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PADS Router: It's Not Just An Autorouter Anymore

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Goal

Increase users' proficiency with PADS Router to make them more comfortable and efficient with the new PADS environment.

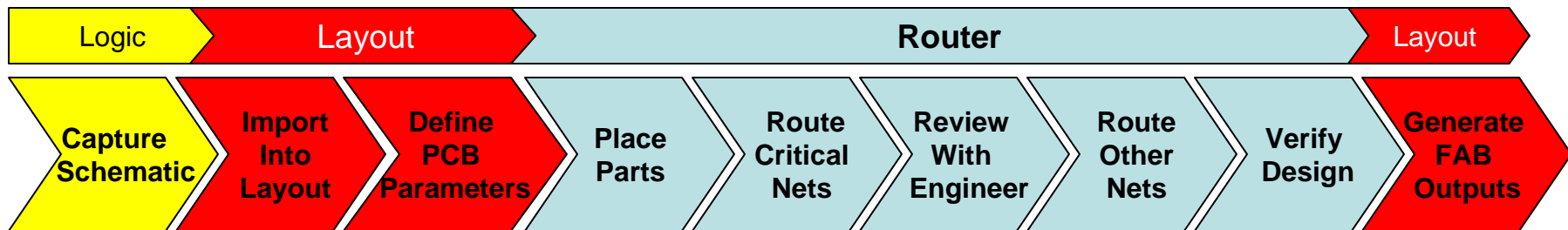
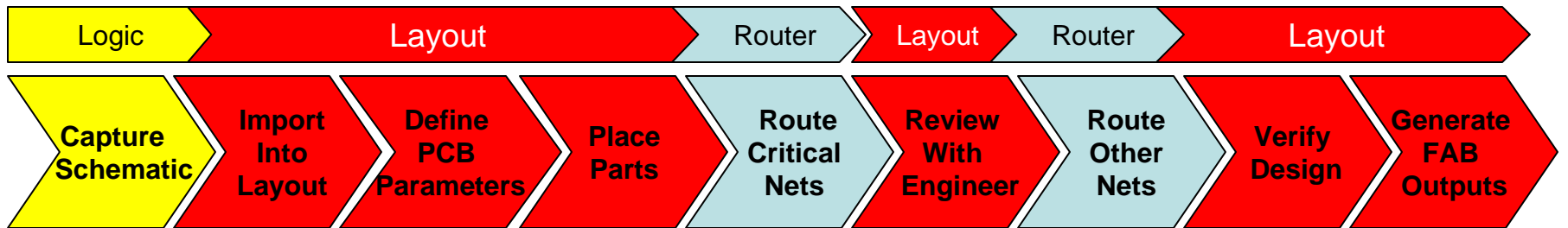
The focus will be on using PADS Router's newer day-to-day layout functions, rather than its traditional autorouting features.



Audience

- **Current PADS Layout users who:**
 - Have been hesitant to move to a new design environment
 - Are unfamiliar with the features and benefits of designing in PADS Router
 - Successful users of PADS Router looking for advanced tips and tricks to speed their design process
- **Users are assumed to have good knowledge of designing in PADS Layout. Basic knowledge of the PADS Router interface is helpful, but not necessary, as users can use the supplied PADS Router Tutorial to learn the interface at their own speed.**

PCB Design Flow



Agenda

- **GUI**
- **Rules Setup**
- **Placement**
- **Interactive & Manual Routing**
- **Design Review & Verification**
- **Miscellaneous Tips**
- **Q&A**



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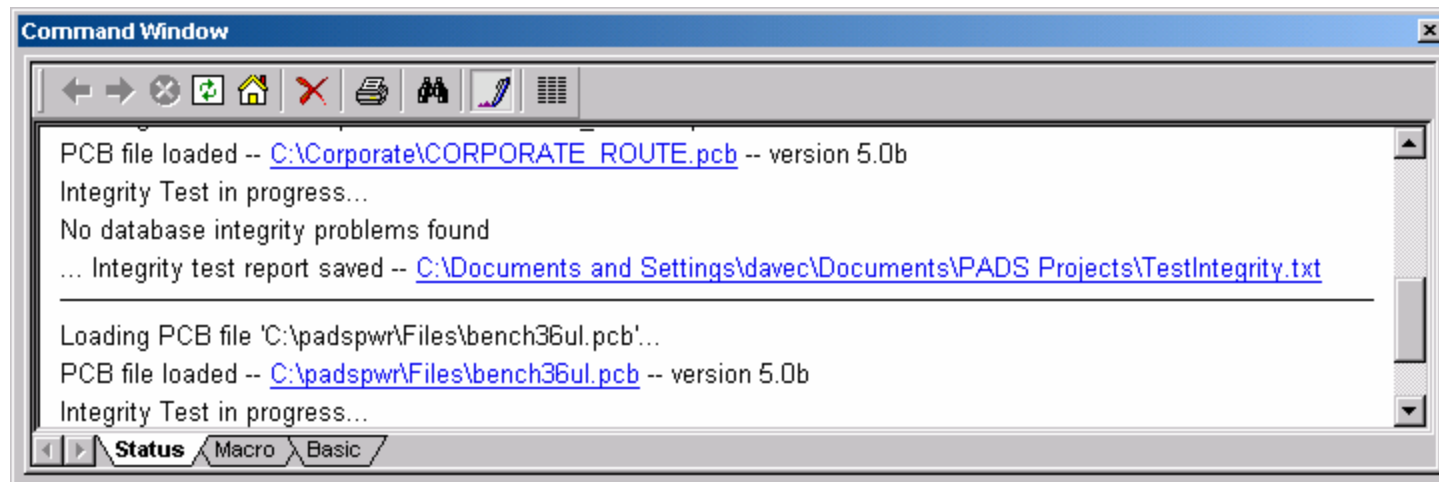
GUI

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GUI – Add-In Windows

■ Command window

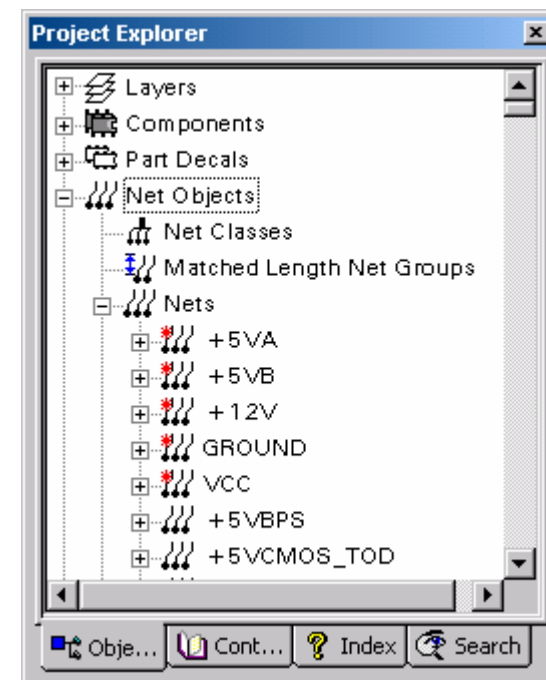
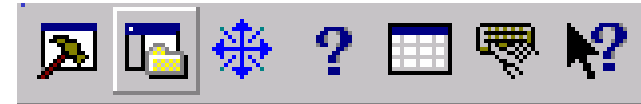
- Hyperlinked actions
 - Reload previous designs
 - View files
- Real-time error messages
- System messages
- VB Scripts and Macros tab



GUI – Add-In Windows

■ Project Explorer

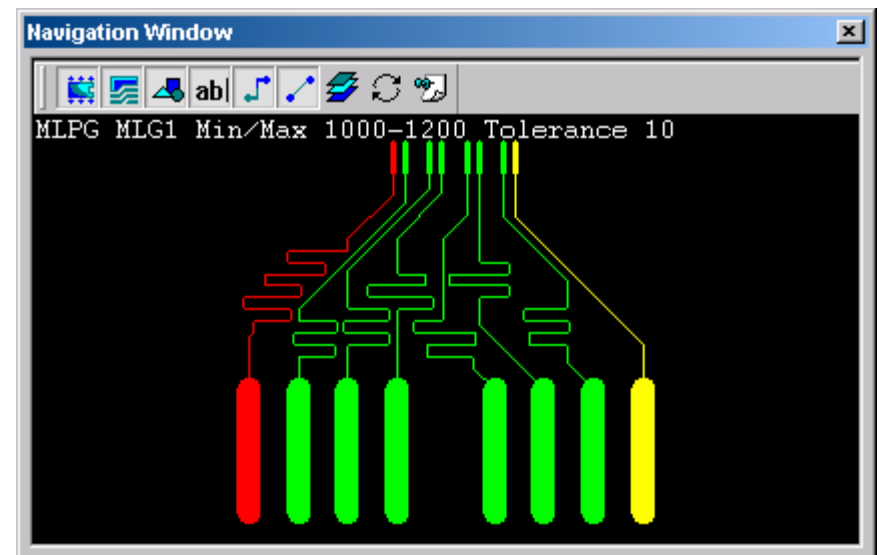
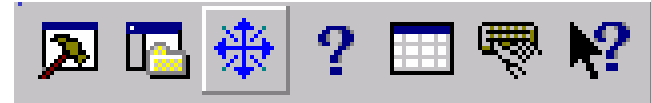
- Split view
- Sort By Rules
- Zoom to Select mode
- Drag-and-drop for class, group, differential pair and conditional rule creation (ARS)
- Access to Help system



GUI – Add-In Windows

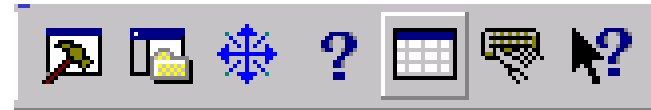
■ Navigation window

- Zooming (F5 & F6), Swap (F7), Freeze (F8)
- Layer based
- Viewing of selected objects
 - Nets/Pin pairs - zooms to extents
 - Components - zooms to extents
 - Pins/Vias - shows cross-section
 - Nets/Pin pairs with length rules - shows color-coded traces (yellow, green, red) (HSD)



GUI – Add-In Windows

■ Spreadsheet



- View and modify properties of design objects
- View error list
- Dynamic net length monitor (HSD)
 - Lists only nets with length rules
 - Updates in real-time
 - Color coded
- Tip: Sort nets by Unrouted Length to find those short, barely visible unconnects

	Name	Unrouted length	Routed length	Total vias	Trace Wid...	Trace Wid...	Trace Wid...	Protect
1	RETEST	1.9	2133.86	2	5	5	5	<input type="checkbox"/>
2	INTA-	1.6	1037.31	2	5	5	5	<input type="checkbox"/>
3	CLK_IN	0	9134.46	2	5	5	5	<input type="checkbox"/>
4	CREQ-	0	3600.27	2	5	5	5	<input type="checkbox"/>
5	CLK_RESET	0	4087.81	4	5	5	5	<input type="checkbox"/>
6	ASYNC+	0	9450	2	5	5	5	<input type="checkbox"/>
7	ASYNC-	0	9450	2	5	5	5	<input type="checkbox"/>
8	FADDR7	0	1647.94	3	5	5	5	<input type="checkbox"/>
9	LED2_ACTI...	0	8383.04	5	5	5	5	<input type="checkbox"/>
10	~STAND_A...	0	433.75	1	5	5	5	<input type="checkbox"/>

GUI – Add-In Windows

■ Spreadsheet

- Customize displayed columns
- Use Filters to limit viewed data
- Save custom Schemes
- Export to HTML, print, or copy/paste



The screenshot shows a window titled "Edit filter" above a "Spreadsheet" window. The spreadsheet window has a toolbar with several icons circled in red. The main area contains a table with the following data:

	name	Unrouted length	Routed length	Total vias	Trace width	Protect
1	\$514452\$1N7	0	226	2	6	<input checked="" type="checkbox"/>
2	\$514453\$1N7	0	226	2	6	<input checked="" type="checkbox"/>
3	\$514454\$1N7	0	226	2	6	<input checked="" type="checkbox"/>
4	\$514455\$1N7	0	226	2	6	<input checked="" type="checkbox"/>

At the bottom of the spreadsheet window, there is a tab labeled "Dave's net scheme".



GUI – Middle-mouse Button/Wheel

■ Zoom and Center

- Same as PADS Layout

■ Scrolling


- Up/Down
- Left/Right (SHIFT + scroll)
- In/Out (CTRL + scroll)
- Layer change (ALT + scroll)

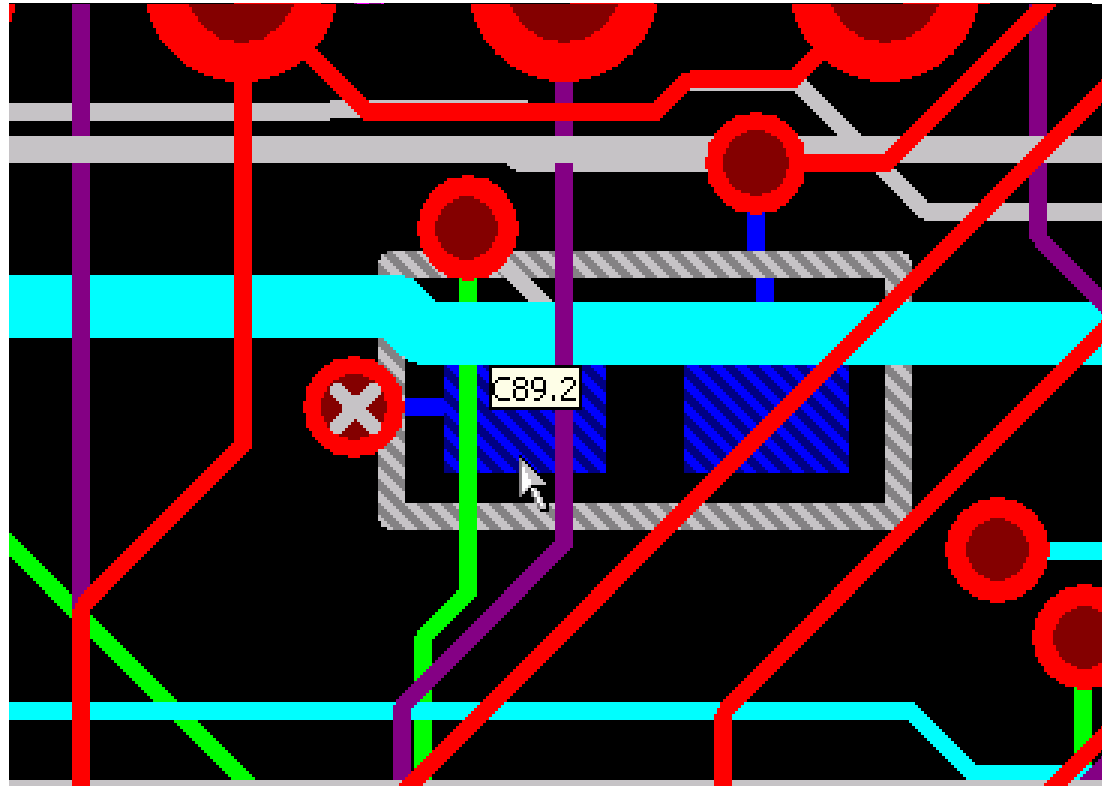
■ Dynamic panning (SHIFT + hold)

■ Drill-to-layer (CTRL + click during interactive routing)



GUI – In-Place Query

- “Always on” query mode 
- Queried object gets cross-hatched
- Info appears at cursor as ToolTip



GUI – Customization

- **Create/modify toolbars**
 - Drag and drop from Customize dialog
 - View text labels of toolbar commands
- **Modify pop-up (right-mouse) menus**
 - Remove unused commands
 - Add commands where you would like them
 - Reorder existing menus
- **Modify/create modeless commands (“Shortcuts”)**
 - Full list of current shortcuts available through Tools/Customize/Keyboard & Mouse/Report
- **Create separate Workspaces for different tasks or different users**



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Rules Setup

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Rules Setup

- **“Properties” replaces “Design Rules”** 
 - Windows standard shortcut: ALT + <enter>
- **“Default” rules available when Properties dialog open with nothing selected (“Design Properties”)**
- **Certain PADS Layout *Preference* settings available in Design Properties**
 - Grid (Setup/Preferences/Grids)
 - Layers (Setup/Layer Definition)
 - Test Points (Tools/DFT Audit) (DFT)

Rules Setup

- **Rules can now be set at the Decal and Component levels (ARS)**
 - Decal rules can be created in the design or in the library
 - Pad Entry and Fanout are now Properties, rather than global options, and exist at the Design, Decal and Component levels
 - Examples:
 - BGAs – smaller via, smaller clearance, smaller trace width, plane/signal/unused fanout
 - Edge connectors – No side pad entry, plane/signal fanout
 - Small pin pitch SMDs – smaller pad-pad clearance, smaller trace width

Rules Setup

- **Secondary Groups created and managed in Project Explorer (ARS)**
 - Classes, Groups, Matched Length net/pin pair groups, Conditional rules, Differential Pairs
 - Use drag and drop methods
 - E.g., drag 8 net names onto “Net Classes” and drop to create new class
- **Secondary Groups can also be created from the design workspace**
 - Select 2 or more objects
 - Available Secondary Groups will show on RMB menu
 - E.g., select 8 nets and choose “Make Class” from RMB menu



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Placement

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Placement

- **Generally the same functionality, menu picks and keystrokes as PADS Layout**
 - Tip: Hotkeys can be customized!
- **Clearances checked in real time with visual feedback**
 - No need to click to check spacing violations
- **Routed components can be moved with their routes attached**
 - Rerouting done during or after move
 - Fanouts moved as single group with parts
- **Auto scroll during move**
- **New Placement toolbar**



Placement

- **Groups always treated as groups**
 - Layout has separate operations for groups
- **Spin mode shows increment at cursor**
- **Currently unsupported features:**
 - Nudge
 - Clusters and Unions
 - Align
 - Move Sequential
 - Disperse



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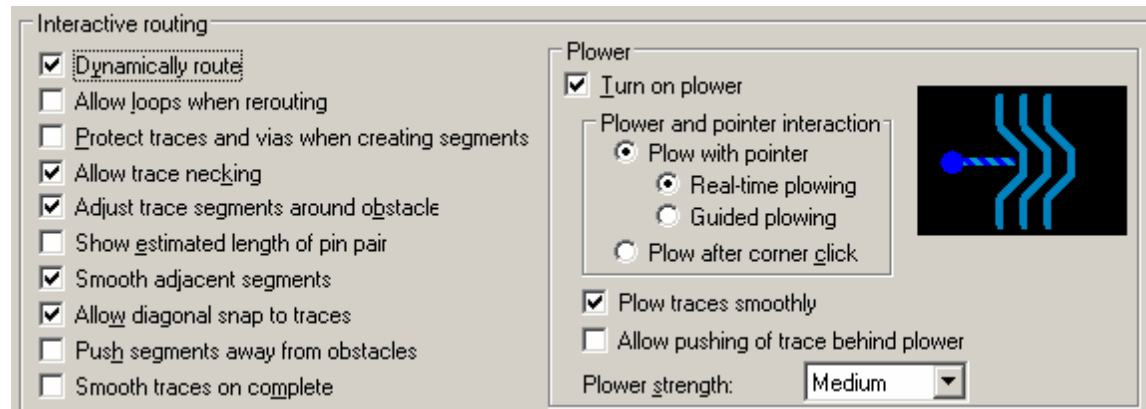
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Interactive & Manual Routing

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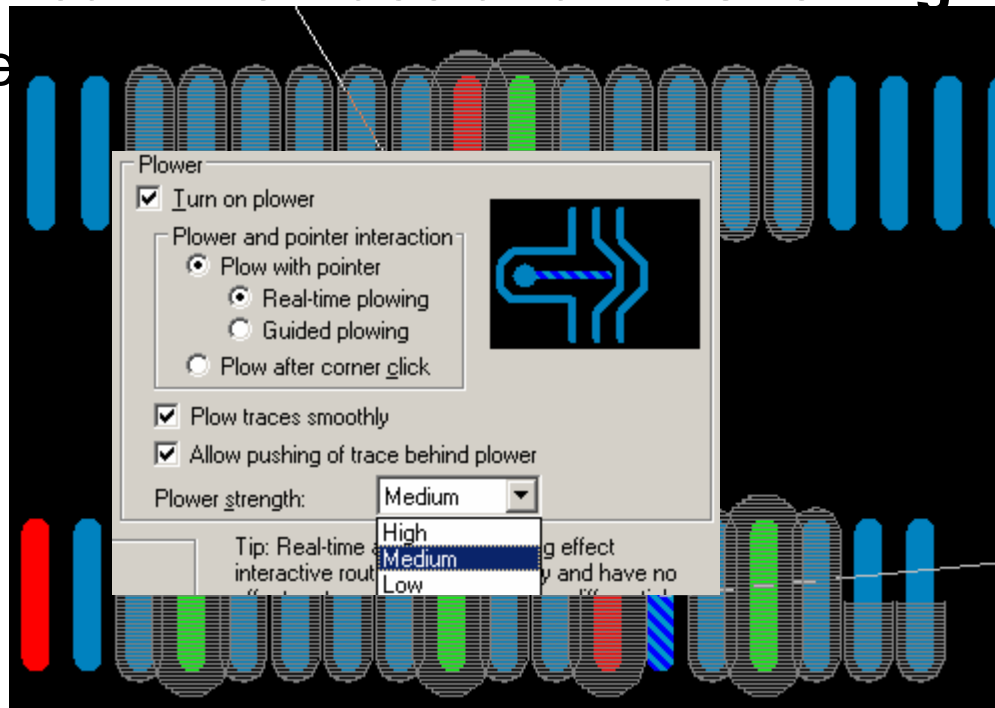
Interactive/Manual Routing

- **Interactive and manual routing now one tool**
 - “Dynamic” switch changes mode
 - Change mid-route
 - Set in Options/Routing tab or SHIFT+D during routing
- **Many settings in Options/Routing tab to control routing behavior**



Interactive Router – Features

- General usability similar to PADS Layout’s “Add Route” and “Dynamic Route Editor” (DRE)
- Unroutes disappear during routing
- Guard Bands show actual clearances
- Powerful real time trace and via shoving
 - Multiple



Interactive Router – Features

- **Via-size preview**
- **Auto Segment Adjust in “manual” mode automatically moves active route segment around fixed obstacles**
- **Double-click “Complete” can autoroute difficult routes**
- **Auto scroll during route**
- **Remember MMB features during routing**
 - ALT + scroll to change active layer
 - CTRL + MMB click to change current trace segment to current layer (Drill to layer)
 - Zoom/Pan

Interactive Router – Features

■ Real-time error explanation

- “Explain last error” from RMB
- View error description in Spreadsheet
- Helpful when the error is at the other end of the trace or is on another trace which is being shoved
- Some errors allow “Continue with errors”

■ Multiple DRC settings

- Example: Check Clearance and Length rules, but ignore Same Net rules
- DRC Filter toolbar for configuration
- “DRC Settings” icon controls Error Response
 - Prevent, Warn, Explain

Interactive Router – Route Editing

- **Route editing uses many of the same features as Interactive routing**
 - Trace and via shoving, Guard Bands, DRC settings, etc.
- **Improved controls for trace width and layer changes**
- **Visual aids**
 - Guard Bands
 - Real-time error markers
 - Move mode shows incremental 45° markers for corners
 - Moving cursor along markers allows segments to be moved in multiple directions
- **Verb modes for Move, Stretch, Protect, Unprotect, Unroute, Smooth**



Interactive Router – Enhancing Performance

- Turn off Guard Bands
- Add a corner after routing several inches of trace
- Turn off unnecessary DRC checks
- Turn off individual settings in Options/Routing
- Lower Power strength



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Design Review and Verification

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Design Review

- Use Project Explorer and Spreadsheet views to select and review critical areas
- High speed rule conformity quick to verify via color coded Spreadsheet

Spreadsheet

Net Length Monitor

	Name	Unrouted le...	Routed length	Length min...	Length max...	Net Class
1	ASync+	0	9450	9450	9500	MATCHTRAC
2	ASync-	0	9450	9450	9500	MATCHTRAC
3	DIFFOUT3	0	962.57	950	1000	
4	DIFFOUT4	0	950	950	1000	
5	DIFFOUT2	0	982.4	1000	1100	
6	DIFFOUT1	188.8	740.32	1000	1100	
7	DIFF3	0	2450	2450	2500	
8	DIFF4	0	2463.33	2450	2500	
9	DIFF1	0	2462.48	2000	2200	
10	DIFF2	0	2450.41	2000	2200	

Highlighted object display

Distinguish highlighted objects by:

- Dimming other object colors
- Turning off highlighting
- Crosshatching highlighted objects
- Dimming other object colors
- Displaying other objects in gray
- Keepout fill:

Brightness: high low

Transparent

Transparency: high low

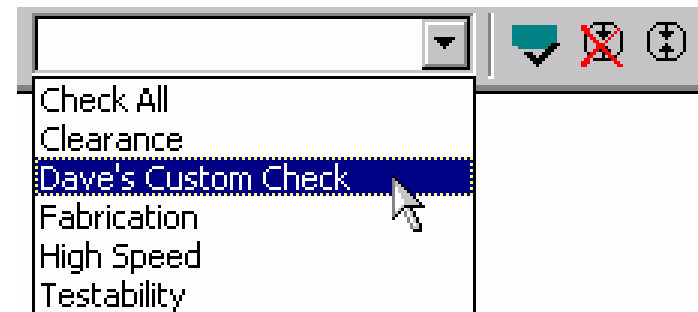
Copper, pour, split plane fill:

No fill

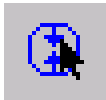
Hatch spacing: 8

Design Verification – Setup

- **Options/Design Verification tab**
- **Similar Clearance and Fabrication (DFF) checks as PADS Layout**
 - High-speed rule checks added (ARS)
 - Component/Decal rule checks added (ARS)
 - Tip: Use Latium Design Verification in PADS Layout to run these checks
- **Design Verification schemes allow users to set and save specific check combinations**
 - E.g., Net clearance and length rules, but not same net



Design Verification – Use

- Choose scheme from Design Verification toolbar
- Spreadsheet shows detailed error information
- Clearance errors highlight offending objects with required clearance value to show exact problem
- Error markers can be selected and queried to get error information
 - “Errors” a selection filter item 
- Errors can be flagged as Ignored
 - Ignored error markers disappear, but remain in database
 - Click “Display Ignored Errors” in Design Verification toolbar to show ignored error markers



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Miscellaneous Tips

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Miscellaneous Tips

- **Toggle-type shortcuts are a single keystroke, no need to <Enter> after**
 - O, E, T, I
- **New shortcuts:**
 - “U” toggles unroute display
 - “Z <layer #(s)>” displays only that layer(s)
 - “Q” Quick Measure added
- **Important change from PADS Layout:**
 - Unroute is now <Backspace>
- **Hover cursor over Status Bar during autorouting to view Subpass information**
- **Read the PADS Router Concepts Guide!**

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Q & A

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