. The progress bar in the Commands pane of the RTL Design Flow Manager dialog box displays the progress. On completion of the RTL generation process, the progress bar changes color to one of the following:

Green To indicate that AMBA Designer generated the RTL successfully.

Red To indicate that AMBA Designer failed to generate the RTL.

Click **Details** to open the Output Window pane to display information about the status of the process.

The configured Verilog and synthesis are generated locally and stored in the `logical` and `implementation` directories. Figure A-5 on page A-5 shows the locations of these directories.

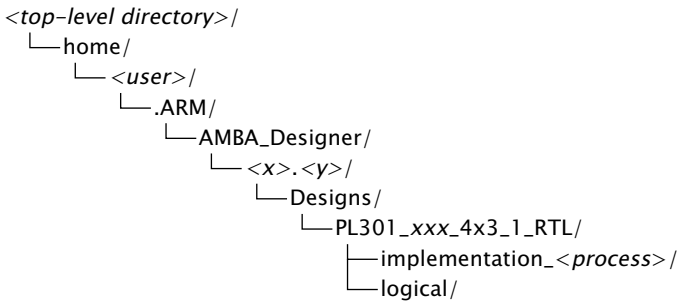


Figure A-5 Location of Verilog and synthesis directories

In Figure A-5:

- <x> represents the major revision number and <y> represents the minor revision number of AMBA Designer, for example, `3.0`
- <process> is either your chosen process or the process that the delivered scripts select, for example, tsmc65lp_adhvs.

Note

Figure A-5 shows the directories for the PL301. For other AMBA devices, the relevant supplement document describes the directory structure.

The RTL generation process creates a *File Reader Master* (FRM) testbench based on the configured AMBA Interconnect. During the simulation process, the RTL Design Flow Manager uses the FRM testbench to verify the functionality of the configured RTL.

Appendix B
Keyboard Shortcuts

This appendix lists the AMBA Designer Canvas keyboard shortcuts. It contains the following section:

- *AMBA Designer Canvas shortcuts* on page B-2.

B.1 AMBA Designer Canvas shortcuts

Table B-1 shows the keyboard shortcuts for AMBA Designer Canvas.

Table B-1 AMBA Designer Canvas shortcuts

Key	Action
Ctrl + N	**File → New**
Ctrl + O	**File → Open**
Ctrl + S	**File → Save**
Ctrl + F4	**File → Close**
Ctrl + P	**File → Print**
Ctrl + Q	**File → Exit**
Ctrl + Z	**Edit → Undo**
Ctrl + Y	**Edit → Redo**
Ctrl + X	**Edit → Cut**
Ctrl + C	**Edit → Copy**
Ctrl + V	**Edit → Paste**
Ctrl + D	**Edit → Duplicate**
Del	**Edit → Delete**
Ctrl + A	**Edit → Select All**
Ctrl + Shift + S	**Edit → Edit Mode**
Ctrl + Shift + C	**Edit → Connect Ports Mode**
Ctrl + G	**View → Grid**
Ctrl + +	**View → Zoom In**
Ctrl + –	**View → Zoom Out**
Ctrl + 1	**View → Set Zoom to 100%**
Ctrl + F	**View → Zoom to Fit**
Ctrl + R	**View → Center on Selected Object(s)**
Ctrl + I	**View → Center Diagram**
Ctrl + PgDn	**Window → Next Window**
Ctrl + PgUp	**Window → Previous Window**
F1	**Help → AMBA Designer (ADR-301) User Guide**

Appendix C
Migration Guide

This appendix describes how to migrate configured components created in earlier versions of AMBA Designer for use in version r3p0 of the product. It contains the following sections:

C.1 Component migration

This section describes how to migrate components created in earlier versions of AMBA Designer for use in version r3p0.

C.1.1 Adding a component to the Component Library

To add a component configured in an earlier version of AMBA Designer, run the following script: `$AD_HOME/etc/MigrateADr2toADr3.csh`.

Note

The migration script is for the Linux platform only. The Solaris platform is not supported.

After running the script, the component appears in the Component Library and you can drag and drop it into the Diagram Window for connecting, stitching, and saving in the new `.adg` file format.

C.1.2 Reconfiguring a component

To reconfigure or regenerate a component originally configured in an earlier version of AMBA Designer:

1. Load the component definition (`.xml`) that was created in the earlier version of AMBA Designer into the Configuration Window for the same component.

   Note

   For the NIC-301 r2 configurator, you can locate and load the component definition (`.xml`) by selecting **File → Open...** from the main menu of the component Configuration Window. For all other IP, click **Browse** in the File Creation Options pane of the Configurator Window. See *Example Configurator Window* on page 2-7.

2. Click **OK** to generate the new component configuration, and close the Configuration Window.
3. In the Diagram Window, right-click the generated component, and select **Reconfigure** from the context-sensitive menu.
4. Save the new component configuration, or follow the normal steps to render the component.

C.2 System migration

AMBA IP-XACT components now have a one-to-one mapping with the RTL. This is not the case for systems that use `.mxp` files created in earlier versions of AMBA Designer, and you cannot open these directly.

To migrate a system created in an earlier version of AMBA Designer:

1. Convert the `.mxp` system file to an `.adg` file by migrating the components using the method that *Adding a component to the Component Library* on page C-2 describes.
2. Re-instantiate and reconnect the migrated components in the Canvas.

Appendix D
Revisions

This appendix describes the technical changes between released issues of this book.

Table D-1 Differences between issues A through F

Change	Location
No revision history recorded	-

Table D-2 Differences between issue F and issue G

Change	Location
Removed references to SoC Designer and SoC Designer Simulator	Throughout book
Removed references to cycle accurate modeling	Throughout book
Removed references to Microsoft Windows	Throughout book
Moved all third-party EDA tool specific content to introduction	Throughout book
Removed references to *Bandwidth Monitoring Components* (BMCs)	Throughout book
Added information on third-party tools	*Third-party tools* on page 1-5
Added information on third-party software	*Third-party software* on page 1-6
Removed *Installation* Chapter and moved information to separate book	*AMBA Designer (ADR-301) Installation Guide*
Removed description of MemMap dialog	Chapter 3 *Canvas Reference*
Changed description of Component Wizard	Using the Components Wizard on page 2-20

Table D-2 Differences between issue F and issue G (continued)

Change	Location
Changed description of command line options	Table 2-1 on page 2-21
Added reference content for canvas	Chapter 3 *Canvas Reference*
Removed **What's This** from the Help menu	*Help menu* on page 3-14
Removed **IP-XACT Properties...** from the Component Context menu	*Component context-sensitive menu* on page 3-21
Removed description of System Properties dialog	Chapter 3 *Canvas Reference*
Added reference content for keyboard shortcuts	Appendix B *Keyboard Shortcuts*

Table D-3 Differences between issue G and issue H

Change	Location	Affects
Changed the description for the Help menu to match the new functionality	*Help menu* on page 3-14	r2p3
Added bullet points stating that hierarchical IP stitching is not supported, and that you must specify default tie-off values in binary format and not in hexadecimal format	*Limitations* on page 3-46	r2p3

Table D-4 Differences between issue H and issue I

Change	Location	Affects
Removed all references to the Component Wizard. Use of this tool is now subject to an additional license agreement.	Chapter 3 *Canvas Reference*	r3p0
Removed all references to dummy components. IP-XACT 1.4 is now supported natively.	Throughout book	r3p0
Removed all references to component models as these are no longer supported.	Throughout book	r3p0
Described all the new IP-XACT component features added to Preferences, the main and context-sensitive menus, the toolbar and existing and new dialog boxes.	Throughout book	r3p0

Table D-5 Differences between issue I and issue J

Change	Location	Affects
Removed all references to generic IP stitching	Throughout book	r3p0
Note added, the **Hierarchy Window** option controls the display of the AMBA Configuration Window	• *Window menu* on page 3-13 • *AMBA Configuration Window* on page 3-26	r3p0
Updated the location of the preferences `.ini` file	Figure 3-64 on page 3-52	r3p0
Updated the keyboard shortcuts	Table B-1 on page B-2	r0p0

Glossary

This glossary describes some of the terms used in technical documents from ARM.

Advanced eXtensible Interface (AXI)
A bus protocol that supports separate address/control and data phases, unaligned data transfers using byte strobes, burst-based transactions with only start address issued, separate read and write data channels to enable low-cost DMA, ability to issue multiple outstanding addresses, out-of-order transaction completion, and easy addition of register stages to provide timing closure.

The AXI protocol also includes optional extensions to cover signaling for low-power operation.

AXI is targeted at high performance, high clock frequency system designs and includes a number of features that make it very suitable for high speed sub-micron interconnect.

Advanced High-performance Bus (AHB)
A bus protocol with a fixed pipeline between address/control and data phases. It only supports a subset of the functionality provided by the AMBA AXI protocol. The full AMBA AHB protocol specification includes a number of features that are not commonly required for master and slave IP developments and ARM recommends only a subset of the protocol is usually used. This subset is defined as the AMBA AHB-Lite protocol.

See also Advanced Microcontroller Bus Architecture and AHB-Lite.

Advanced Microcontroller Bus Architecture (AMBA)
A family of protocol specifications that describe a strategy for the interconnect. AMBA is the ARM open standard for on-chip buses. It is an on-chip bus specification that details a strategy for the interconnection and management of functional blocks that make up a *System-on-Chip* (SoC). It aids in the development of embedded processors with one or more CPUs or signal processors and multiple peripherals. AMBA complements a reusable design methodology by defining a common backbone for SoC modules.

Advanced Peripheral Bus (APB)
A simpler bus protocol than AXI and AHB. It is designed for use with ancillary or general-purpose peripherals such as timers, interrupt controllers, UARTs, and I/O ports. Connection to the main system bus is through a system-to-peripheral bus bridge that helps to reduce system power consumption.

AHB *See* Advanced High-performance Bus.

AHB-Lite A subset of the full AMBA AHB protocol specification. It provides all of the basic functions required by the majority of AMBA AHB slave and master designs, particularly when used with a multi-layer AMBA interconnect. In most cases, the extra facilities provided by a full AMBA AHB interface are implemented more efficiently by using an AMBA AXI protocol interface.

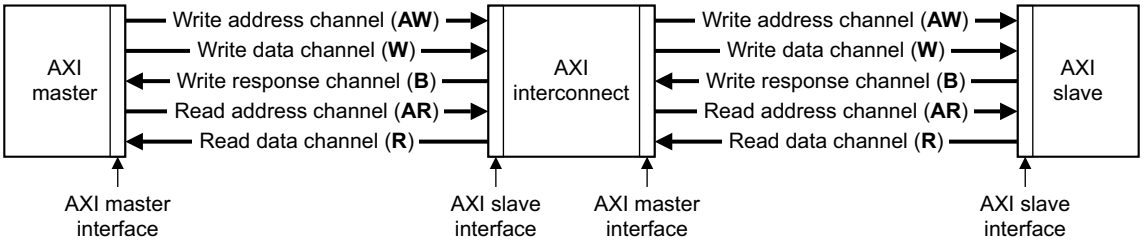
Aligned A data item stored at an address that is divisible by the number of bytes that defines the data size is said to be aligned. Aligned words and halfwords have addresses that are divisible by four and two respectively. The terms word-aligned and halfword-aligned therefore stipulate addresses that are divisible by four and two respectively.

AMBA *See* Advanced Microcontroller Bus Architecture.

APB *See* Advanced Peripheral Bus.

AXI *See* Advanced eXtensible Interface.

AXI channel order and interfaces
The block diagram shows:
- the order in which AXI channel signals are described
- the master and slave interface conventions for AXI components.



AXI terminology The following AXI terms are general. They apply to both masters and slaves:

Active read transaction
A transaction for which the read address has transferred, but the last read data has not yet transferred.

Active transfer
A transfer for which the **xVALID**[1] handshake has asserted, but for which **xREADY** has not yet asserted.

Active write transaction
A transaction for which the write address or leading write data has transferred, but the write response has not yet transferred.

1. The letter **x** in the signal name denotes an AXI channel as follows:
AW Write address channel.
W Write data channel.
B Write response channel.
AR Read address channel.
R Read data channel.

Completed transfer

A transfer for which the **xVALID**/**xREADY** handshake is complete.

Payload The non-handshake signals in a transfer.

Transaction An entire burst of transfers, comprising an address, one or more data transfers and a response transfer (writes only).

Transmit An initiator driving the payload and asserting the relevant **xVALID** signal.

Transfer A single exchange of information. That is, with one **xVALID**/**xREADY** handshake.

The following AXI terms are master interface attributes. To obtain optimum performance, they must be specified for all components with an AXI master interface:

Combined issuing capability

The maximum number of active transactions that a master interface can generate. It is specified for master interfaces that use combined storage for active write and read transactions. If not specified then it is assumed to be equal to the sum of the write and read issuing capabilities.

Read ID capability

The maximum number of different **ARID** values that a master interface can generate for all active read transactions at any one time.

Read ID width

The number of bits in the **ARID** bus.

Read issuing capability

The maximum number of active read transactions that a master interface can generate.

Write ID capability

The maximum number of different **AWID** values that a master interface can generate for all active write transactions at any one time.

Write ID width

The number of bits in the **AWID** and **WID** buses.

Write interleave capability

The number of active write transactions for which the master interface is capable of transmitting data. This is counted from the earliest transaction.

Write issuing capability

The maximum number of active write transactions that a master interface can generate.

The following AXI terms are slave interface attributes. To obtain optimum performance, they must be specified for all components with an AXI slave interface:

Combined acceptance capability

The maximum number of active transactions that a slave interface can accept. It is specified for slave interfaces that use combined storage for active write and read transactions. If not specified then it is assumed to be equal to the sum of the write and read acceptance capabilities.

Read acceptance capability

The maximum number of active read transactions that a slave interface can accept.

Read data reordering depth

The number of active read transactions for which a slave interface can transmit data. This is counted from the earliest transaction.

Write acceptance capability

The maximum number of active write transactions that a slave interface can accept.

Write interleave depth

The number of active write transactions for which the slave interface can receive data. This is counted from the earliest transaction.

Beat

Alternative word for an individual transfer within a burst. For example, an INCR4 burst comprises four beats.

See also Burst.

Burst

A group of transfers to consecutive addresses. Because the addresses are consecutive, there is no requirement to supply an address for any of the transfers after the first one. This increases the speed at which the group of transfers can occur. Bursts over AMBA are controlled using signals to indicate the length of the burst and how the addresses are incremented.

See also Beat.

Byte lane strobe

A signal that is used for unaligned or mixed-endian data accesses to determine which byte lanes are active in a transfer. One bit of this signal corresponds to eight bits of the data bus.

Direct Memory Access (DMA)

An operation that accesses main memory directly, without the processor performing any accesses to the data concerned.

DMA

See Direct Memory Access.

Halfword

A 16-bit data item.

Unaligned

A data item stored at an address that is not divisible by the number of bytes that defines the data size is said to be unaligned. For example, a word stored at an address that is not divisible by four.

Word

A 32-bit data item.