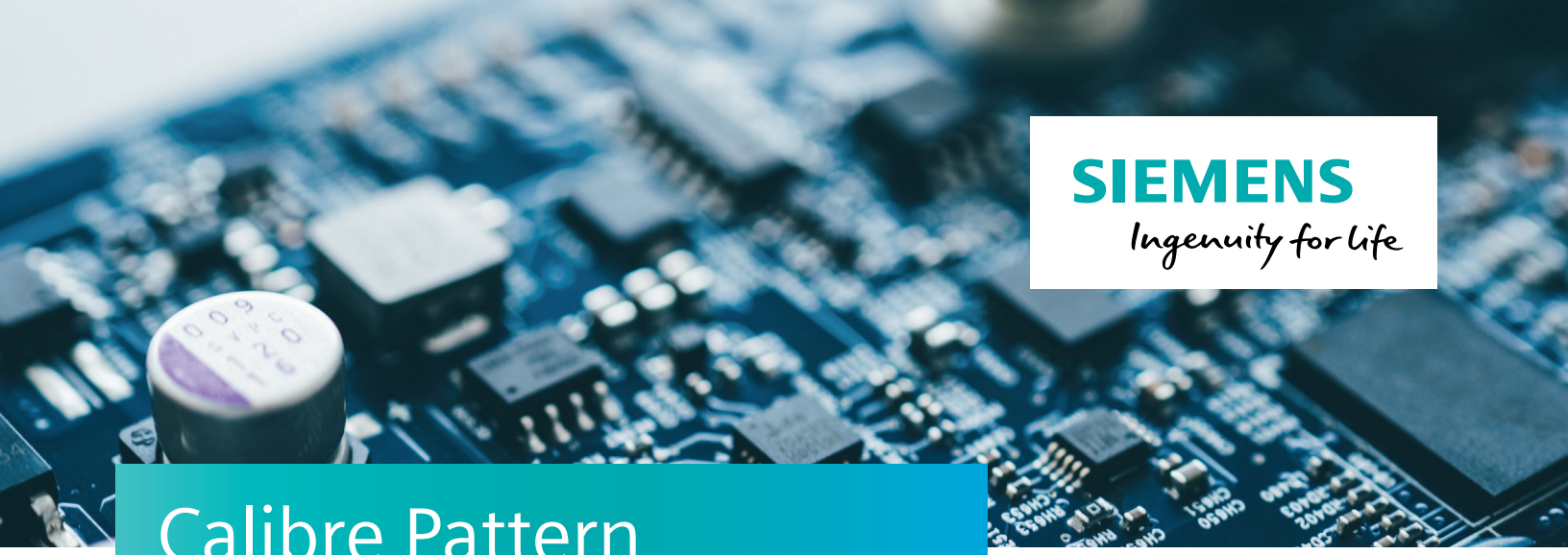


SIEMENS
Ingenuity for life

Calibre Pattern Matching

Features and benefits

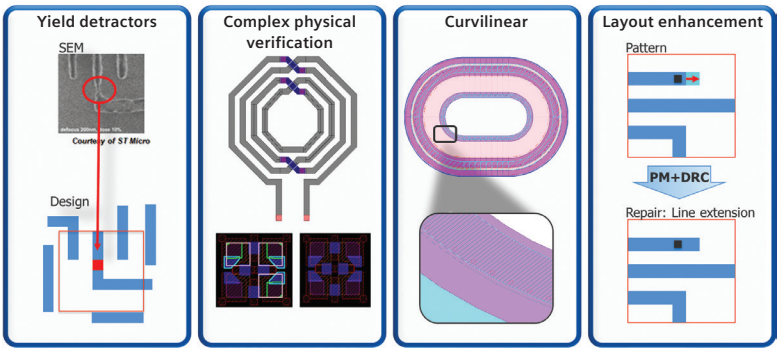
- Automated pattern capture via GUI or scripting
- Specify exact matches or controlled variability
- Calibre nmPlatform integration:
  - Single rule deck integration with multiple Calibre tools
  - Enables pattern-matching-driven, Calibre signoff-quality analysis, verification, and layout enhancement using a broad range of Calibre and Tessent tools
  - Enables integrated flows to create new applications that solve hard design problems
- Integrated with P&R to enable pattern-matching-driven implementation with auto-fixing and verification
- Invoked through existing Calibre integrations with 3rd party design environments
- Reduces design variability: enables PV checks that were previously impractical or impossible
- Uses a single visual geometry definition to significantly simplify the addition of new, complex, layout-specific design rules and new devices

Calibre Pattern Matching

At advanced nodes, design constraints become a complex, interdependent, multi-dimensional set of variables. Multi-dimensional checks that examine the interrelationship of multiple geometries over long ranges and between multiple layers are essential to ensure manufacturability. Even at mature design nodes, AMS and RF applications often have design elements that are difficult to implement in text-based design rules. This rule complexity means many design rule checks are difficult (or impossible) to code accurately.

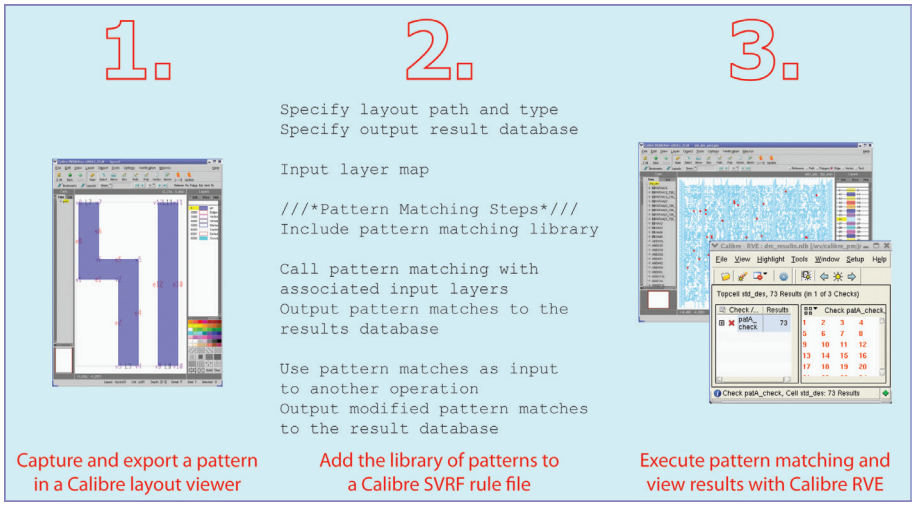
Calibre® Pattern Matching provides interactive and automated pattern capture, definition, and search that can be used across implementation, verification, and test flows. Pattern matching supplements multi-operational text-based design rule checks with an automated visual geometry capture and compare process. The simplicity of capturing extremely complex geometric relationships with Calibre Pattern Matching enables advanced physical verification and design methodology checks that were previously difficult or operationally impossible to create – enabling designers to deliver higher-performing products with reduced design variability and improved yield.

Calibre Pattern Matching is built on and integrated into the industry-leading Calibre nmPlatform, known for delivering best-in-class performance, accuracy, and reliability. With its capability to automatically and precisely match desired geometries, and its ability to operate on multiple layers simultaneously, Calibre Pattern Matching provides a unique opportunity to automatically verify a wide range of complex and multi-layer geometries while simultaneously reducing runtimes and improving design quality and reliability.



Calibre Pattern Matching complements text-based design rules to enable a wide range of complex physical verification across all technology nodes and processes.

Calibre Pattern Matching



Using Calibre Pattern Matching functionality is as easy as 1-2-3.

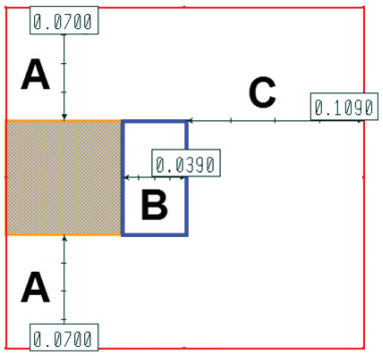
Here are just a few of the use cases where pattern matching has been implemented:

- Waive by Pattern: Capturing known waive-able contextual DRC violations as patterns enables automatic filtering of these results in subsequent layout iterations, allowing designers to focus debug time on real errors
- Automated Layout Enhancement: Using pattern matching to identify opportunities for design enhancements, such as line-end extensions, improve yield and reliability without the need for expert coding resources

Pattern identification and definition
Designers import a layout into Calibre DESIGNrev™ or Calibre Workbench™, then capture the geometry of interest in the UI. Alternatively, using error markers from a prior Calibre nmDRC™/LFD™ run, designers can use the Calibre Pattern Matching automated flow to capture hundreds or thousands of patterns all in one step. When added to a pattern library, a pattern can be defined as an exact match, or controlled for specified variation.

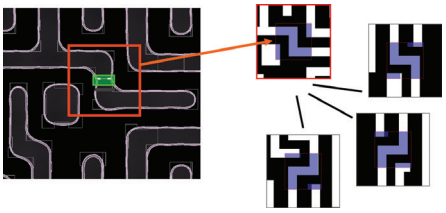
DRC runs can be defined to look like regular DRC results, and can be debugged in exactly the same way). Because pattern matching is a direct visual comparison between actual geometries, accuracy and precision are increased, and debugging is greatly simplified.

Pattern matching applications
Leveraging the Calibre nmPlatform, the industry's most trusted verification toolset, Calibre Pattern Matching enables an ever-increasing variety of applications.

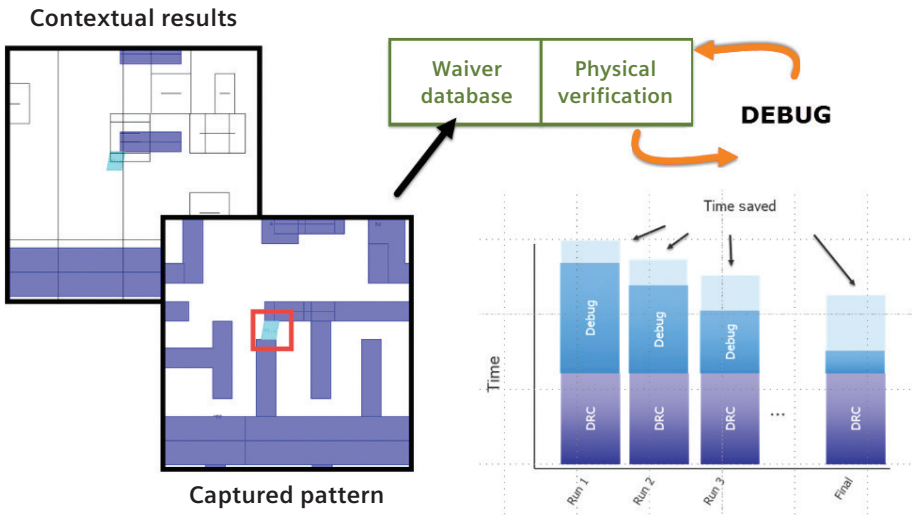


Designers can edit a pattern with DRC rules in mind, to ensure a layout remains DRC-clean after modification.

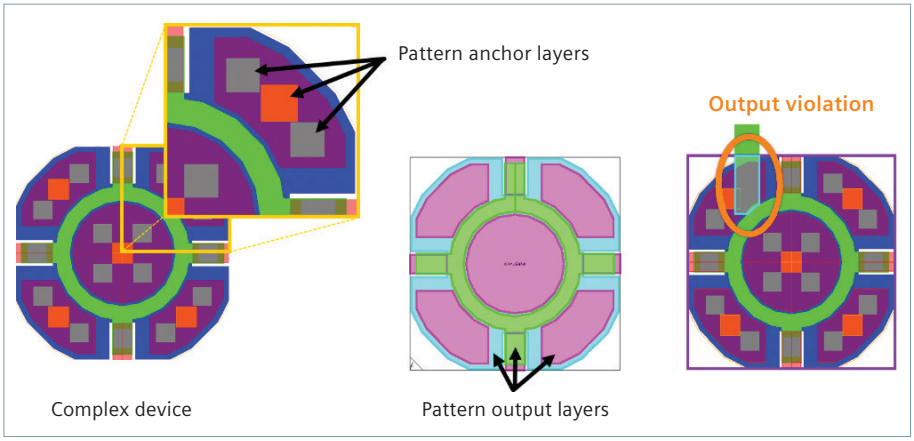
Pattern detection
Calibre Pattern Matching scans the design, and places a marker at the site of every pattern match. Flexible marker definitions enable the use of different markers for different layers, and provide for user-defined markers appropriate to a specific process (e.g., markers used for



Locating problematic configurations in a layout is fast and efficient with Calibre Pattern Matching.



Create contextual patterns and output a waiver database for automated contextual waiving during iterative physical verification runs.



Complex device recognition with pattern anchors can output multiple layers that are used to identify specific violations that require fixing.

- Validate Non-Manhattan and Analog Geometries: Capturing these devices and geometries as patterns and using Calibre Pattern Matching layers technology enables both the verification of compliant devices and the identification of un-matched devices

Calibre nmPlatform Integration

As a part of the Calibre nmPlatform, Calibre Pattern Matching can be used with a range of different Siemens EDA products using a single physical verification sign-off deck. No stream-outs/stream-ins or complicated scripts are needed – it can be used with regular Calibre rule decks and your established implementation or physical verification process flows. Complete Calibre rule files and extensive coverage of Calibre processes for DRC and DFM are available at all major semiconductor foundries.

It is also integrated with P&R tools to provide pattern-matching-driven place and route with auto-fixing. Results are debugged using the same process and design environment used to debug Calibre nmDRC results. This direct integration enhances performance and reduces turnaround times for even the most complex and advanced digital designs.

The Calibre nmPlatform's integration with all major design creation environments also means you can run Calibre Pattern Matching technology anywhere you run Calibre tools. Design teams can invoke Calibre Pattern Matching functionality in a wide range of 3rd-party P&R and design tools.

Calibre Pattern Matching streamlines communication between design implementation, verification, and manufacturing teams. For example, teams can receive accurate, quick updates for recently identified yield-limiting patterns with a level of simplicity not possible with traditional flows. Faster, more accurate communication makes the entire implementation and verification process faster and more efficient.

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