Overview

The Galaxy Custom Router™ solution provides automatic routing for complex high-speed digital and mixed-signals nets that require carefully crafted, high-quality layout. This advanced shape-based router delivers 2-5X productivity over manual efforts and is ready for advanced designs with support for 20-nanometer design rules. Galaxy Custom Router is part of Synopsys’ Galaxy™ Implementation Platform and is integrated in the Galaxy Custom Designer® layout editor. The router works with the IC Compiler Custom Co-Design solution to form a complete solution for mixed-signal and high-speed digital design implementation.

Introduction

Galaxy Custom Router enables IC Compiler™ and Galaxy Custom Designer users to create high-quality routing patterns for difficult routing tasks, such as differential-pair routing, shielded routing (including bus and differential-pair shielding), matched RC routing, river routing and point-to-point coaxial routing. For a digital IC design, users can pre-route sensitive nets using a rich set of custom routing options and continue with IC Compiler to complete the physical implementation.

Galaxy Custom Router supports advanced nodes, including 20-nm process technology. For example, it supports double-patterning requirements by automatically creating colorable routing patterns. It also supports variable track grids — a requirement for some advanced-node processes. Galaxy Custom Router adheres to constraints specified in IC Compiler, including default and non-default design rules, routing grids, route keep-outs, route blockages and route guides.

The router provides both a GUI-driven (see Figure 1) and batch-driven capability via TCL scripting.

Figure 1: Galaxy Custom Router user interface
Advanced Routing Features
Galaxy Custom Router extends the already powerful Galaxy Implementation Platform by enabling design teams to quickly and efficiently connect analog and high-speed digital nets that have special routing requirements. Advanced routing features of the Galaxy Custom Router solution include:

- Bus routing
  - Single layer (river routing)
  - Parallel, tandem and coaxial shielding
- Differential-pair, star and balanced routing
- Matched routing
- Clock tree routing
- Shielding (parallel, tandem, coaxial)
  - Bus
  - Differential pair
  - Scalar net
- Resistance, capacitance (RC) and length matching
- Double-cut vias
- Non-default rules

Bus Routing
Buses may be routed as a trunk and then split into individual bits. The split bus trunk wires will then be connected to the pins individually by the router in a step called “tap-off routing” (see Figure 2).

Buses may include shielding using several styles. Shield wires may be placed in a bus in any combination of the following styles: outside of the bus, shield wires inserted between bit nets (interleaved — see Figure 3), or two shield wires inserted between the bit nets (double-interleaved). If tap-off routing is used in the bus then shields can automatically be placed on both sides of the individual bits.

River Routing
Buses may also be routed using “river routing”, i.e., where each net route is accomplished in a single layer. Multiple layers may be used in river routing to stack routes in very congested channels, but each net route will be completed in a single layer (see Figure 4).

Analog Routing
Galaxy Custom Router supports many features for analog block-level routing, including matched route, differential-pair, triplet, star and balanced routing. These routes may also be shielded or twisted using several different styles. Routes may be matched either by length or by resistive and capacitive values (RC match routing—see Figure 5).
For differential-pair or triplet routing, two or three pins are defined and routed together (per the spacing constraint) with matched length. Differential pairs or triplets can be optionally shielded and/or twisted. Twisting can be either “orthogonal” (90-degree twist) or “diagonal” (45-degree twist) with a specified spacing for the twist. There are a number of options for shielding as well.

Three different shielding styles can be used: parallel, tandem and coaxial. Parallel shielding places a same-layer shield line on either side of the signal line, optionally including around a via or a pin (see Figure 6). Tandem shields place shield wires either above the signal wires, below the signal wires, or simultaneously above or below the signal wires. Coax shielding wraps shielding around the signal line on all four sides.

**Platform Support**

- Red Hat Enterprise Linux version 4 and 5 (AS, ES, WS)

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