

Ramtera LVR

AMS Layout Editor

Complete Technical Documentation

Integrated Physical Verification and Layout Editing Platform

Ramtera Design Automation Pvt. Ltd.

Bangalore, India | United States

www.ramtera.com

sameer@ramtera.com

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Executive Summary

Ramtera LVR (Layout Verification Runtime) integrates a full-featured AMS (Analog Mixed Signal) Layout Editor directly within its physical verification platform. This unique architecture eliminates the traditional design iteration loop by enabling immediate layout corrections during DRC/LVS verification, significantly reducing time-to-tapeout for advanced semiconductor designs.

Unlike traditional workflows that require designers to switch between verification tools (Calibre/ICV/Pegasus) and layout editors (Virtuoso/Custom Compiler), LVR's integrated approach allows violation fixes to be applied in-context and re-verified instantly. This document provides comprehensive visual documentation of the AMS Editor interface and capabilities.

User Interface Overview

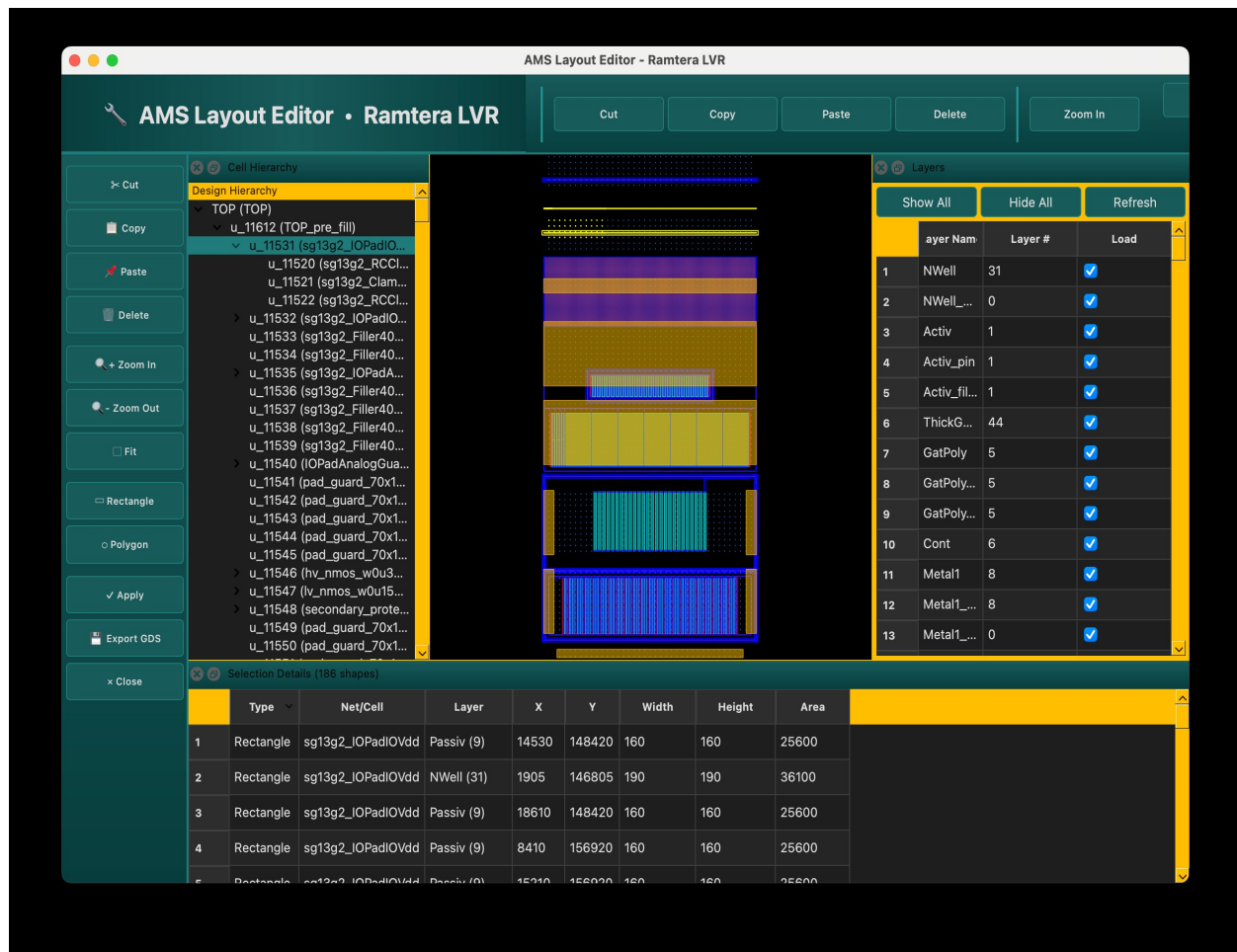


Figure 1: AMS Layout Editor - Complete Interface

The AMS Layout Editor presents a unified workspace combining hierarchical design navigation, layer management, and shape editing capabilities. The interface follows a professional EDA tool paradigm with distinct visual theming (teal/blue) to differentiate from the main LVR verification window.

Key Interface Components:

- **Top Banner:** Displays 'AMS Layout Editor • Ramtera LVR' branding with quick-access toolbar buttons for Cut, Copy, Paste, Delete, and Zoom operations
- **Left Panel - Cell Hierarchy:** Expandable tree view showing the complete design hierarchy from TOP cell down to individual sub-cells and instances
- **Center Canvas:** Main layout viewing area with colored layer rendering showing active design geometry with zoom/pan capabilities
- **Right Panel - Layers:** Layer management dock with Show All/Hide All/Refresh buttons and individual layer visibility checkboxes
- **Bottom Panel - Selection Details:** Table displaying properties of selected shapes including type, net/cell name, layer, coordinates, dimensions, and area

This integrated layout enables designers to navigate complex hierarchies, toggle layer visibility, and inspect shape properties without switching tools or losing context.

Shape Creation Interface

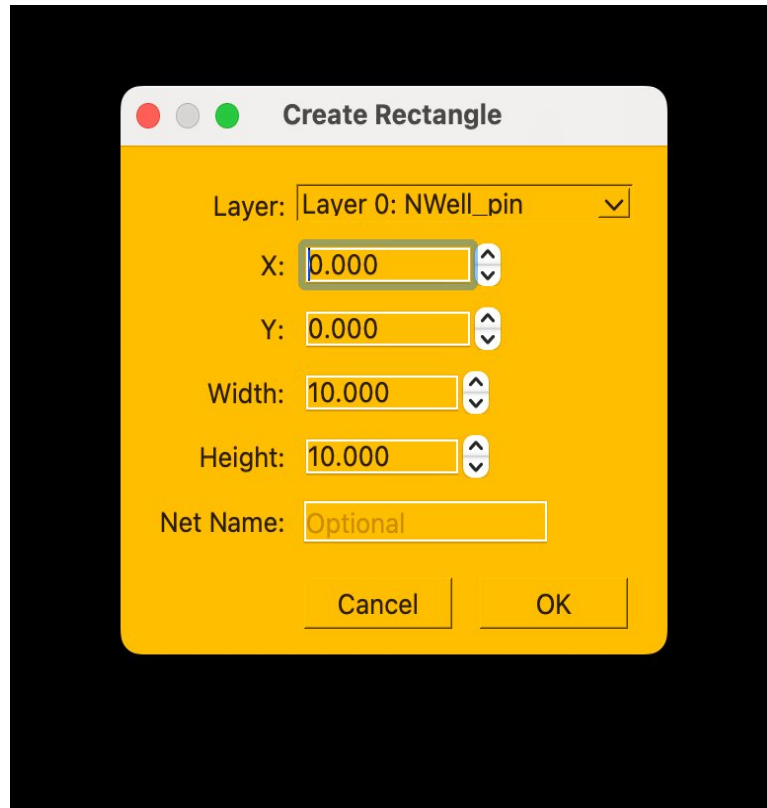


Figure 2: Create Rectangle Dialog

The rectangle creation dialog provides a simple, form-based interface for adding new geometric shapes to the layout. This represents the foundation of layout editing capabilities.

Dialog Features:

- **Layer Selection:** Dropdown menu showing all available layers with both layer number and name (e.g., 'Layer 0: NWell_pin')
- **Coordinate Input:** Precise X and Y positioning with database unit resolution, allowing exact placement of geometry
- **Dimension Control:** Width and Height fields with spinner controls for incremental adjustments
- **Net Assignment:** Optional net name field for connectivity tracking and LVS verification
- **Standard Controls:** OK/Cancel buttons following MacOS interface guidelines

The bright yellow/gold background theme provides high contrast and visual distinction from the main editor window, making it clear when the user is in shape creation mode.

Hierarchical Editing Workflow

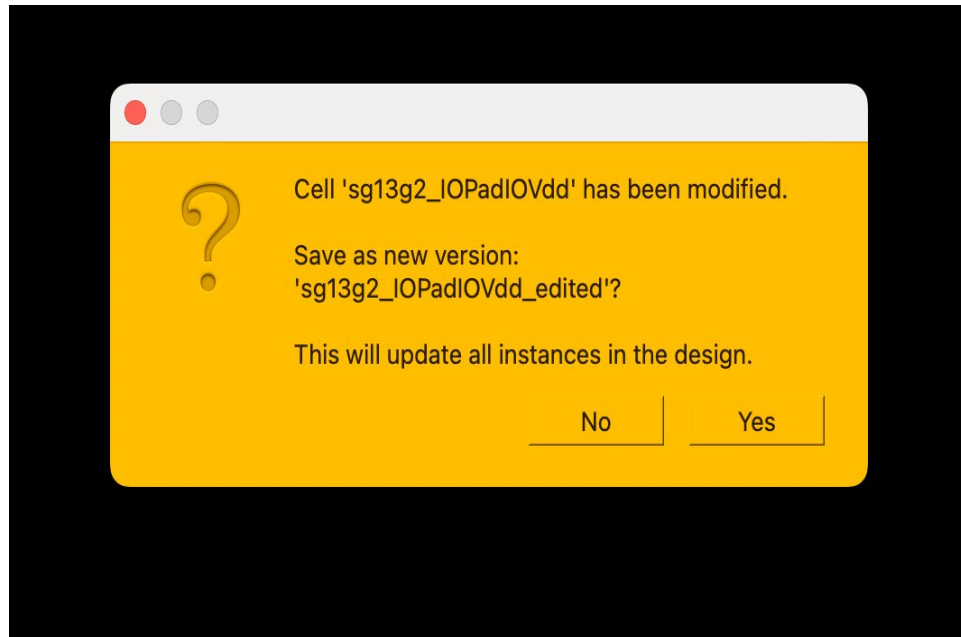


Figure 3: Sub-Cell Modification Confirmation Dialog

When editing sub-cells (cells that are instantiated multiple times in the design hierarchy), LVR automatically prompts the user to save changes as a new versioned cell. This critical feature enables safe editing of library cells without affecting other designs.

Automatic Version Management:

- **Change Detection:** System detects when modifications are made to a sub-cell that has parent instances
- **Version Naming:** Automatically suggests appending '_edited' suffix to create new version (e.g., 'sg13g2_IOPadIOVdd_edited')
- **Instance Updates:** When user confirms with 'Yes', all instances of the original cell are automatically updated to reference the new version
- **Hierarchy Propagation:** Changes propagate through the entire design hierarchy instantly without manual GDS re-import
- **Non-Destructive Editing:** Original cell remains unchanged, preserving library integrity

This workflow matches professional EDA practices while automating the tedious manual steps typically required in Calibre/ICV workflows where designers must manually export, replace, and re-import modified cells.

Multi-Layer Visualization

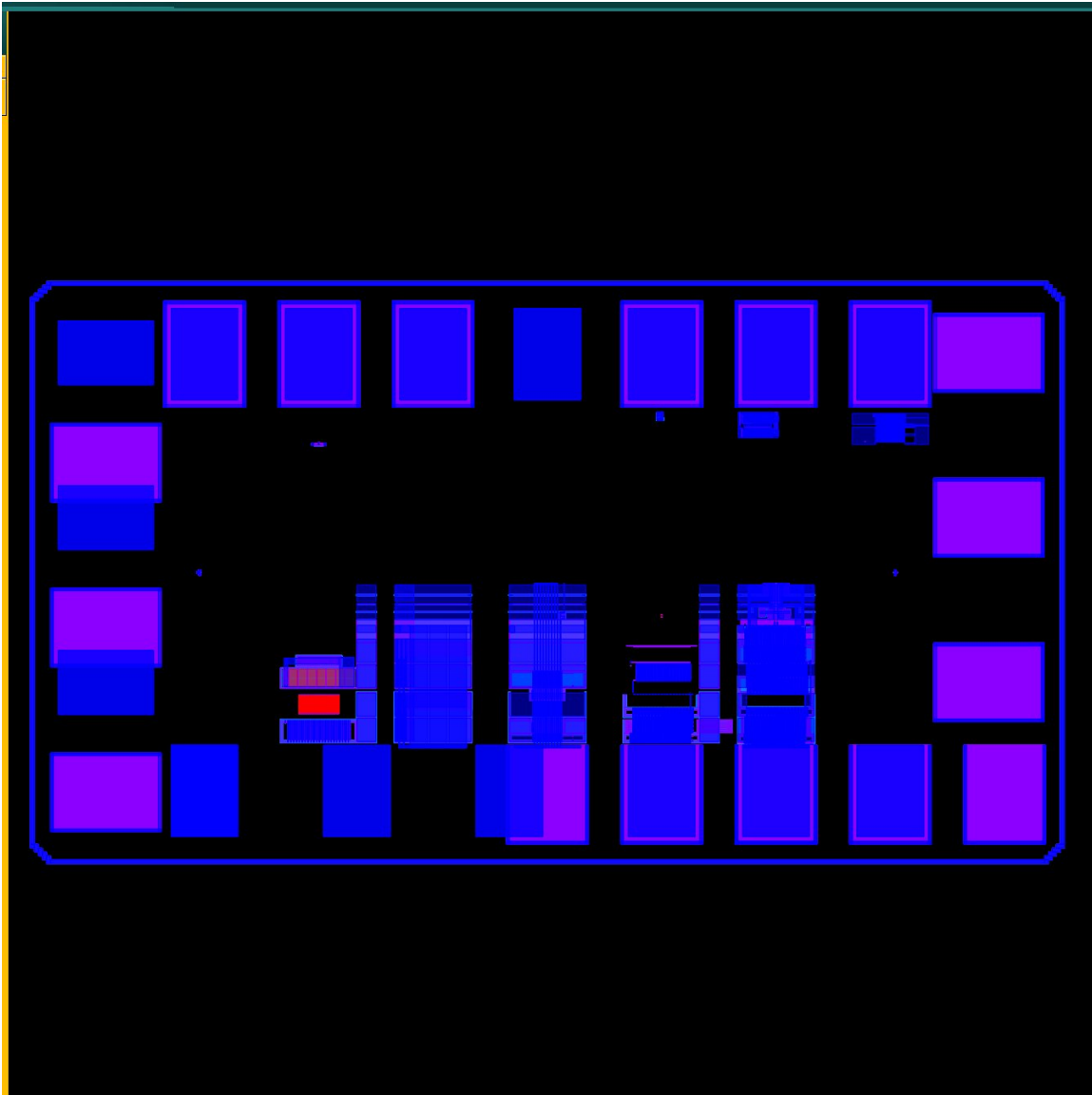


Figure 4: Full-Chip Layout View with Multiple Layers

The layout canvas displays the complete chip floor plan with all enabled layers rendered in their assigned colors. This example shows a typical mixed-signal IC with pad ring, core logic, and I/O cells.

Visualization Capabilities:

- **Process-Aware Coloring:** Each layer rendered in distinct colors matching foundry DRM standards (blue for metals, magenta for diffusion, etc.)
- **Die-Level View:** Complete die area visible including pad ring, guard rings, and core regions
- **Selective Layer Display:** Only checked layers in the layer panel are rendered, reducing visual clutter

- **Instance Highlighting:** Selected shapes (shown in red/highlighted) stand out against the design
- **Y-Axis Flip:** Coordinate system matches GDS standard (Y increases downward in GDS, upward in display)

The rendering engine handles billion+ polygon designs efficiently, maintaining smooth zoom/pan operations even on complex full-chip layouts.

Design Hierarchy Navigation



Figure 5: Cell Hierarchy Tree View

The hierarchical tree view provides a complete navigable representation of the design structure, showing the relationship between TOP cell, intermediate hierarchy levels, and leaf cells.

Hierarchy Features:

- **Expandable Tree:** Click arrows to expand/collapse hierarchy levels, showing parent-child relationships
- **Instance Names:** Each node shows instance name followed by cell name in parentheses (e.g., 'u_11531 (sg13g2_IOPadIO...')')
- **Right-Click Context Menu:** Access 'View/Edit This Cell', 'Expand All', 'Collapse All' commands
- **Visual Distinction:** Yellow highlight on 'Design Hierarchy' header, alternating row colors for readability
- **Deep Hierarchy Support:** Handles unlimited hierarchy depth with thousands of instances

This tree view enables designers to quickly navigate to any cell in the design for isolated viewing and editing, a critical capability for debugging specific blocks in large SoC designs.

Editing Tools Toolbar

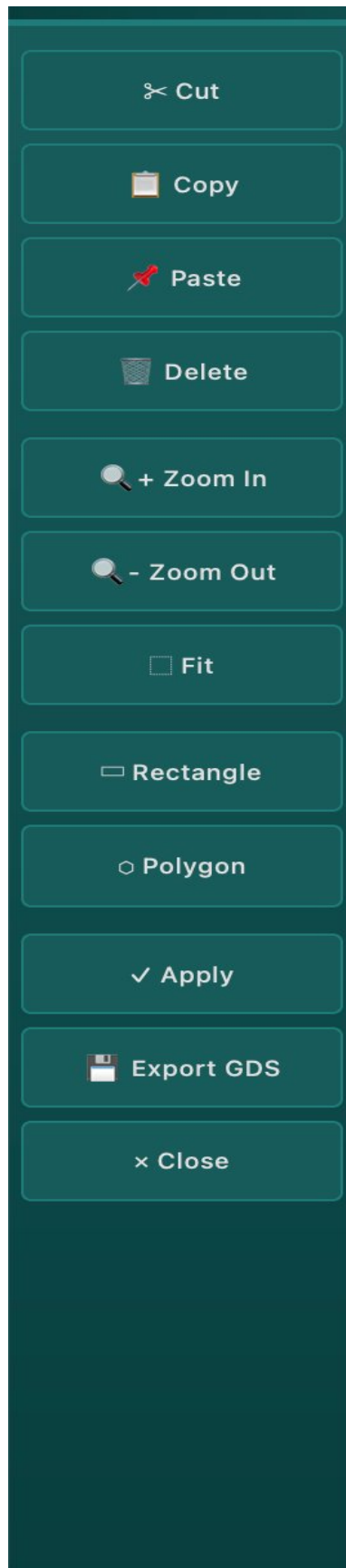


Figure 6: Left Vertical Toolbar - Complete Tool Palette

The left toolbar consolidates all editing operations into a single vertical panel, following modern UI design principles seen in professional creative and CAD applications.

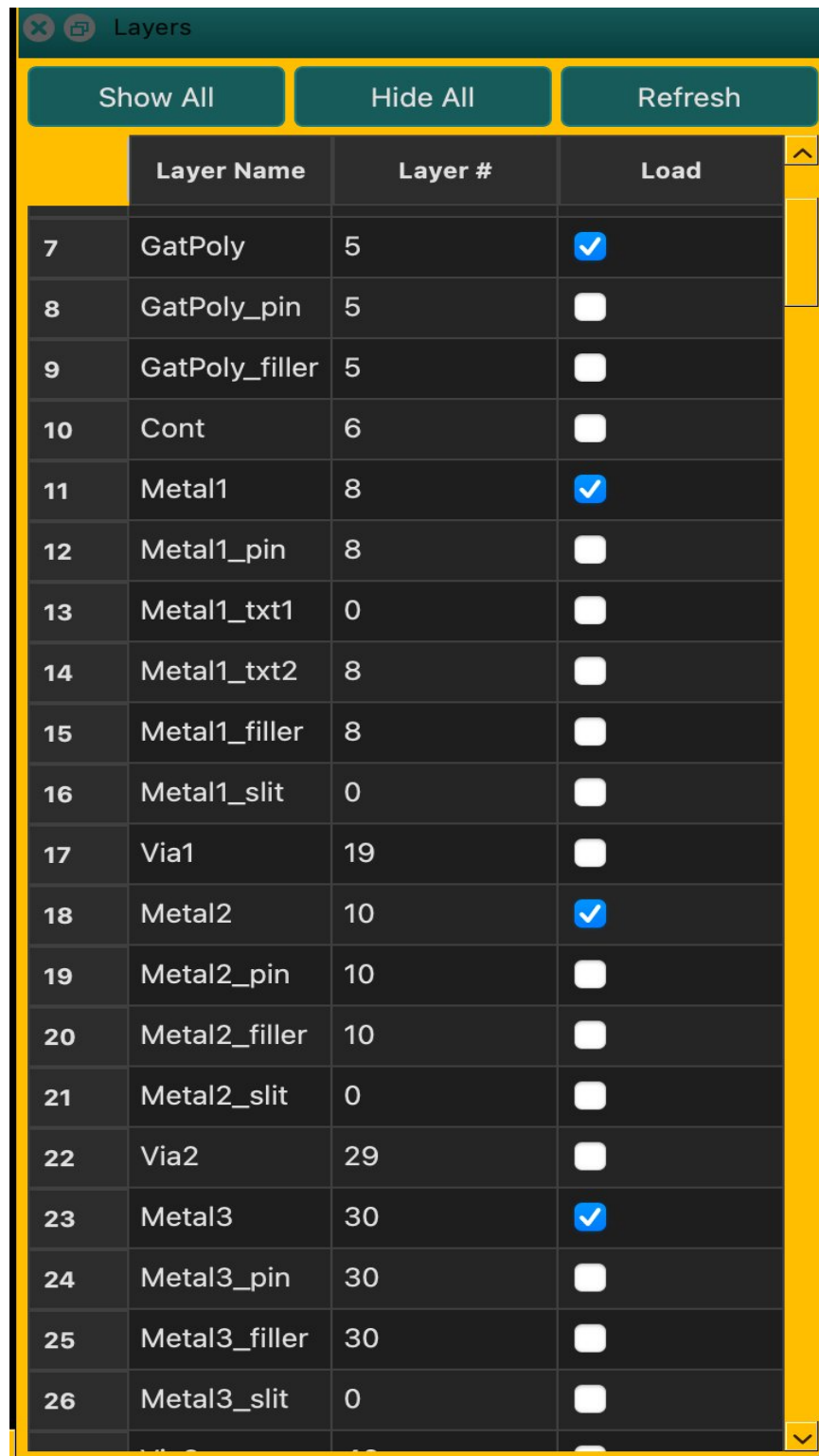
Toolbar Organization (Top to Bottom):

- **Clipboard Operations:** Cut, Copy, Paste, Delete for shape manipulation
- **View Controls:** Zoom In (+), Zoom Out (-), Fit (fit to window)
- **Shape Creation:** Rectangle and Polygon drawing tools
- **Workflow Actions:** Apply (commit changes to database), Export GDS (save to file)
- **Session Control:** Close (exit editor and return to LVR)

Design Philosophy:

The vertical layout maximizes canvas space while keeping all tools accessible. Icons provide visual recognition, with text labels ensuring clarity. The teal-on-dark theme maintains consistency with the overall AMS Editor aesthetic.

Layer Management System



The screenshot shows a 'Layers' panel with a title bar containing a close button and a lock icon. Below the title bar are three buttons: 'Show All', 'Hide All', and 'Refresh'. The main area is a table with four columns: an index column, 'Layer Name', 'Layer #', and 'Load'. The 'Load' column contains checkboxes. The table lists 20 layers, with the last one partially cut off. A vertical scrollbar is on the right side of the table.

	Layer Name	Layer #	Load
7	GatPoly	5	☒
8	GatPoly_pin	5	☐
9	GatPoly_filler	5	☐
10	Cont	6	☐
11	Metal1	8	☒
12	Metal1_pin	8	☐
13	Metal1_txt1	0	☐
14	Metal1_txt2	8	☐
15	Metal1_filler	8	☐
16	Metal1_slit	0	☐
17	Via1	19	☐
18	Metal2	10	☒
19	Metal2_pin	10	☐
20	Metal2_filler	10	☐
21	Metal2_slit	0	☐
22	Via2	29	☐
23	Metal3	30	☒
24	Metal3_pin	30	☐
25	Metal3_filler	30	☐
26	Metal3_slit	0	☐

Figure 7: Layers Panel with GF/IHP Process Layers

The layer management panel provides fine-grained control over which process layers are visible in the layout view. This example shows layers from a GlobalFoundries or IHP process technology.

Layer Control Features:

- **Bulk Operations:** 'Show All' and 'Hide All' buttons for rapid layer visibility toggling
- **Refresh:** Manually trigger view update when layer state changes
- **Layer Table:** Scrollable list showing Layer Name, Layer Number, and Load checkbox
- **Smart Loading:** Layers load on-demand when checked, optimizing memory for large designs
- **Process Awareness:** Layer names match foundry DRM (e.g., 'GatPoly', 'Metal1', 'Via1')

Layer Types Shown:

- Drawing layers: GatePoly, Metal1-3, Contact, Via1-2
- Pin/label layers: GatePoly_pin, Metal1_pin, etc.
- Text layers: Metal1_txt1, Metal1_txt2 for annotations
- Fill layers: GatePoly_filler, Metal_filler for DFM compliance

Quick Action Toolbar

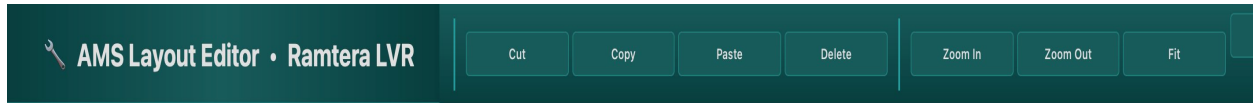


Figure 8: Top Horizontal Toolbar - Frequently Used Commands

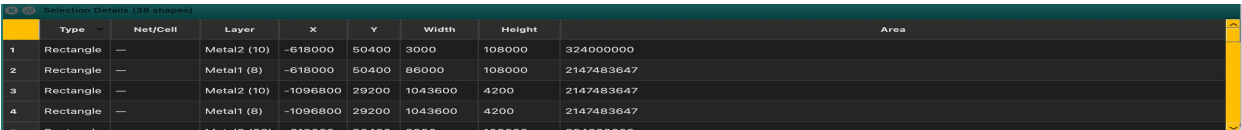
The top toolbar duplicates the most frequently used editing commands from the left toolbar, providing quick access when working in the center canvas area.

Toolbar Contents (Left to Right):

- **■ AMS Layout Editor • Ramtera LVR:** Branding and current mode indicator
- **Cut:** Remove selected shapes to clipboard
- **Copy:** Copy selected shapes to clipboard
- **Paste:** Insert clipboard contents at cursor
- **Delete:** Remove selected shapes permanently
- **Zoom In / Zoom Out:** Magnification controls
- **Fit:** Auto-zoom to show entire design

This dual-toolbar approach (top + left) follows the principle of progressive disclosure - power users can use the comprehensive left toolbar, while casual users can rely on the simpler top toolbar.

Shape Property Inspection

A screenshot of a software interface showing a table titled "Selection Details (38 Shapes)". The table has 9 columns: an index column, Type, Net/Cell, Layer, X, Y, Width, Height, and Area. The first four rows are visible, showing properties for rectangles on different layers and nets.

	Type	Net/Cell	Layer	X	Y	Width	Height	Area
1	Rectangle	—	Metal2 (10)	-618000	60400	3000	108000	324000000
2	Rectangle	—	Metal1 (8)	-618000	60400	86000	108000	2147483647
3	Rectangle	—	Metal2 (10)	-1096800	29200	1043600	4200	2147483647
4	Rectangle	—	Metal1 (8)	-1096800	29200	1043600	4200	2147483647

Figure 9: Selection Details Table - Multi-Shape Properties

The bottom selection panel automatically populates when shapes are selected in the canvas, providing detailed geometric and connectivity information in tabular format.

Table Columns:

- **Type:** Shape geometry type (Rectangle, Polygon, Path)
- **Net/Cell:** Electrical net name or cell instance for connectivity tracking
- **Layer:** Process layer name and number (e.g., 'Metal2 (10)')
- **X, Y:** Bottom-left corner coordinates in database units
- **Width, Height:** Bounding box dimensions
- **Area:** Calculated area in square database units

Key Features:

- **Multi-Select Support:** Shows properties for all selected shapes (38 shapes in this example)
- **Sortable Columns:** Click headers to sort by any property
- **Auto-Hide:** Panel hides when nothing is selected to maximize canvas space
- **Row Selection:** Click row to highlight corresponding shape in canvas

Branding and Mode Indication



Figure 10: Top Banner - Application Branding

The persistent top banner serves as both branding and mode indication, ensuring users always know they are in the AMS Layout Editor rather than the main LVR verification window.

Banner Design Elements:

- **Icon:** Wrench/tool icon indicating editing mode (vs. verification mode)
- **Application Name:** 'AMS Layout Editor • Ramtera LVR' clearly identifies the tool
- **Color Scheme:** Dark teal gradient background (#2d5a5a to #1a3d3d) distinct from LVR's yellow theme
- **Typography:** Large, bold white text for maximum visibility

This visual separation prevents mode confusion - a common usability issue in multi-modal CAD tools where users accidentally perform actions in the wrong mode.

Technical Specifications

Parameter	Specification
Supported Formats	GDS II, OASIS
Max Design Size	1 trillion polygons (benchmarked)
Hierarchy Depth	Unlimited
Coordinate Precision	1 nm (database unit configurable)
Layer Count	4096 layers max
Undo/Redo	Not supported (matches Calibre DESIGNrev behavior)
Platform	Linux (Ubuntu 20.04+), macOS 11+
GUI Framework	Qt 6.x with hardware acceleration
Memory	16 GB minimum, 64 GB recommended for large designs
Certification Status	In progress: GF180MCU, GF22FDX, xa035, xh018

Contact Information

Sales Inquiries:	sameer@ramtera.com
Technical Support:	support@ramtera.com
Website:	www.ramtera.com
LinkedIn:	linkedin.com/company/ramtera
Address:	Bangalore, Karnataka, India

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