

Using the ispXPGA Floorplanner

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Using the ispXPGA Floorplanner

This tutorial shows you how to use the Floorplanner to make adjustments to your ispXPGA design.

Learning Objectives

When you have completed this tutorial, you should be able to:

- Open a Floorplanner design file
- Tour the graphical user interface
- Customize the Floorplanner display
- Locate an element using the Design Browser
- Change pin assignments
- Reassign PFU block locations
- Set a placement region
- Use the Query Widget to find instances and nets
- Locate timing delay paths with the Timing Widget
- Group instances with the Design Browser
- Locate a group with the Group Widget

Time to Complete This Tutorial

The time to complete this tutorial is about 40 minutes.

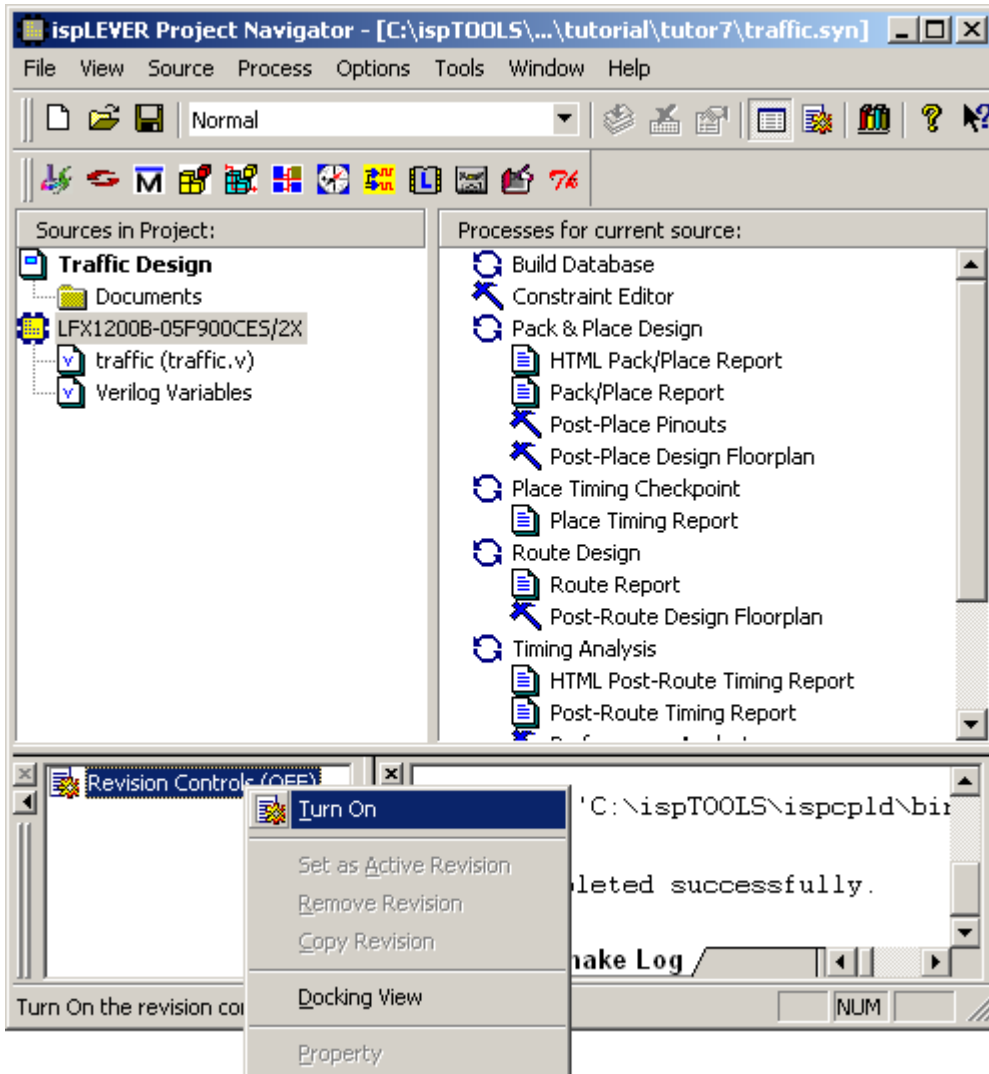
Task 1: Open the Design

After starting the Project Navigator you can open the tutorial design file.

1. Choose **File > Open Example** to open the dialog box.
2. Navigate to the `tutorial\tutor7` directory.

Note: If you want to preserve the original tutorial design files, save the `tutor7` directory to another location on your computer before proceeding.

3. Select `traffic.syn`.
4. Click **Open**.



*Note: You can toggle Revision Control on/off by right clicking in the Revision Control window and selecting either **Turn On** or **Turn Off** from the popup menu. For this tutorial, it doesn't matter.*

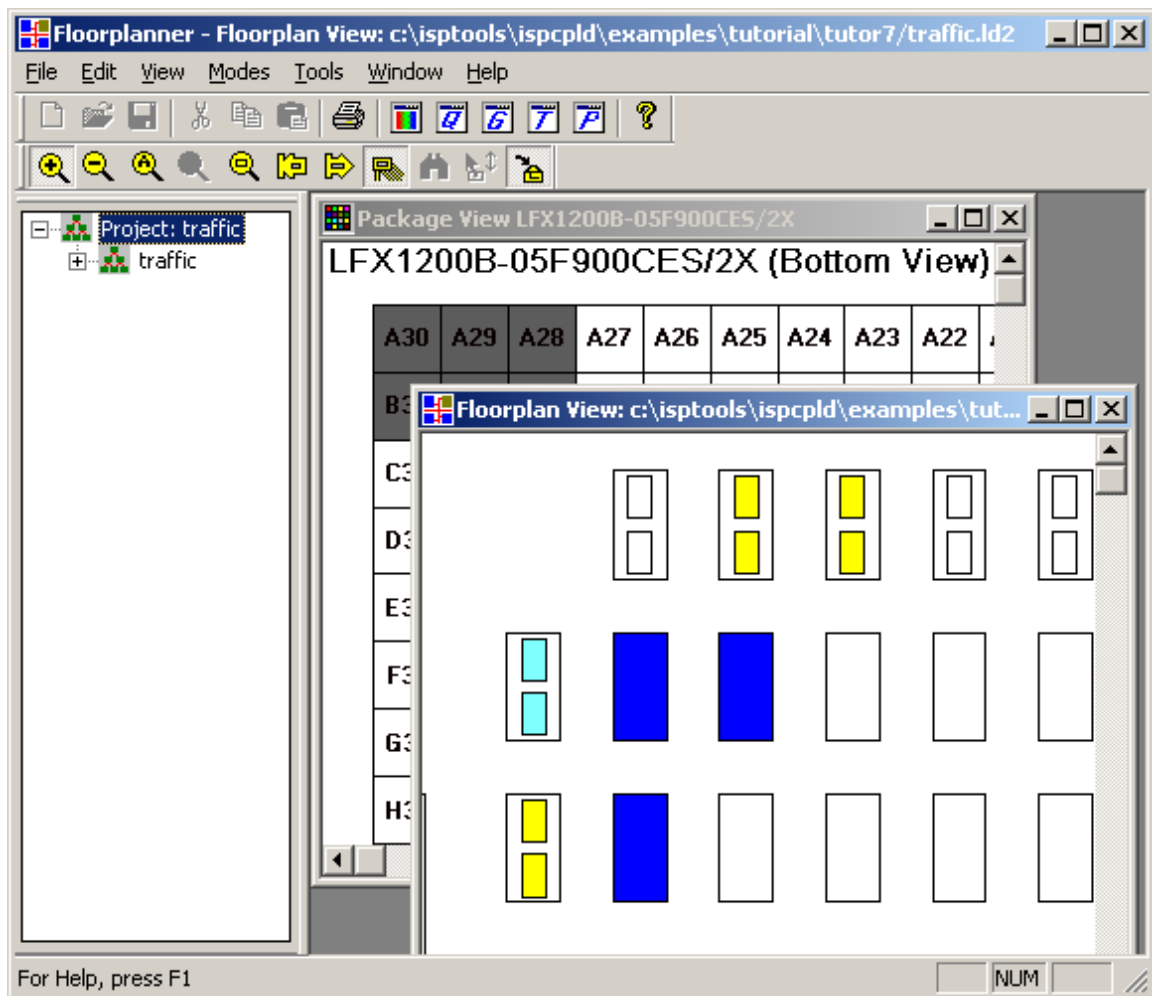
Task 2: Open a Floorplanner Design File

After an initial Lattice internal database is generated, the Pack & Place Design process packs the design instances, or cells, into Programmable Functional Units (PFUs) and places them on the ispXPGA device. The output of this process is the post-place design database and a Pack/Place Report.

When you run the Post-Place Design Floorplan process, the project design automatically loads into the Floorplanner.

To open a post-place design floorplan file:

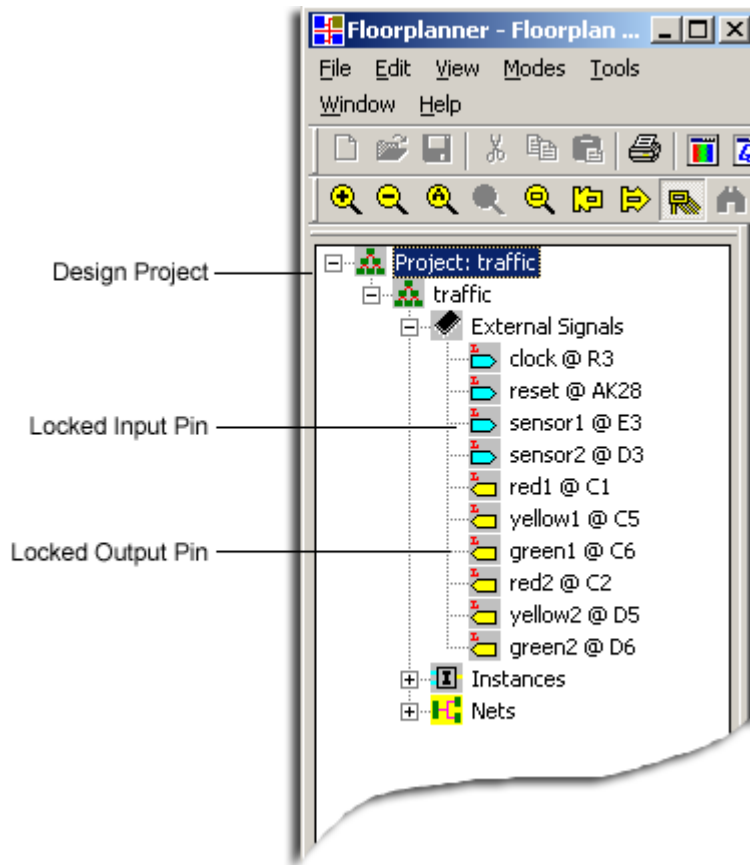
- In the Project Navigator Processes window, double-click the **Post-Place Design Floorplan** process to open the Floorplanner with the current design. Your view will look similar to this one.



Task 3: Tour the Graphical User Interface - The Design Browser

The Floorplanner main window contains three windows: the Design Browser, the Package View, and the Floorplan View.

The Design Browser is located on the left side of the main window and gives you a logical perspective of your design. You can use the Design Browser to locate an instance or net in the Floorplan View window, or locate an external signal in either the Package View or Floorplan View windows. Additionally, you can unplace an instance, group nets and instances, and set regions in the top-level design using the Design Browser.



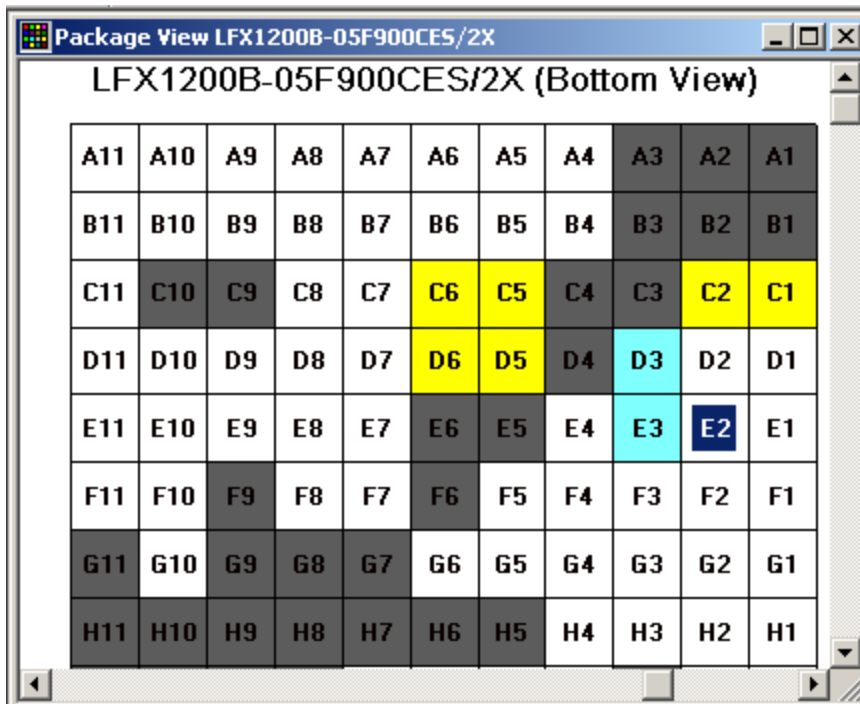
The Design Browser divides your design into three sections: External Signals, Instances, and Nets. Each section can be expanded to show the logic elements used in the design. The Design Browser comprises various symbols.

NOTE: For more information about using the Design Browser, see the *Floorplanner Help – ispXPGA: Procedures > Design Browser*.

Task 4: Tour the Graphical User Interface - The Package View

The Package View window provides a physical view of the design. The Package View shows the actual pin assignments. The system (non-user) pins are highlighted in gray. Any reserved pins are light gray. Assigned input pins are in blue. Output pins are in yellow. Bi-directional pins are in magenta. Unused pins are blank. These are the default colors, and they can be changed using the Color Legend, as you will learn in Task 6.

***Note:** You can toggle between the Package View and Floorplan View windows by choosing View > Package View or Floorplan View or by using the Windows shortcut Ctrl+F6. Choosing one of these commands brings the corresponding window to the front.*



For easy pin assignments, you can drag signals from the Design Browser to the Package View, or drag and drop signals inside the Package View.

Right-click pop-up menus offer commands for controlling the view. For example, to view IO banking, click an empty space in Package View, right-click, and select **Show Bank IO** from the pop-up. To view pin attributes, click a pin, right-click, and select **Pin Property**.

***Note:** For more information about using Package View, see the **Floorplanner Help – ispXPGA: Procedures > Package View**.*

Task 5: Tour the Graphical User Interface - The Floorplan View

The Floorplan View window displays the physical placement of the design logic and displays how device resources are utilized. You can use this window to debug and edit device utilization to achieve better performance.

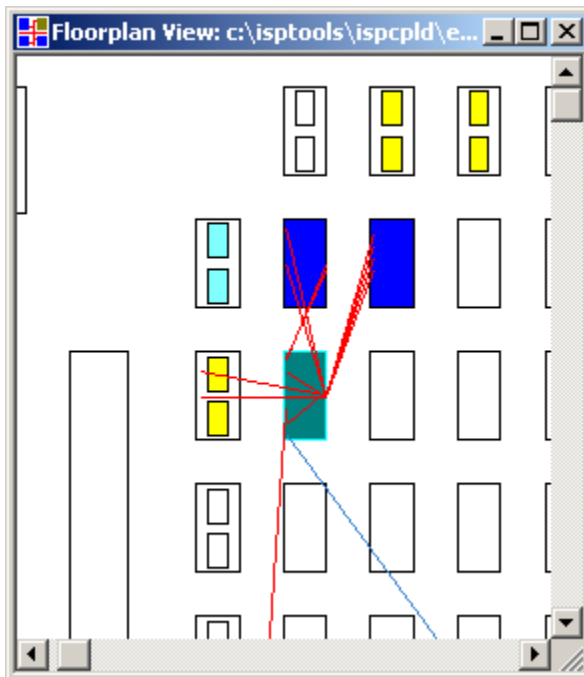
To change the Floorplan View display:

1. On the toolbar, click the **Fanin** and **Fanout** buttons.

Note: Fanin displays the signals coming into a component, and Fanout displays the signals leaving a component.



2. Select the bottom PFU. Notice that the routing lines are displayed.



Some of the procedures that you can perform in the Floorplan View include:

- Moving PFUs, EBRs, and PIOs by selecting the blocks and dragging and dropping in the Floorplan View.
- Setting group assignments using the Retain Packing command. By setting group assignments, you retain the logic packing and location of one or more PFU, PIO, and/or EBR. The group assignments are written to the Lattice Constraint File (.lct).
- Creating regions (post-place, and post-route) to reserve resources in your design. You can also select instances within the region and move them as a group.

- Selecting instances and nets and grouping them with the Group command.
 - Displaying an amplified (enlarged) view of blocks, such as PFUs and PIOs. This allows you to see a detailed view of the blocks without the need to zoom in on each individual block in the Floorplan View. You can click on pins in the amplified view and see their routing from a global perspective.
 - Performing custom pin-to-pin routing using the Pin Routing dialog box.
 - Viewing properties of an EBR, PFU, and PIOs.
3. Click the **Fanin** and **Fanout** buttons again to turn off routing display.



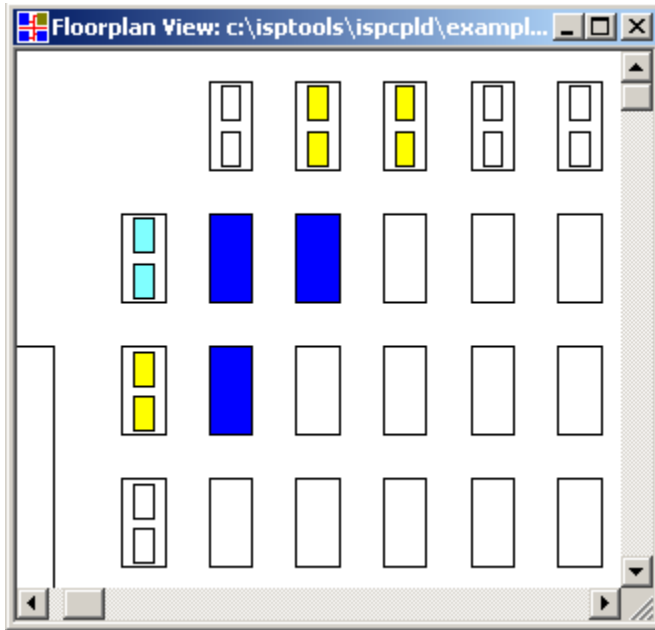
Note: For more information about using Floorplan View, see the *Floorplanner Help – ispXPGA: Procedures > Floorplan View*.

Task 6: Customizing the Floorplanner Display

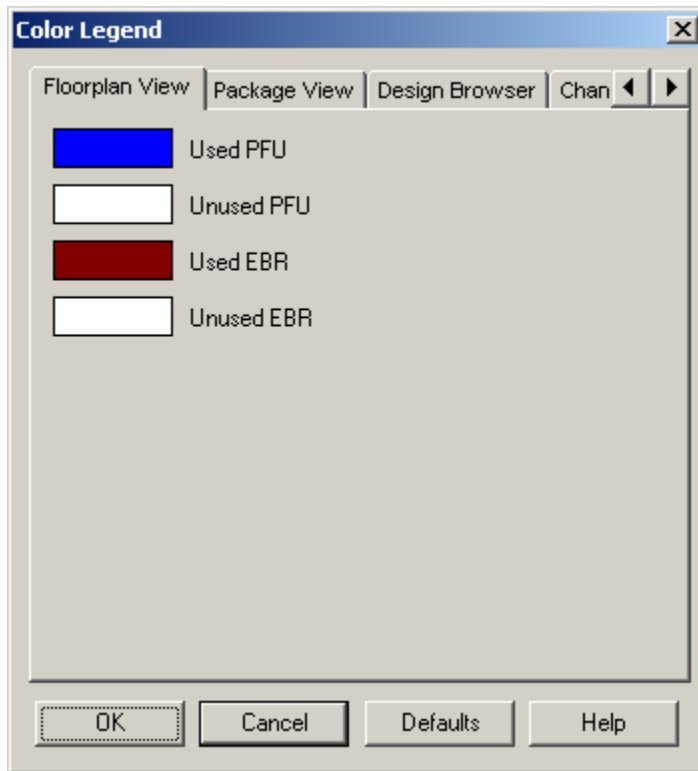
You can customize display colors of elements within the Floorplan View, Package View, and Design Browser windows. In this step, change the display color of used PFUs in the Floorplan View window.

To customize display colors in the Floorplanner:

1. Make the Floorplan View window active and use the **View > Zoom** commands (or the toolbar icons) so that your view is similar to this one.

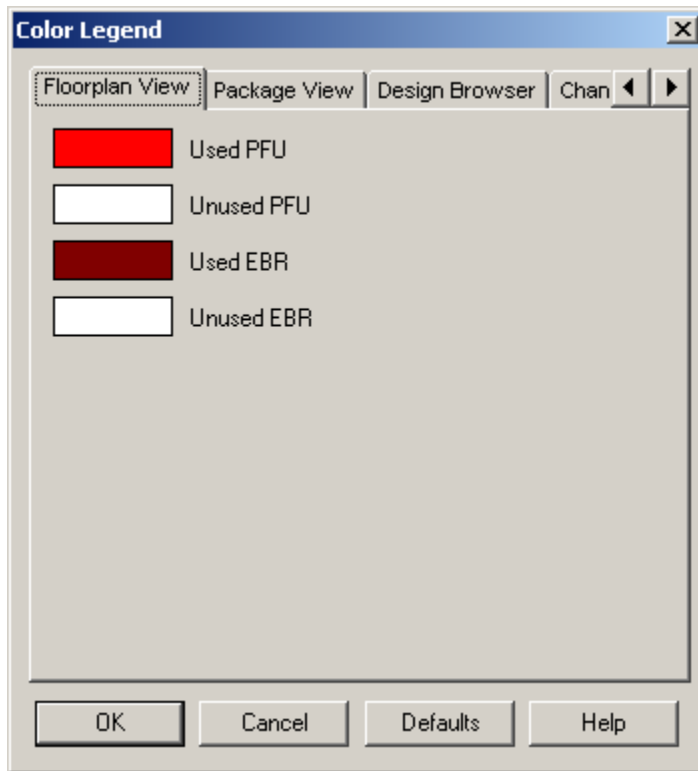


2. Choose **Tools > Color Legend** to open the Color Legend dialog box.

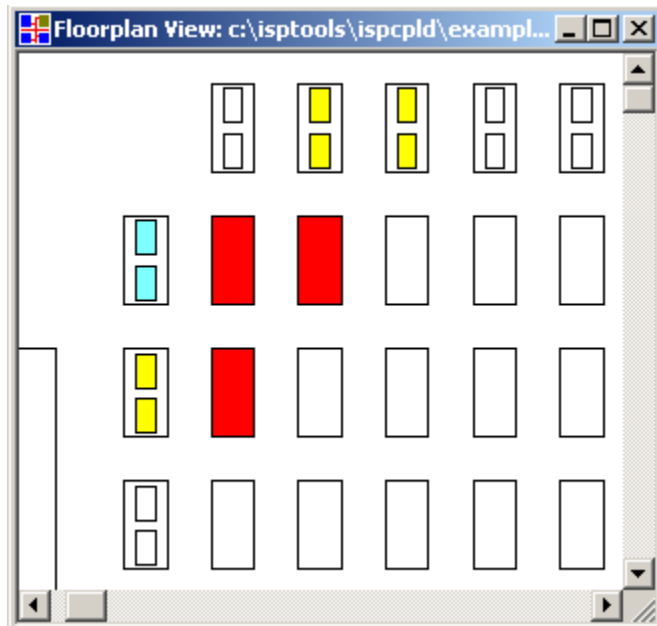


3. Use the **scroll arrows** and view the tabs to become familiar with what you can do using the dialog box. When you are through, return to the **Floorplan View** tab.
4. Click the **Used PFU** color box (blue) to open the Color dialog box.

5. Select the color **red** and click **OK** to close the Color dialog box.



6. Click **OK** to close the Color Legend dialog box. Notice the Used PFU color in the Floorplan View has changed from blue to red.



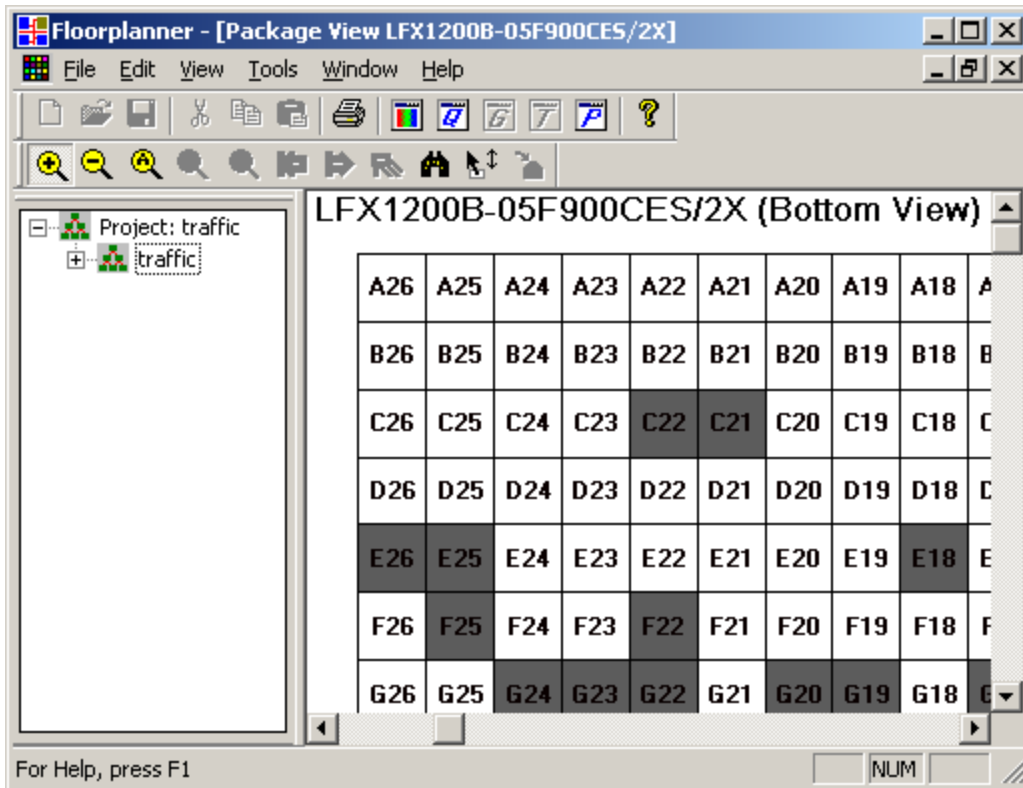
Task 7: Locate an Element with the Design Browser

You can locate an instance or net in the Floorplan View using the Design Browser, and you can locate an external signal in either the Package View or Floorplan View.

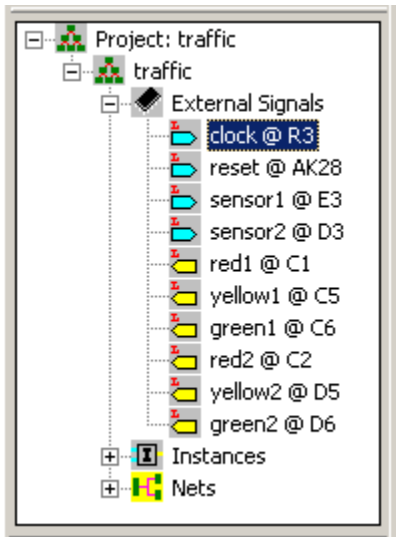
To locate an external signal (Device Pin) in the Package View:

1. Double-click the Package View window title bar to expand the window. Choose **View > Zoom In** and adjust the view so that you are able to read the pin names.

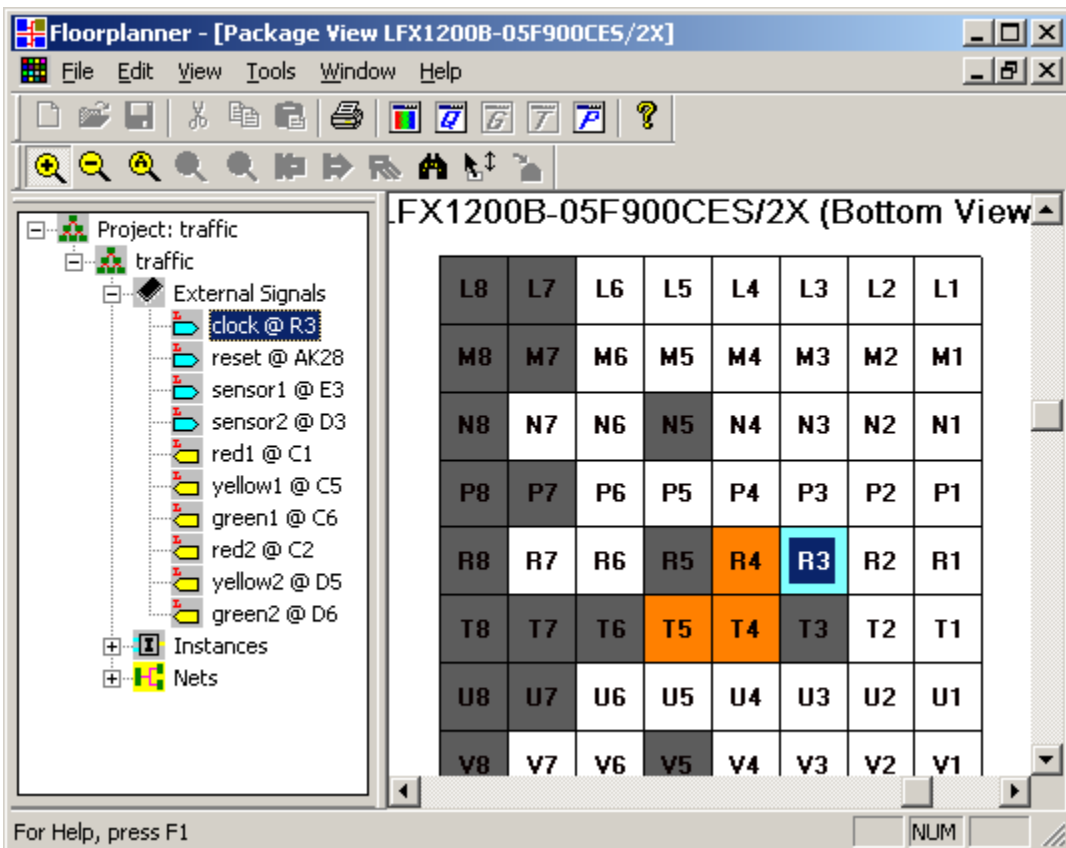
NOTE: Don't worry about matching your view to this one. The important thing is to make sure you can read the pin numbers.



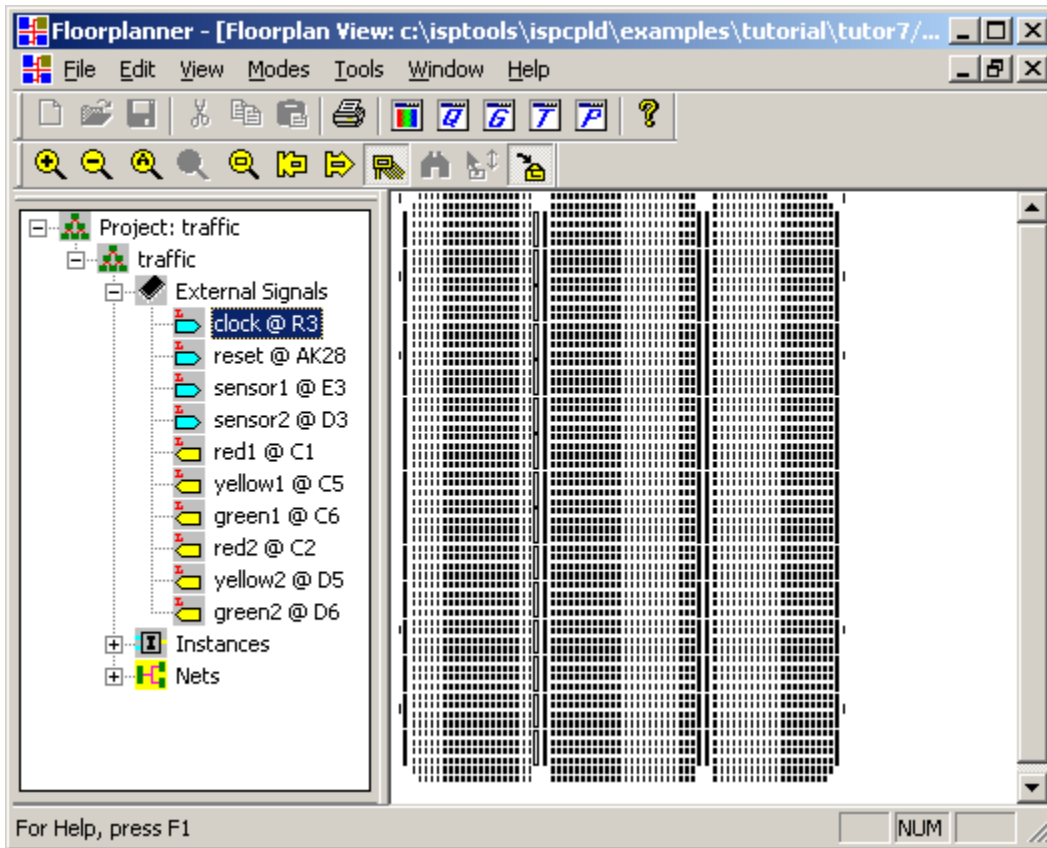
- In the Design Browser, expand the tree until you can see **External Signals > clock @ R3**.



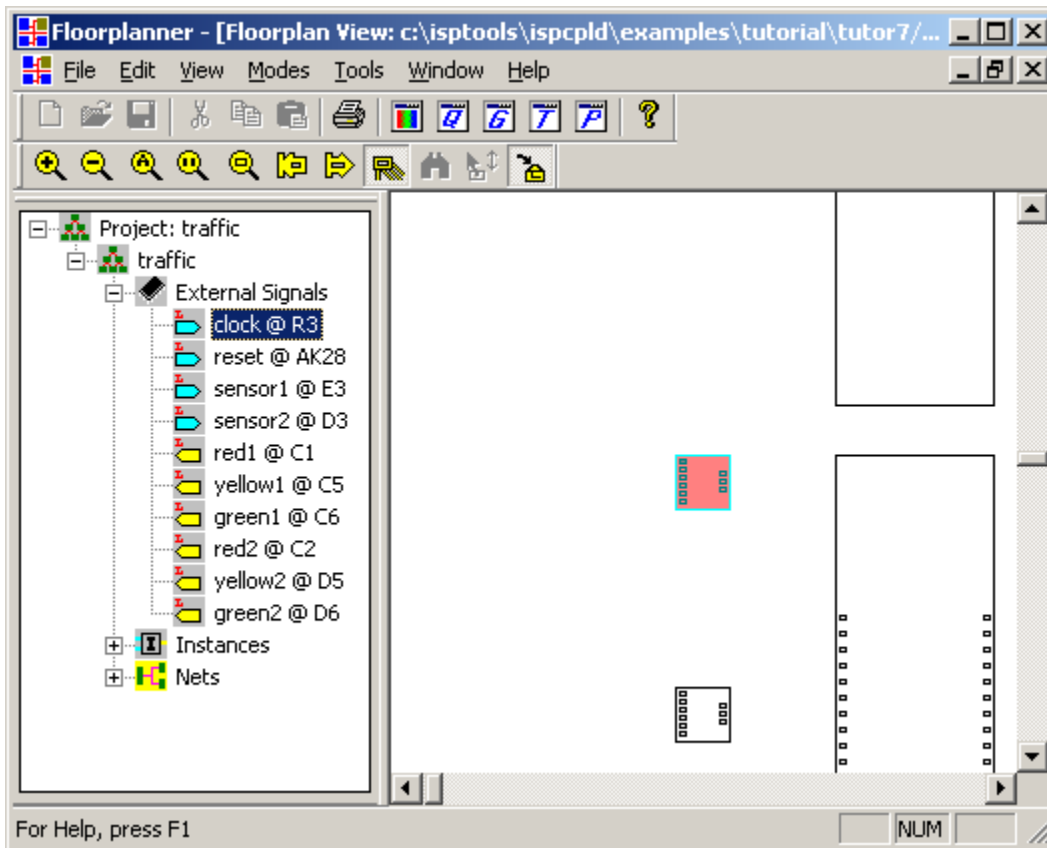
- In the Design Browser, right-click **clock @ R3** and choose **Locate > Device Pin**. The view jumps to the **R3** pin in the Package View.



4. Choose **View > Floorplan View** to make the Floorplan View window active.
Choose **View > Zoom to Fit** so that you can see the entire floorplan.



5. In the Design Browser, right-click **clock @ R3** and choose **Locate > PIO**. The view jumps to the **R3 PIO** in the Floorplan View. This lets you see the association between the pin, signal, and the PIO.

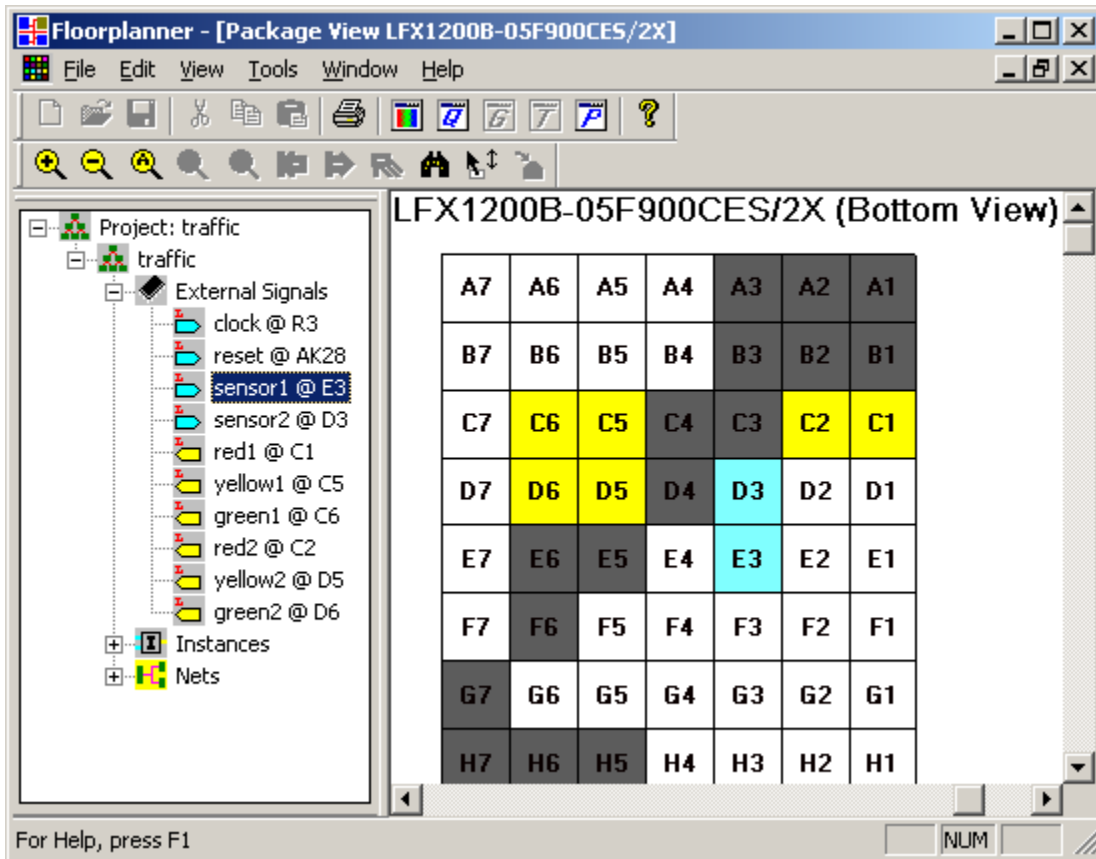


Task 8: Change Pin Assignments

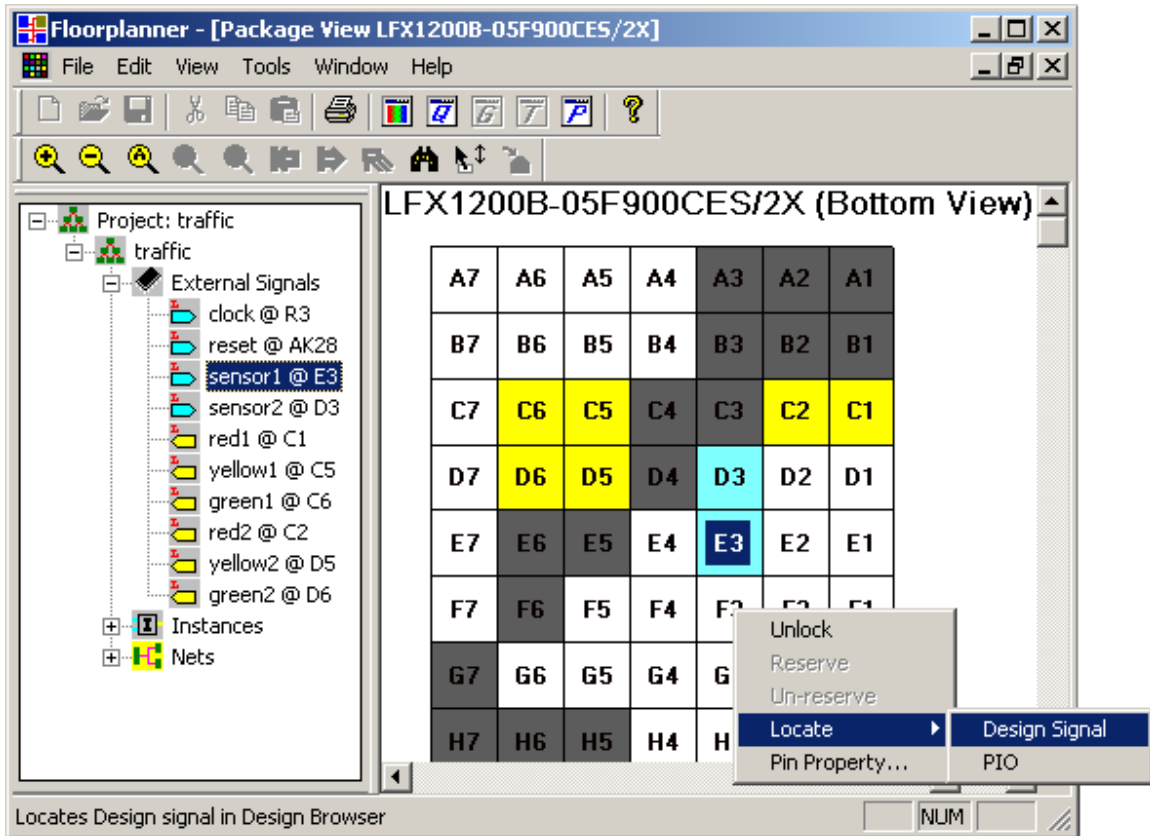
This reentrant design flow procedure lets you set or modify pin assignments using the Package View window. You can assign pins by dragging signals from the Design Browser to a pin in the Package View. Also, you can change pin assignments by dragging and dropping signals inside the Package View.

To change a pin assignment:

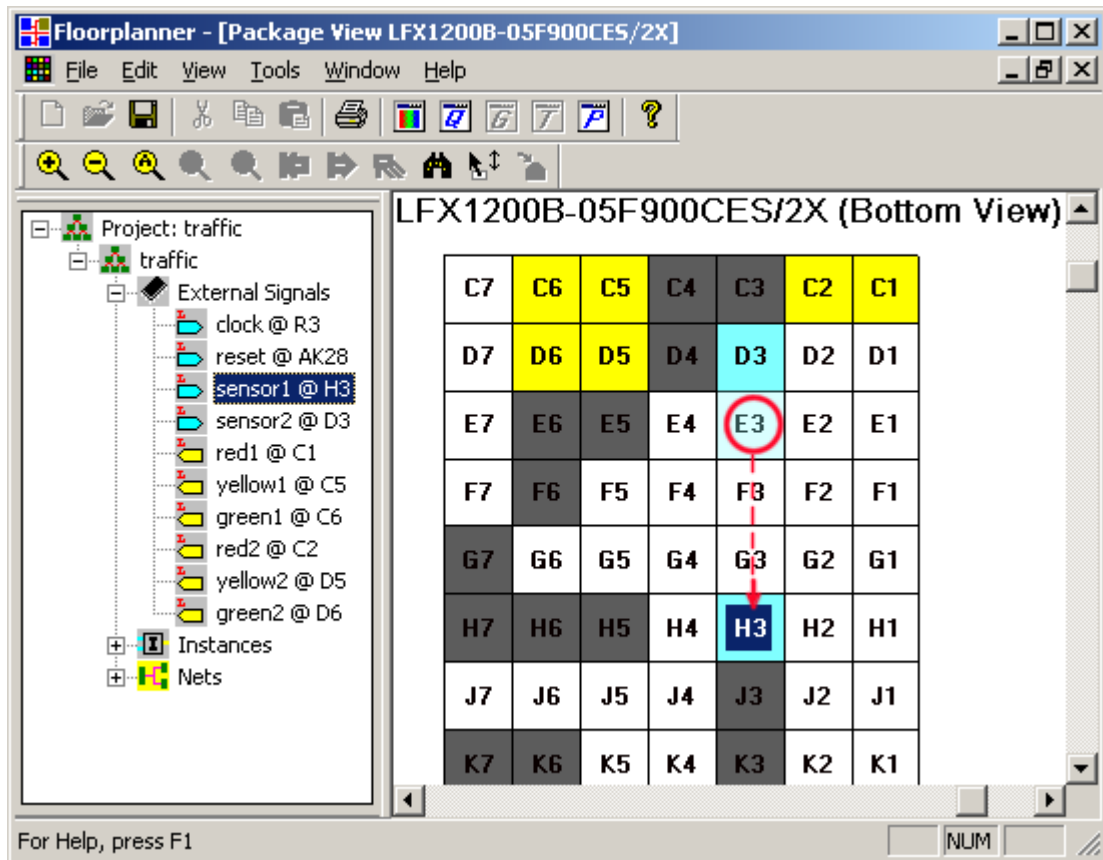
1. Make the Package View active by choosing **View > Package View** and adjust the window so that you can easily see the pin names. Then scroll all the way to the upper-right so that your view is similar to the one below.



- In the previous task, you were using the Design Browser to locate pins in the Package View. Now you will do the reverse. In Package View, right-click **E3** and select **Locate > Design Signal**. The signal **sensor1 @ E3** is selected in the Design Browser.

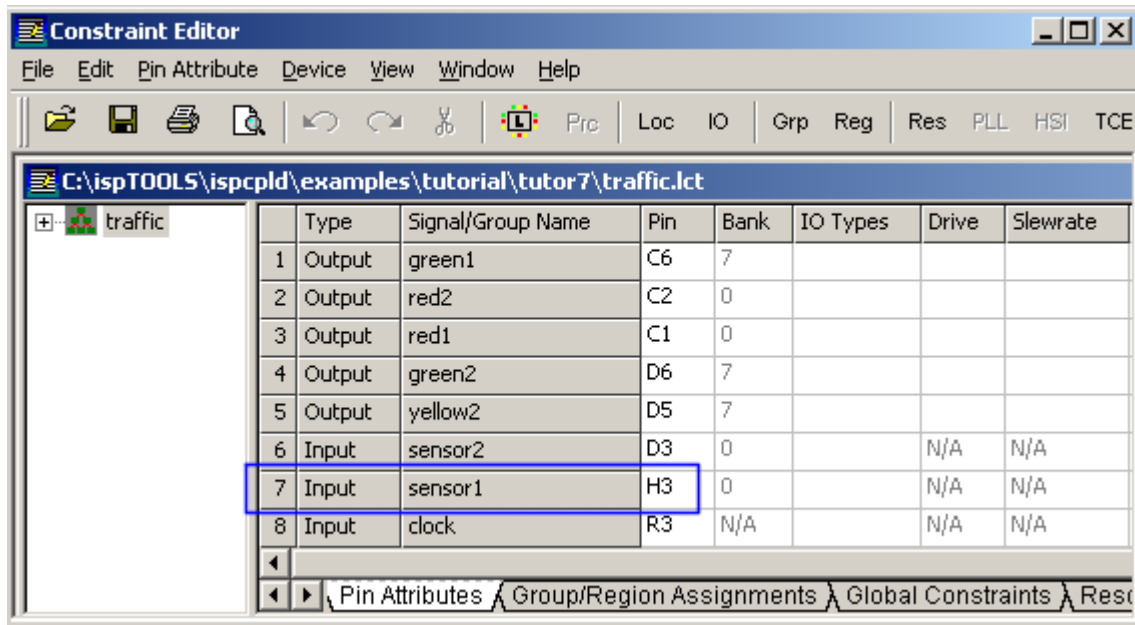


3. In Package View, click **E3**, drag down three pins to **H3** and drop it. Notice that the pin assignment also changed in the Design Browser.



4. Select the C5 pin in package view, right-click and choose **Unlock** to delete the pin assignment. The color code is cleared from the pin in the Package View, and the L is cleared from the signal in the Design Browser.
5. Now save the new pin changes to the constraint file. Choose **File > Save Constraints** to open the dialog box. Accept the current file name. At the bottom of the dialog box, select **Pin Assignments**, and then click **Save**.
6. A message warns you that the file already exists. Click **Yes** to replace it.
7. Choose **File > Exit** to exit the Floorplanner. A message asking, "Do you want to save the design changes you made?" appears. Click **No**.
8. Return to the **Project Navigator**. Notice that the green check marks that indicated the Pack & Place Design process had completed are now gone. This is because the previous packed and placed design database is no longer accurate after you changed the pin assignment.

9. In the Project Navigator, double-click the **Constraints Editor** process to open the Constraint Editor. On the Pin Attributes tab, find the signal **sensor1** and notice that it is assigned to pin **H3**.



*Note: If you wanted to, you could also change the pin assignment using the Constraint Editor Location Assignment dialog box (**Pin Attribute** > **Location Assignment**).*

10. Choose **File > Exit** to exit the Constraint Editor.
11. In the Project Navigator, double-click the **Post-Place Design Floorplan** to open the design in the Floorplanner again.
12. In Package View, verify in the Design Browser that the new pin assignment (H3) was saved as a design constraint and used during the reentrant Pack & Place process.

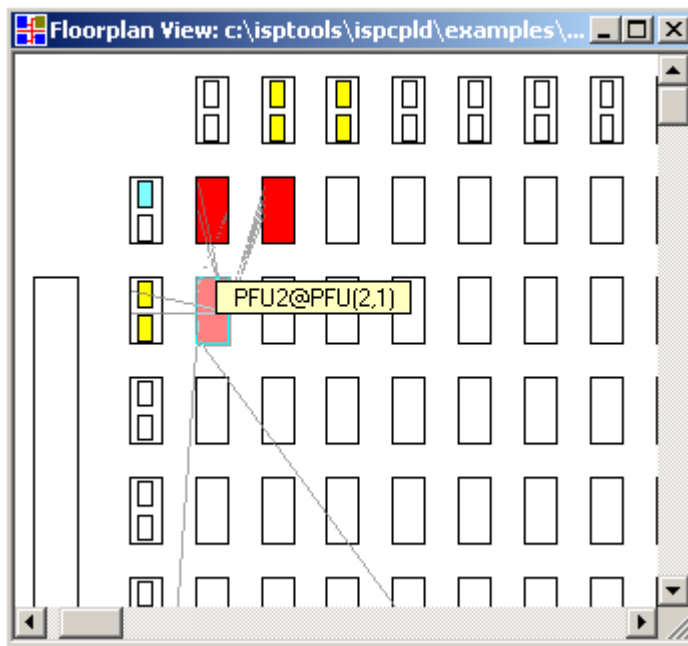
Task 9: Reassign PFU Block Locations

This reentrant design flow procedure lets you move Blocks (PFUs, EBRs, and PIOs) by dragging and dropping in Floorplan View.

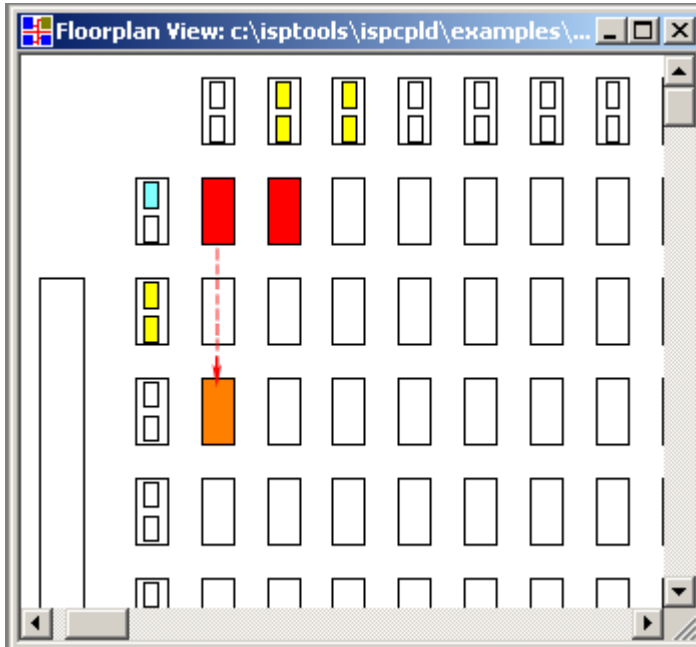
To reassign block locations in Floorplan View:

1. Choose **View > Floorplan View** to display Floorplan View.
2. Choose **View > Zoom In** to enlarge the view of the upper-left corner.
3. Select the PFU in row 2, column 1 (**PFU2@PFU(2,1)**) and hold down left mouse button.

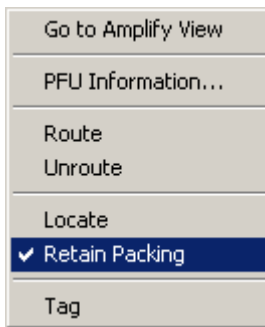
***Note:** Your layout might show different PFU placements. If so, select any PFU on the layout.*



4. Drag the selected PFU down and to the row beneath it (row 3, column 1) and release the mouse button.



5. Select the moved PFU (left-click), and then right-click and select **Retain Packing**. If a check mark is next to the Retain Packing command, the block packing is already retained.



6. Save the new PFU location to the constraint file. Choose **File > Save Constraints** to open the dialog box. Accept the current file name. At the bottom of the dialog box, select **PFU packing/placement**, and then click **Save**.
7. A message warns you that the file already exists. Click **Yes** to replace it.

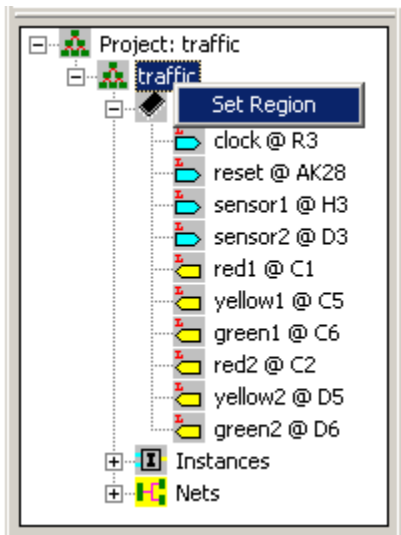
Task 10: Set a Placement Region

You can use the Design Browser to set a region in the top-level design that designates PFU placement within the Floorplan View.

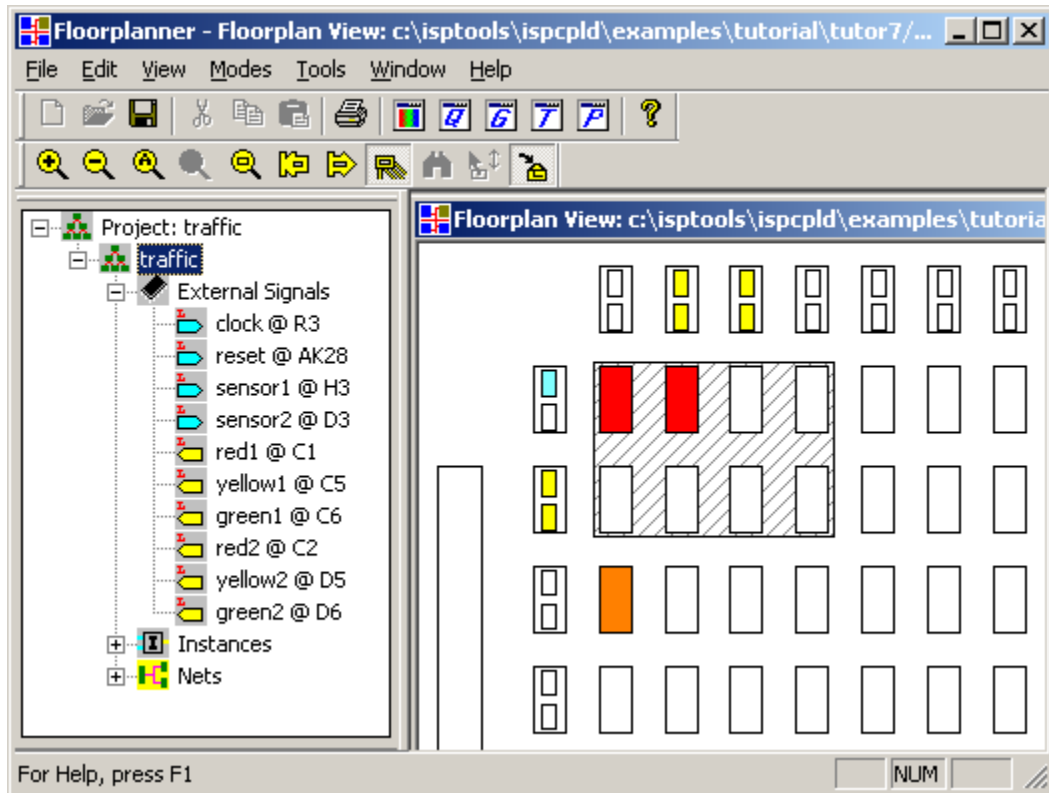
To set a PFU placement region:

1. In the Design Browser, right-click the top-level hierarchical list (**traffic**) and select **Set Region**.

Note: Make sure you select **traffic** first, and then right-click. If you do not see the region drawn as shown in step 2, try this step again.

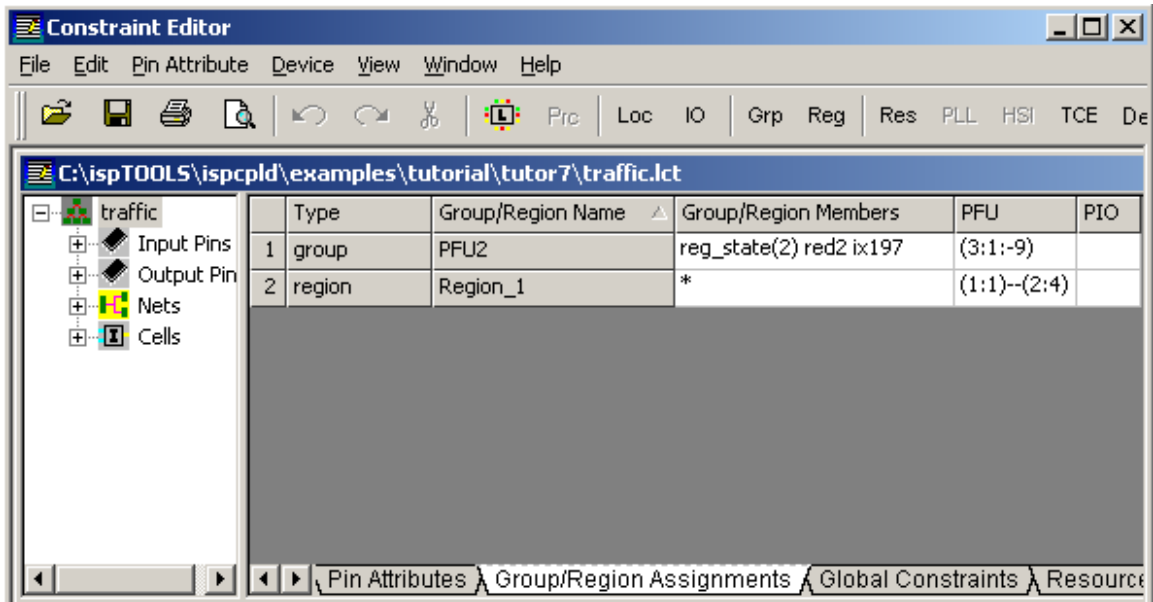


- In the Floorplan View, drag an area in which you want the PFUs to be placed. This region must be large enough to include all the PFUs in your design.



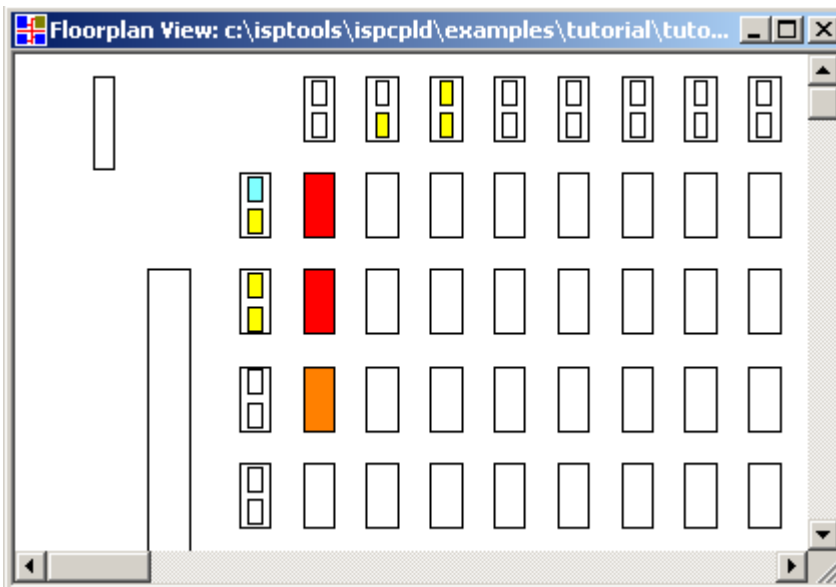
- Choose **File > Save Constraints** to open the dialog box. Select **Region** and then click **Save**.
- A message warns you that the file already exists. Click **Yes** to replace it.
- Choose **File > Exit** to exit the Floorplanner. A message asking, "Do you want to save the design changes you made?" appears. Click **No**.
- Return to the **Project Navigator** and double-click the **Constraint Editor** process to open the Constraint Editor.

- Click the **Group/Region Assignments** tab. Notice the region defined in the constraints file.



Row 1 shows the constraint of moving the PFU up one row. Row 2 shows the region you just created.

- Choose **File > Exit** to exit the Constraint Editor.
- Return to the Project Navigator and double-click the **Post-Place Design Floorplan** process. Notice the difference in the Floorplan View placement.

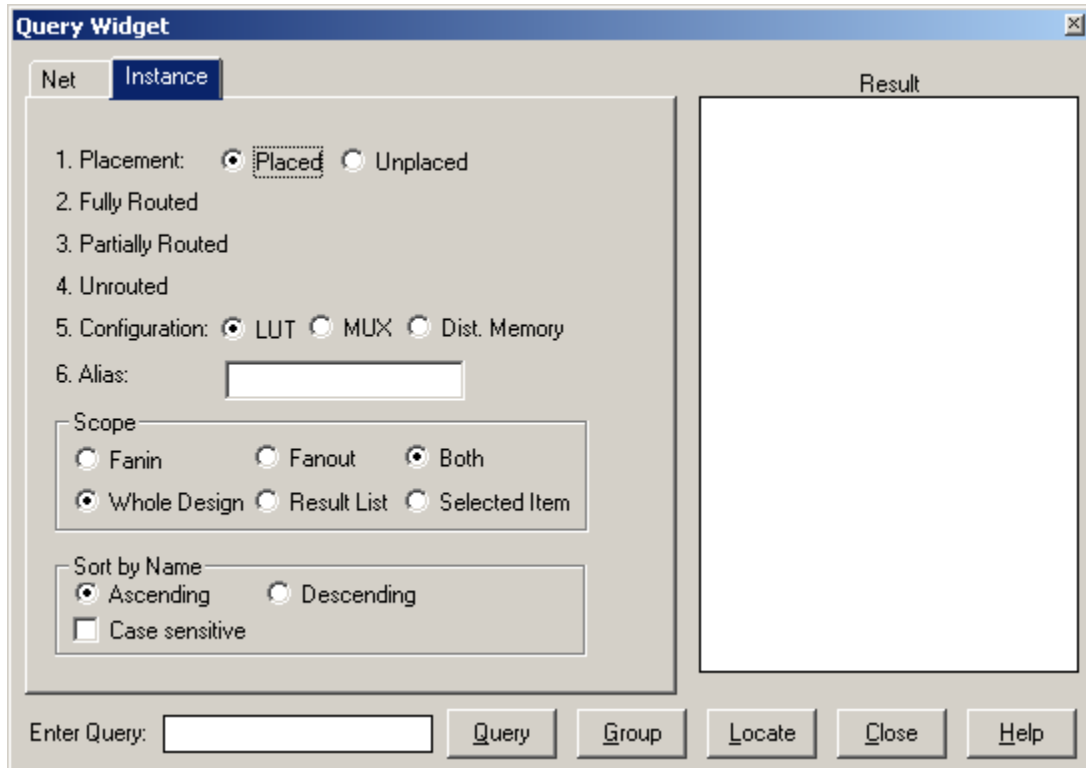


Task 11: Use the Query Widget to Find Instances and Nets

You can use the Query Widget to find instances and nets in Floorplan View.

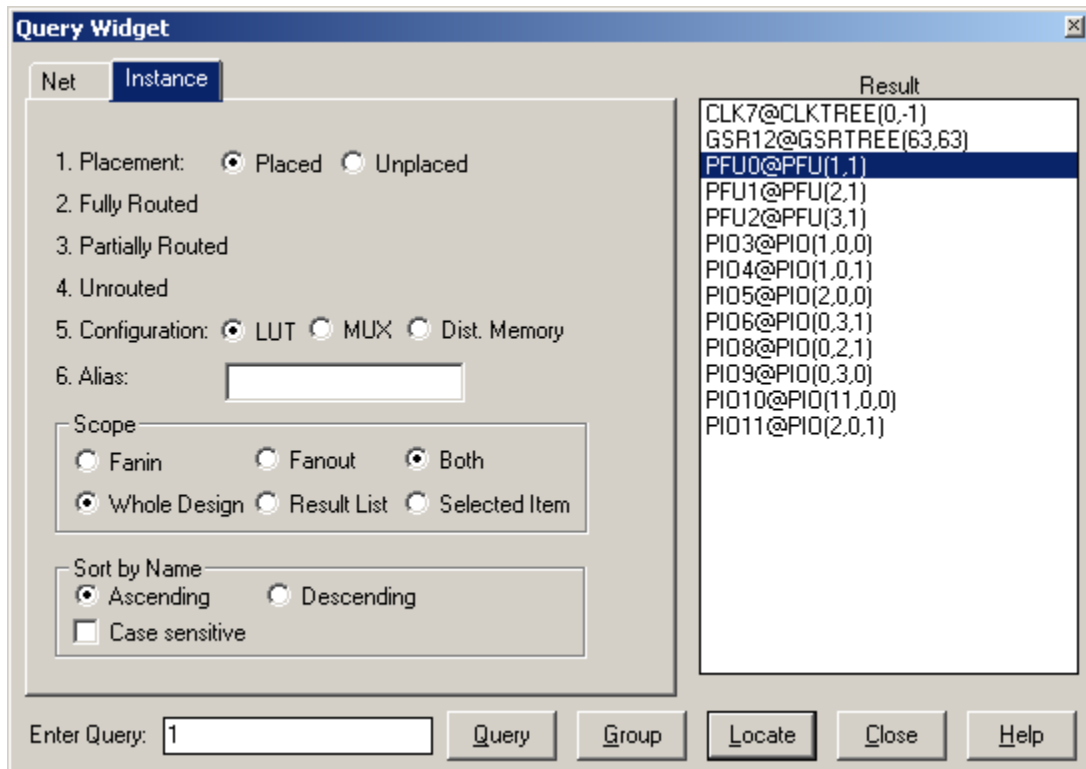
To find instances with the Query Widget:

1. Choose **Tools > Query Widget** to open the Query Widget.
2. Click the **Instance** tab.

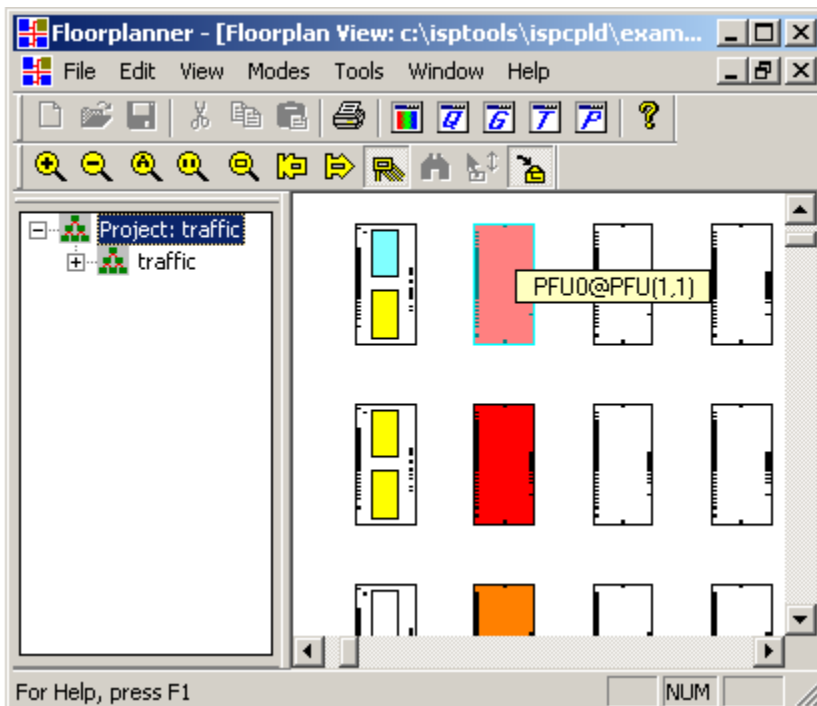


3. There are 6 different queries you can run. In the dialog box, do the following (defaults):
 - For Placement, select **Placed**.
 - Under Scope, select **Both** and **Whole Design**.
 - Under Sort by Name, select **Ascending**.
4. In the Enter Query box, enter the number **1**, for the Query (Placement).
5. Click **Query**. The query result is displayed in the Result box.

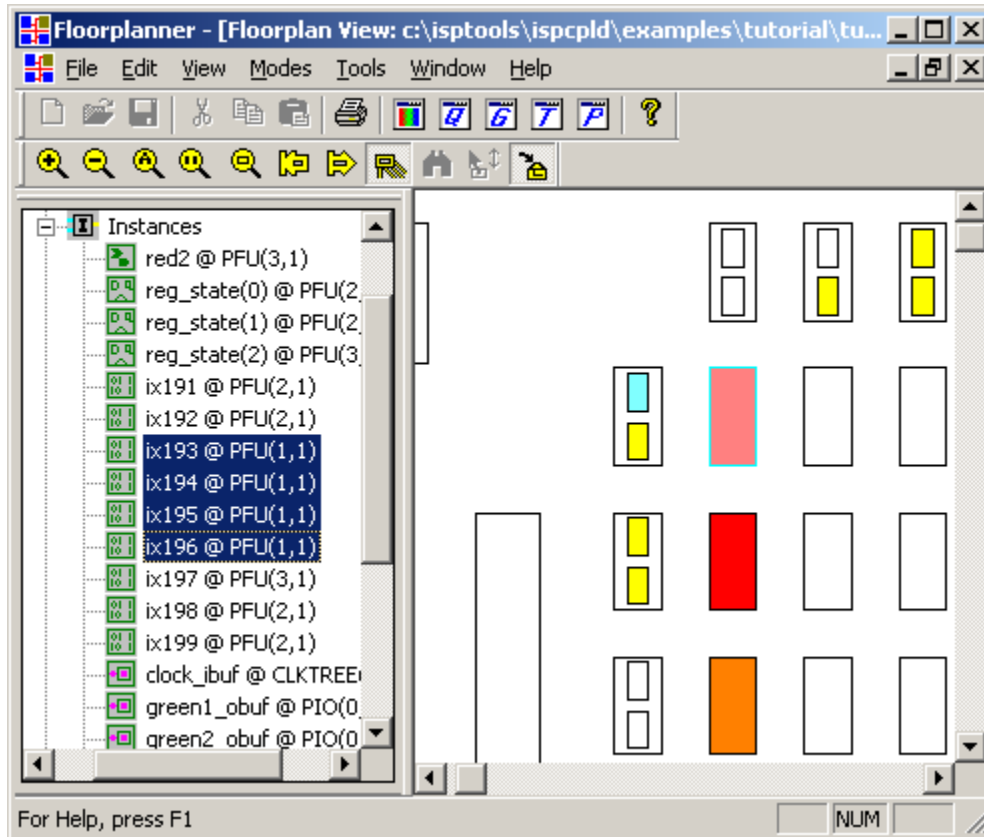
6. Select **PFU0@PFU(1,1)**.



7. Click **Locate**. The selected PFU instance (PFU0@PFU(1,1)) is highlighted in the Floorplan View.



8. Right-click on the instance and select **Locate**. The instance is also located and highlighted in the Design Browser.



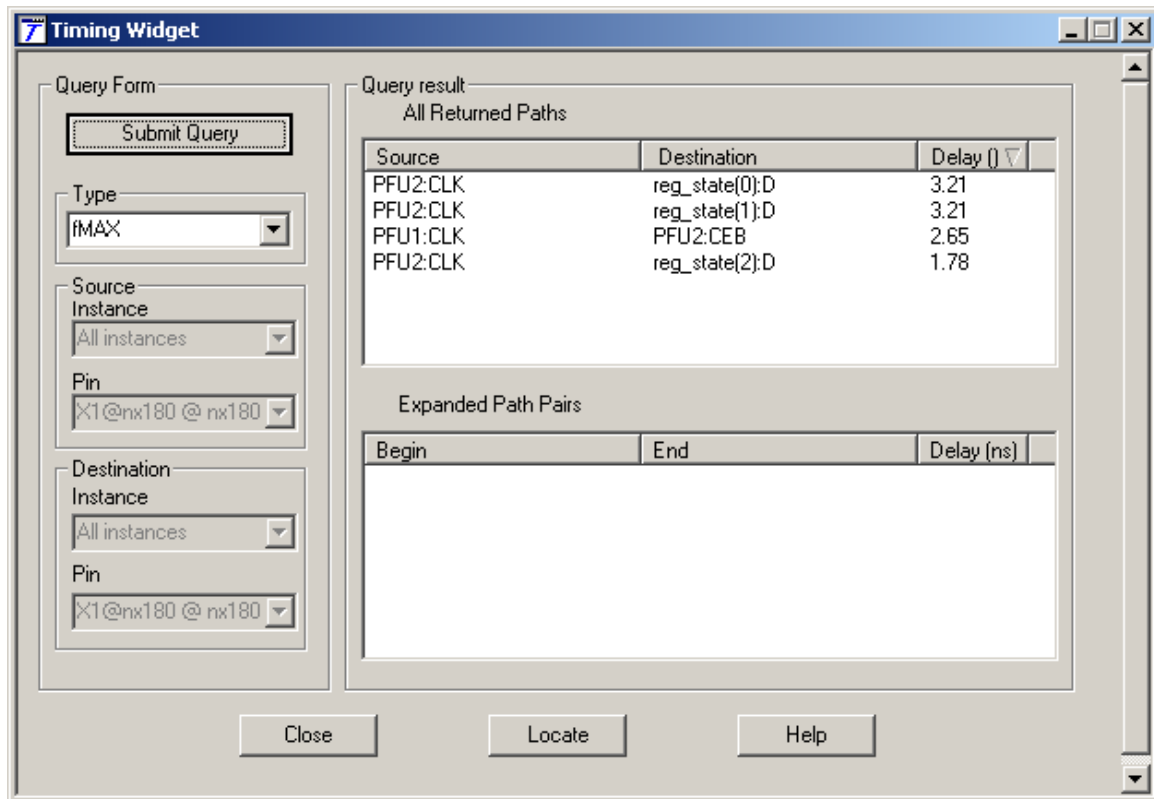
9. Click **Close** to close the Query Widget.
10. Choose **File > Exit** to exit the Floorplanner.
11. Click **No** to not save the constraint changes you made.

Task 12: Locate Timing Delay Paths with the Timing Widget

You can use the Timing Widget to locate routed and unrouted signals. You can also locate timing delay paths for routed and unrouted signals. For this, you will have to run the Post-Route Design Floorplan process.

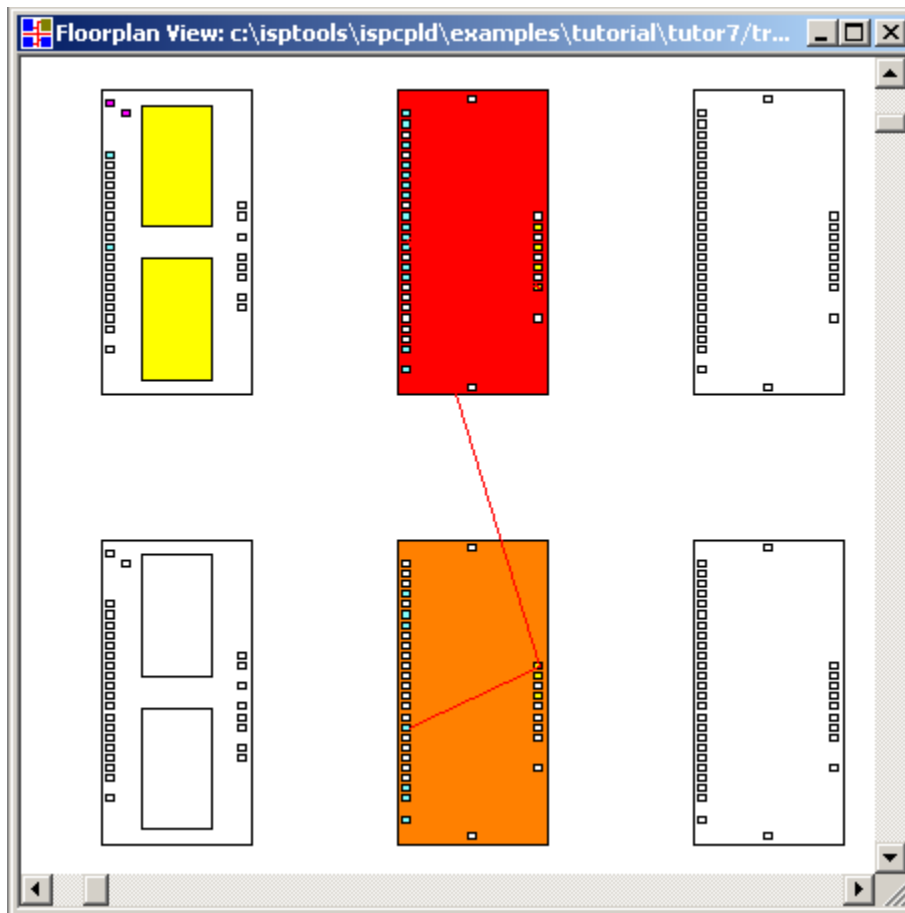
To locate timing delay paths with the Timing Widget:

1. In the Project Navigator, double-click the **Post-Route Design Floorplan** process.
2. In the Floorplanner, choose **Tools > Timing Widget** to open the Timing Widget.
3. Click **Submit Query**. The results are displayed in the All Returned Paths box.



4. In the All Returned Paths box:
 - Select the first signal on the list (**PFU2:CLK**)
 - Under Type, make sure **fMAX** is selected
 - Click **Locate**.

The longest delay path is highlighted in the Floorplan View window.



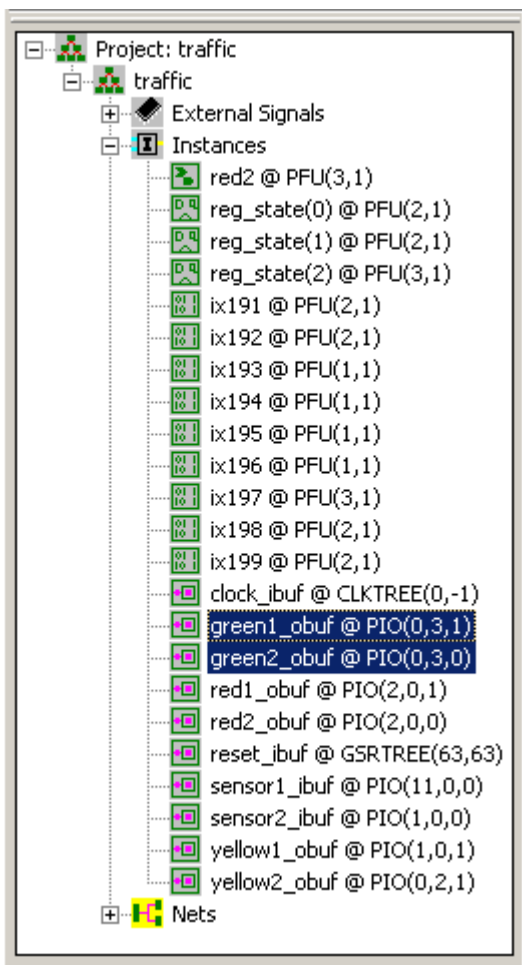
5. Click **Close** to close the Timing Widget.

Task 13: Group Instances with the Design Browser

You can use the Design Browser to group instances or nets. Grouping instances or nets allows you to visually identify a group of certain design elements; for example, all instances that perform a function. Then, using the Group Widget you can easily locate them. This can be particularly useful in a complex design. A group can contain all instances or all nets, but not in combination.

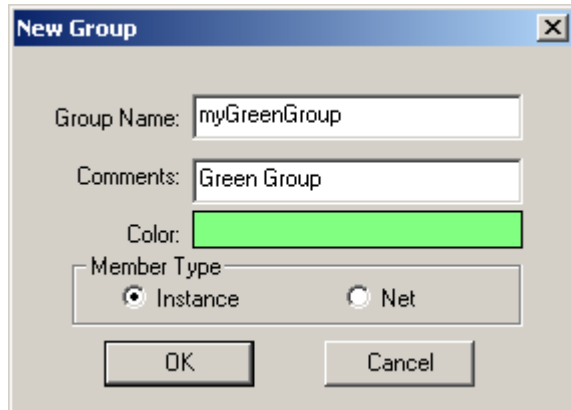
To group instances:

1. In the Design Browser, expand the tree until you can see all the instances that you want to group.
2. While holding down the CTRL key, click the **green1** and **green2** instance names to select them.



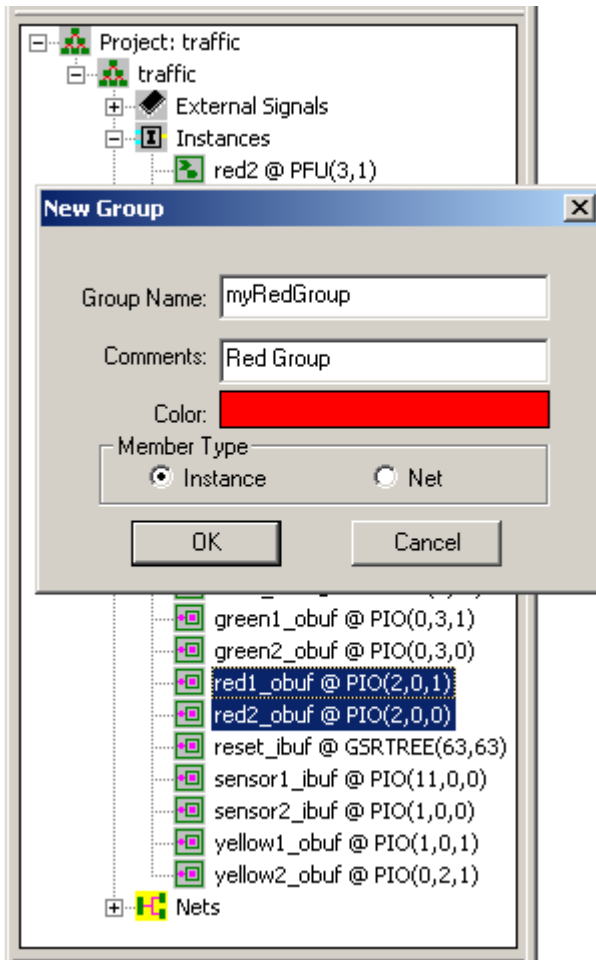
3. Right-click on the selected Instances and choose Locate from the popup menu. (You must do this before you create the group.)
4. Choose **Edit > Group** to open the New Group dialog box.
5. In the dialog box, do the following:

- In the Group Name box, type **myGreenGroup**.
- In the Comment box, type a descriptive note (**Green Group**).
- In the Color box, click to open the Color dialog box. Select the color **green** for all the group elements.
- Under Member Type, leave it set to **Instance**.



6. Click **OK** to close the dialog and create the new group.

7. Repeating the above steps, select the two **red** instances and create another group called **myRedGroup**.



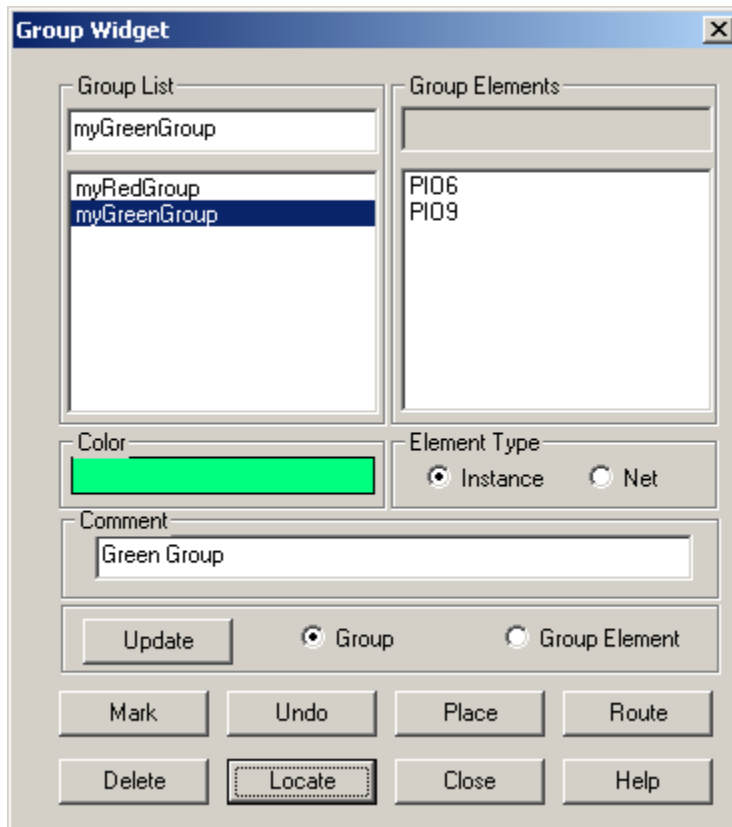
8. Click **OK** to close the dialog and create the new group.

Task 14: Locate a Group with the Group Widget

You can locate a group with the Group Widget.

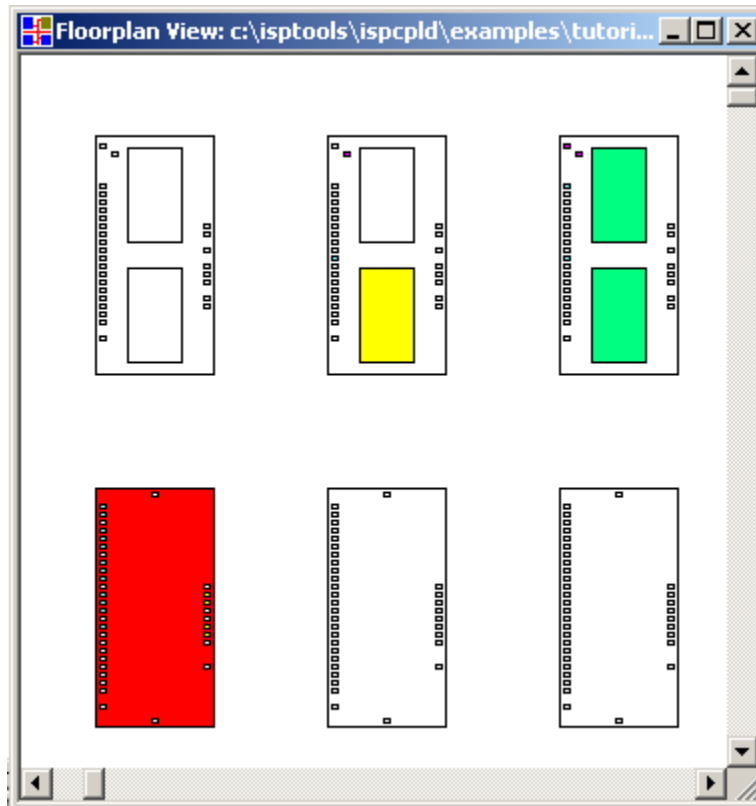
To locate a group with the Group Widget:

1. Choose **Modes > Group Display**. This command allows you to toggle the display, in the Floorplan View, of any groups you have created. The groups will display in whatever color you have selected in the Group Widget.
2. Choose **Tools > Group Widget** to display the Group Widget.
3. In the Group List, select **myGreenGroup**.



4. Click **Locate**. The group is highlighted in the Floorplan View.

- Click in the field to unselect the group. Now you can see the group displayed in green.



Congratulations

You have completed the Debugging Designs with the Floorplanner tutorial. In this tutorial you have learned how to:

- Open a Floorplanner design file
- Tour the graphical user interface
- Customizing the Floorplanner display
- Locate an element using the Design Browser
- Change pin assignments
- Reassign PFU block locations
- Set a placement region
- Use the Query Widget to find instances and nets
- Locate timing delay paths with the Timing Widget
- Group instances with the Design Browser
- Locate a group with the Group Widget

For More Information

You will find much more information about using the Floorplanner and ispXPGA devices in the online Help. For Floorplanner concepts, procedures, and user interface information, see **Floorplanner Help – ispXPGA**. For information about ispXPGA designs, see **ispLEVER Help > Process Flows > ispXPGA Flow**.