

Keeping Existing Physical Constraints Using Designer v5.0

Overview

In Designer v5.0, the Import Source Files dialog and related subsystems have been changed to support the use of GCF files in an iterative design flow.

In an iterative design flow, the user has completed a design through Layout, and later, has made an incremental change to the netlist or constraints. To introduce these changes into Designer, the user must re-import the new source netlist and GCF files, and run Compile and Layout again.

This document describes the changes in Designer v5.0 to support merging constraints from the original Layout with the newly imported netlist and GCF files used in the next iteration of Compile and Layout. In Designer v5.0, users control the constraint merging through the new option "Keep existing physical constraints" in the Import Source Files dialog (Figure 1).

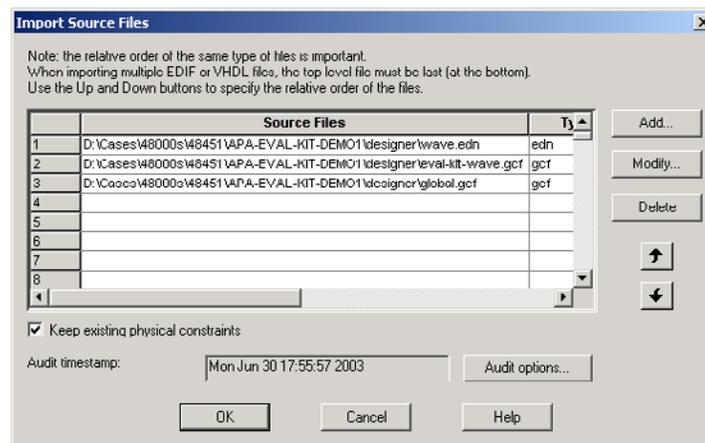


Figure 1 • Import Source Files Dialog

Constraint Types

In this document, we divide the GCF constraints into two categories: physical constraints and nonphysical constraints. The constraints in each category are listed below.

Physical Constraints

The "Keep existing physical constraints" option only applies to the following physical placement constraints.

- Physical Placement
 - set_io
 - set_initial_io
 - set_empty_io
 - set_io_region
 - set_location
 - set_initial_location

- set_empty_location
- set_net_region

Global resource constraints are also physical constraints, but the “Keep existing physical constraints” option does not apply to them.

- Global Resource Control
 - set_global
 - set_noglobal
 - use_global
- Global Promotion/Demotion
 - dont_fix_globals
 - set_auto_global
 - set_auto_global_fanout

Nonphysical Constraints

The nonphysical constraints are organized by category and listed below. The “Keep existing physical constraints” option does not apply to these constraints.

- Optimization
 - dont_optimize
 - optimize
 - don't_touch
 - set_max_fanout
- Critical Port/Net Control
 - net_critical_ports
 - set_critical
 - set_critical_port
 - set_critical_routing_ports
- Routing Resource Use
 - dont_use_bus_lines
 - dont_use_global_lines
 - don't_use_actives
 - set_default_switch_threshold
 - set_switch_threshold
 - set_routing
- Timing Control
 - generate_paths
 - timing_buffer_fanout
- JTAG
 - use_JTAG
 - use_extended_JTAG
- File Management
 - read

Timing Constraints

A third category of constraints is the timing constraints. The “Keep existing physical constraints” option does not apply to these constraints. For more details on these timing constraints, please refer to the technical brief *ProASIC and ProASIC^{PLUS} Timing Constraints*.

- Timing
 - create_clock
 - set_multicycle_path
 - set_false_path
 - set_input_to_register_delay
 - set_register_to_output_delay
 - set_max_path_delay

Import Source Files Dialog

In Designer v5.0, the Import Source Files dialog has the new check box “Keep existing physical constraints,” which is used to merge existing constraints with the constraints that are being imported.

This option is unchecked by default. However, once you have used the MultiView Navigator tools to edit the layout and saved the changes, the “Keep existing physical constraints” option will be checked by default.

Checking this option will preserve all existing placement constraints that you have entered using imported GCF files, or by using the MultiView Navigator tools—PinEditor, ChipPlanner, or the I/O Attribute Editor. If you re-import a GCF file and you have this box checked, Designer will try to merge the existing placement constraints already in the design database with the placement constraints in the your imported GCF file.

If you do not want Designer to merge the physical constraints, uncheck this box when importing source files. This will cause Designer to clear all existing physical placement information.

The Import Source Files “Keep existing physical constraints” option is only available in the APA and A500K families. These are the only families that support GCF constraint files.

Keep Existing Physical Constraints Implementation

The “Keep existing physical constraints” option is provided to control whether Designer “remembers” those constraints already established in the design floorplan when the source files are re-imported with minor changes such as in an Engineering Change Order (ECO).

When you re-import source files with “Keep existing physical constraints” checked, Designer preserves the physical constraints listed in the “Constraint Types” section on page 1. It does not preserve the non-physical constraints such as those that control global promotion, optimization or timing. These must be imported in a GCF file each time you import source files. Because Designer handles the physical and non-physical constraints differently, it may be more convenient for you to separate them into different GCF files when importing.

The physical constraints that Designer preserves when importing source files can come from any of the following sources.

1. Constraints entered by a user and imported in a GCF file.
2. Constraints entered via the MultiView Navigator tools—PinEditor, ChipPlanner, or the I/O Attribute Editor.
3. Constraints derived from the previous layout. These constraints will always be initial constraints except where they have been explicitly fixed by method 1 or 2 above.

Backward Compatibility

In releases before Designer v5.0, Import Source Files overwrote constraint information each time files were imported. Users who re-imported source files (either netlist or GCF) were starting the design flow over again. Users who prefer this method of operation, or who prefer having the maximum control over the constraint flow should always import source files with the “Keep existing physical constraints” option unchecked. They will still have the ability to export the floorplan as a GCF file and manually edit or merge layout constraints themselves before re-importing. See the “Exporting GCF” section on page 5 for details on how to export GCF files.

Using the “Keep Existing Physical Constraints” Option

When importing source files with the “Keep existing physical constraints” checked, constraint conflicts can occur later in Compile and Layout when the constraints are applied to the design. Designer reports constraint conflicts as error and warning messages. Some design flows work better than others in avoiding constraint conflicts when source files are imported with “Keep existing physical constraints” checked.

Use Flows With “Keep existing physical constraints” Checked

The following methods of entering constraints work well with the “Keep existing physical constraints” option checked.

- Floorplanner only
A customer who uses only Floorplanner to enter constraints would normally re-import source files with “Keep existing physical constraints” checked. There should not be any physical constraint conflicts because all the physical constraints come from either Floorplanner or are derived from Layout. If Layout has been run successfully after the Floorplanner changes, the constraints should be consistent.
- Floorplanner with GCF containing only physical placement constraints
Similarly, customers who use GCF files only to enter the non-physical constraints (e.g. global control, optimization, timing, etc.), and use Floorplanner to enter physical constraints will normally be able to re-import source files with “Keep existing physical constraints” checked.
A note of caution is in order for the use_global constraint. This constraint assigns instances on a net to a spine, but can only be entered via a GCF file. It can be in conflict with physical constraints set in the Floorplanner.
- Use GCF to initialize placement, use Floorplanner to improve placement
Customers who use GCF to initialize the placement, then use Floorplanner to improve the placement can re-import source files with “Keep existing physical constraints” checked. In this case, they should re-import without the GCF placement constraints. No data will be lost because the design database will contain the original constraints unchanged except for those that were improved in the Floorplanner.
In this case, it may be easiest to separate the GCF physical constraints and non-physical constraints into different GCF files
- GCF only with no physical placement changes
Customers who use only GCF files to enter constraints, and make no placement changes in the design either through GCF files or Floorplanner can re-import source files with “Keep existing physical constraints” checked.

Use Flows With “Keep existing physical constraints” Unchecked

The following design flows may encounter constraint conflicts with the “Keep existing physical constraints” option checked. They will work better with “Keep existing physical constraints” unchecked. Consult the constraint conflict table under the “Troubleshooting” section on page 6 for details on the types of constraint conflicts that Designer will report.

- GCF with physical placement constraints and iterative changes

This method of entering constraints is the method used in releases earlier than Designer v5.0. See the [“Backward Compatibility” section on page 4](#) for more detail.

Customers who use GCF to enter physical constraints, then change the physical constraints in the GCF, may get constraint conflicts when re-importing the GCF file with different physical constraints if they check the “Keep existing physical constraints” option. For this design flow, we recommend that you import source files with the “Keep existing physical constraints” option unchecked.

- GCF with Floorplanner and manual merge

If you use GCF to enter physical constraints, then change the physical constraints in the Floorplanner and try to re-import physical constraints from the GCF files, you may get constraint conflicts when re-importing source file with “Keep existing physical constraints” checked.

The best approach when mixing GCF physical constraint entry with Floorplanner is to export the floorplan constraints in a GCF file. See [“Exporting GCF” section on page 5](#) for details on how to export a GCF file. Once you export the floorplan constraints, you can use an editor to merge them with the constraints in your GCF file. Re-import the merged GCF file with the option “Keep existing physical constraints” unchecked.

Use With Incremental Placement

When you want to re-import a netlist or GCF file into an Existing design and later run incremental placement, the “Keep existing physical constraints” option can be either checked or unchecked. Either way, Designer will preserve the placement from the previous layout and later use it as the initial placement when it runs the placer in incremental mode.

Exporting GCF

Sometimes the best method of resolving constraint conflicts will be to export the constraints from the design database and merge these constraints with the constraints you are trying to import. You then import the merged constraints as a source file with “Keep existing physical constraints” unchecked.

To export a GCF file, go to menu File > Export > Constraint Files. Select the GCF files option. A new window will pop-up and ask for the type of constraints that should be exported. There are three options available to users while exporting GCF as shown in [Figure 2 on page 6](#).

1. Pin locations

This option exports the set_io, set_initial_io and set_empty_io constraints.

2. Placement constraints

This option exports all the physical constraints that are saved in the design database. These are the I/O, location and the region constraints.

3. All GCF constraints

This option exports all the GCF constraints. This includes the physical constraints saved in the design database plus the non-physical constraints provided by the user.

Note that if you export the GCF file in the pre-Compile design state, you will not see the three options in [Figure 2 on page 6](#). The pre-Compile exported GCF file will contain the placement constraints describing the last successful Layout.



Figure 2 • Export GCF File Dialog

Troubleshooting

Fixing Constraint Conflicts

There are two basic methods used to resolve physical constraint conflicts that arise from re-importing source files after an ECO change.

1. Edit the constraint

In this case, you need to trace the instance name or location back to a constraint in an imported GCF file. Edit or remove the constraint in the imported GCF. Re-import the source files again with “Keep existing physical constraints” checked.

This method is easier if you have just a few constraint conflicts and they are easily identified in the GCF files.

2. Export and merge the constraints.

In this approach, you export your existing placement constraints in a GCF file as described above in Exporting GCF. Then use an editor to merge the exported constraints with those in your imported GCF files. Resolve conflicting constraints by editing or removing them. Re-import the merged GCF as a source file with “Keep existing physical constraints” unchecked.

This approach may be best when the number of conflicting constraints is high, or when you need to review the constraints closely to decide which constraints to use in the next design iteration.

Note that region constraints and constraints that use wildcarding may generate multiple warnings when they are in conflict with other constraints because they apply to multiple instances.

Constraint Conflicts in floorplan.gcf

When you have a constraint conflict, you may see error messages like the following.

```
Error: [fixed_plmt_overlap]:
    In file D:\Designs\bench5-150\bench5-150.dtf\floorplan.gcf,
    line 15, there is an overlap of instances U4
    and U5 at location (18,53).

Error: [multiple_fixed_plmt_io]:
    In file D:\Designs\bench5-150\bench5-150.dtf\floorplan.gcf,
    line 20, the instance U5 is given multiple
    fixed placements. For IO instances this is not allowed.
```

The file floorplan.gcf contains constraints derived from the design database by Designer for its internal use. This file is generated and maintained by Designer. Designer reports errors and warnings on floorplan.gcf when the design database has conflicts with placement constraints in the user GCF.

Do not edit floorplan.gcf directly. Your edits will not be taken into account because it is regenerated by Designer every time it is used. Instead, use one of the methods described above to resolve your constraint conflict.

Constraint Errors with No User GCF

Suppose you have a design that completed Layout successfully. You make an ECO change to the netlist and re-import it without any physical constraints in the GCF files and with "Keep existing physical constraints" checked. When you run Compile or Layout, you get constraint errors.

A likely source for these errors is the change in the netlist. You may have introduced congestion into the new netlist which resulted in conflicts with the existing floorplan. This can occur when you are using Layout with the incremental fixed placement option. The error for an over-constrained design may be reported by the placer.

Constraint Conflict Table

Table 1 shows the behavior of Designer Compile when it encounters conflicting constraints. Any conflict between fixed I/O constraints will generate an error. For core cells, the error checking is less restrictive, but some conflicts between fixed core cell constraints can generate errors. Conflicts between fixed and initial constraints or two initial constraints will generate either warnings (I/Os) or no message (core cells).

Table 1 • Constraint Conflicts Table

Original Constraint	Explanation of Conflict	Conflict Type			
		FF	IF	FI	II
1. set_location (x,y) InstA					
a. set_location (x,y) InstB	Another instance placed at the same location	E	N	N	N
b. set_location (x1,y1) InstA	Instance moved to another location	W	N	N	N
c. set_location (x1,y1 x2,y2) InstA	Instance moved to another region	W	N	X	X
d. set_empty_location (x1,y1 x2,y2)	Instance is in an enclosing region set as empty	E	N	X	X
e. set_location (x,y) InstA	Same location - duplicate constraint	N	N	N	N
2. set_io x InstA					
a. set_io x InstB	Another instance placed at the same I/O	E	W	W	W
b. set_io y InstA	Instance moved to another I/O	E	W	W	W
c. set_io_region (x1, y1, x2, y2) InstA	Instance moved to another I/O region	E	W	X	X
d. set_empty_io x	Instance is in an enclosing I/O region set as empty	E	W	X	X
e. set_io x InstA	Same I/O - duplicate constraint	N	N	N	N
3. Region	Constraint comes through set_net_region or use_global				
a. set_location (outside)	Moved to outside location /I/O	E	X	N	X
b. set_location (inside)	Placed/Fixed at specific location	N	X	N	X
c. set_empty	Enclosing region set as empty	E	X	X	X

Notes:

1. FF = Fixed/Fixed
IF = Initial/Fixed
FI = Fixed/Initial
II = Initial/Initial
E = Error message
W = Warning message
2. N = No message
3. X = Does not apply

Rules

1. A fixed constraint always overrides an initial constraint on the same instance.
2. In ECO mode, any constrained instances not present in the netlist are ignored

Related Documents

Application Notes

ProASIC and ProASIC^{PLUS} Timing Constraints

http://www.actel.com/documents/Flash_TimConst_AN.pdf

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