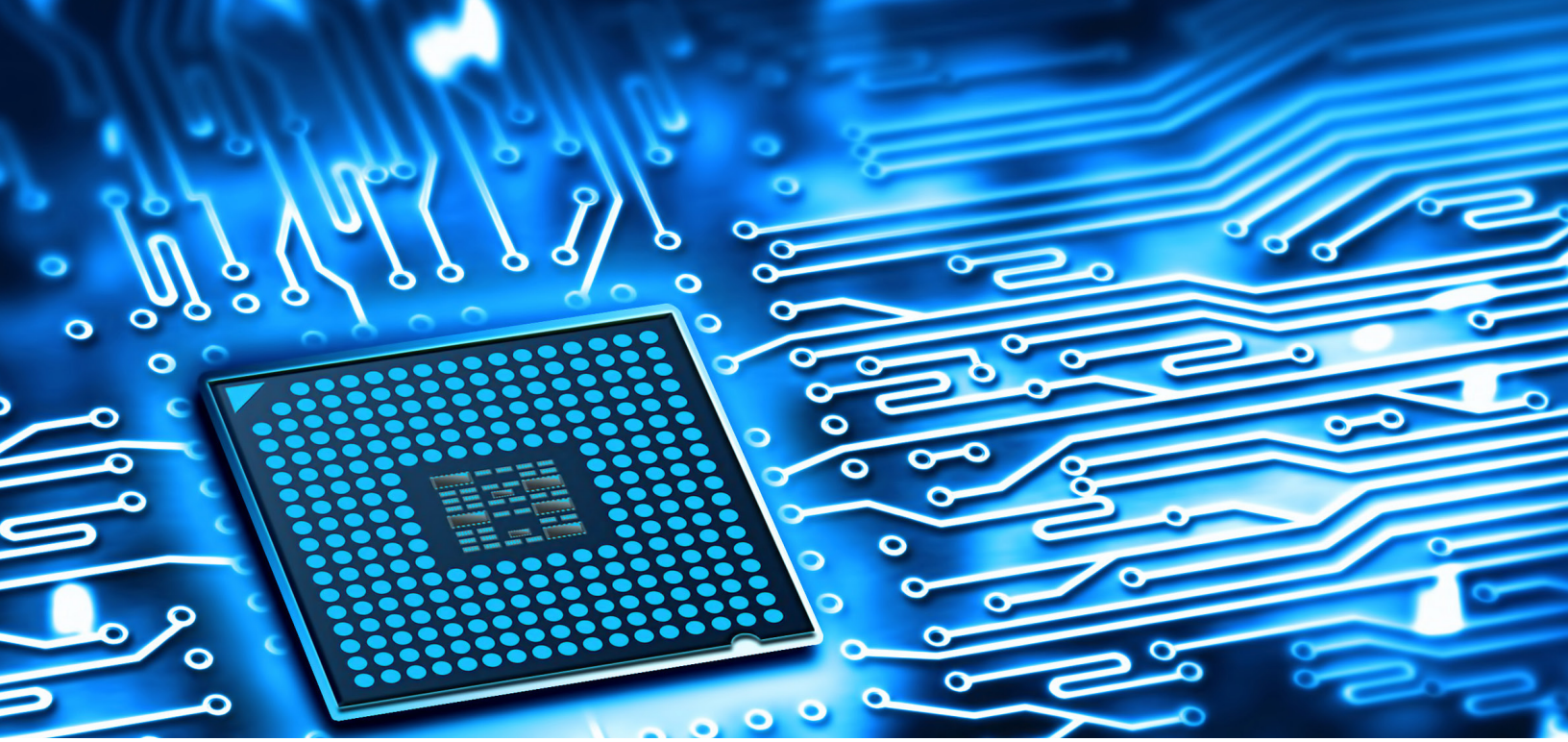


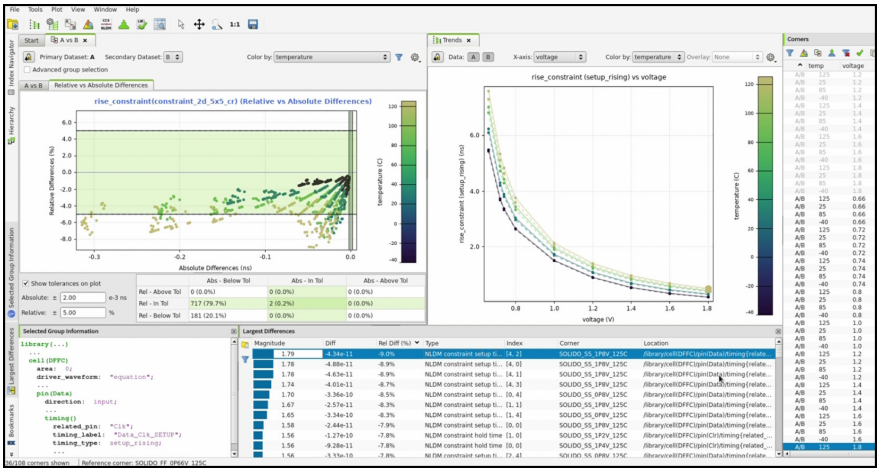
DIGITAL INDUSTRIES SOFTWARE

Solido Characterization Suite
Library Characterization

Features and Benefits

Solido Characterization Suite

- Massive speedup in library characterization and verification
- Enables full characterization flows
- Better quality libraries, improved power, performance, and area (PPA)
- Supports standard cells, IOs, memories, and custom cells
- Works with all characterization tools and flows
- Works on all .lib data types: timing, power, noise, and variation



Solido Characterization Suite enables faster and more accurate library characterization and verification, resulting in better quality libraries for improved power, performance, and area.

SIEMENS

siemens.com/eda

Features and Benefits - *continued*

Solido Analytics

- Comprehensive .lib verification in hours instead of weeks
- Finds issues undetectable by traditional checks
- Supports hundreds of standard checks and custom checks
- Compares all library metrics and summarizes information for the user
- Supports custom plots with user-defined functions and variables

Solido Generator

- Uses artificial intelligence to accelerate characterization
- Produces new PVTs .libs in minutes, 100x+ faster than SPICE
- Works using .libs as input; does not need SPICE simulation or characterizer calibration

Solido Library Profiler

- Informed library selection based on PPA requirements
- Smart auto-alignment of .lib data between libraries
- PPA analysis of libraries with interpolation, plots, and reports

Solido Characterizer

- Solido's advanced statistical techniques deliver efficient and accurate LVF
- Artificial intelligence in-the-loop for acceleration across PVTs
- Optimized with Solido Simulation Suite technologies
- Direct integration with Solido Analytics for streamlined quality assurance

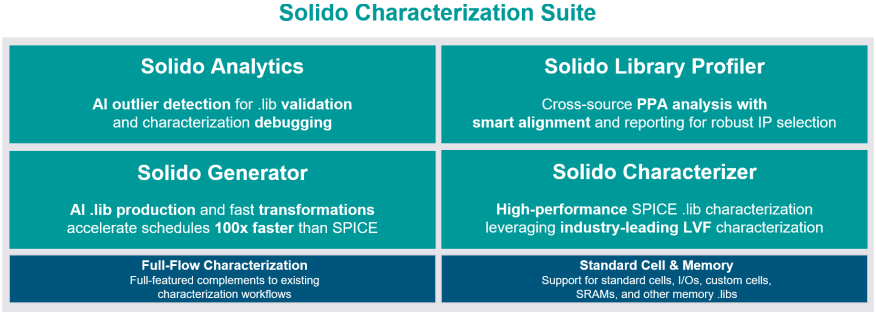
Summary

Modern static timing analysis (STA)-based design flows rely on characterized .lib models of standard cells, IOs, memories, and custom blocks. However, traditional library characterization and validation have become increasingly expensive in terms of computation and engineering effort, due to complexity and the amount of characterized data.

Solido Characterization Suite

The Solido™ Characterization Suite™ provides fast and accurate library characterization tools powered by artificial intelligence (AI) technologies. This suite significantly reduces standard cell, custom cell, and memory characterization time and resources, while delivering production-accurate .lib models and statistical data, and performing comprehensive validation for characterized .lib files. It achieves this using various artificial intelligence and reinforcement learning (RL) methods that adaptively model the full characterization space, boosting accuracy where needed to achieve production targets, while saving large amounts of simulation time in other areas. Additionally, it can aid decision-making on IP selection for downstream design requirements by directly comparing PPA across libraries.

The Solido Characterization Suite deliver a full characterization workflow that also complements any existing characterization solution. It works on standard cells, IOs, memories as well as custom cells – anything that is described by a .lib model. It supports all .lib data types, including timing, power, noise and variation, and supports all .lib data structures such as NLDM, CCS, LVF, and Moments.



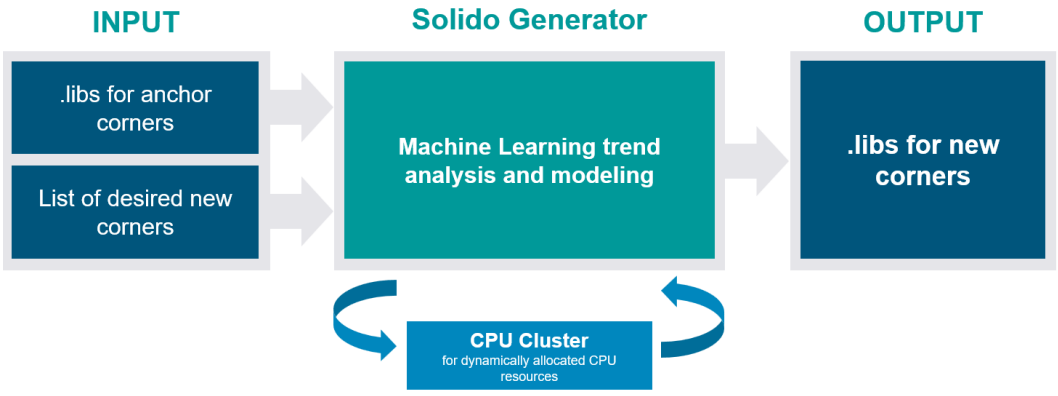
Analytics combines comprehensive Liberty model validation with advanced Library Visualization, enabling full .lib verification in hours instead of weeks.

Solido Generator

Solido Generator uses artificial intelligence methods to generate production-accurate .lib models at new PVT corners in minutes, using existing PVT .libs as anchor data. Generator produces new PVTs 100x +faster than SPICE-based characterization, is production accurate, and works with any existing characterization flow.

Generator builds an artificial intelligence model of the library to produce production-accurate Liberty models at new PVT corners 100x+ faster than SPICE. The tool:

- Uses artificial intelligence to accelerate characterization: by building an artificial intelligence model to produce .libs at new PVT corners. It does not require SPICE simulation and does not require characterization environment calibration.
- Creates production-accurate Liberty models at a fraction of runtime: by generating new .libs 100x+ faster than SPICE, with accuracy equivalent to SPICE-characterized .libs.
- Generates all .lib data types and constructs: including timing, power, noise, and variation data in all .lib data constructs including NLDM, CCS, LVF, and Moments.
- Works with all characterization tools and flows: to provide massive speedup to characterization runtime.
- The Solido Characterization Suite empowers teams to bring products to market quicker and with less schedule volatility. By improving the quality of IP libraries, it helps improve power, performance, and area metrics, and increases silicon yield.



Generator builds an artificial intelligence model of the library to produce production-accurate .lib models at new PVT corners 100x+ faster than SPICE.

Solido Analytics

Solido Analytics is the industry leader for comprehensive library validation and debugging. It provides outlier detection using an AI engine, combined with an information visualization approach for reviewing and verifying data. Analytics enables full verification of .lib files in hours instead of weeks.

Analytics results in better quality libraries and much faster library verification schedules. Using Analytics, design teams can reduce schedule time, improve power, performance, and area metrics of the final design, as well as increase silicon yield. The solution includes:

- Artificial intelligence Outlier Analysis: finds critical issues in Liberty data automatically, including those undetectable by traditional methods. It can detect issues not only across PVTs but also in the slew-load tables within a single PVT.
- Rule-based Checks: employs fast and parallelized rule-based checks, including hundreds of standard checks, and support for custom checks using an API.
- Library Comparison: provides full-coverage comparisons between libraries or library revisions. Compares all timing, power, noise, and variation aspects of libraries and summarizes differences in an easy-to-understand and analyze format.
- Advanced Library Visualization: uses advanced information visualization methods linked to library data to minimize the time and effort for library analysis, and to allow users to seamlessly trace issues to their source.
- Custom Plots: allows users to create their own plots and display multiple measurements against multiple variables, making it the most effective method for understanding and analyzing .libs
- High-performance, high-capacity .lib handling: parallelizable up to 1000s of CPUs, able to handle .lib files 10GB+ in size.

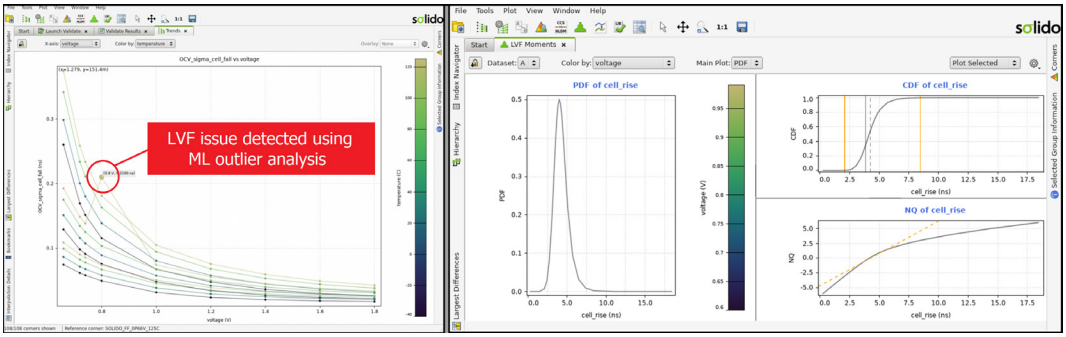
.lib Variation Modeling (LVF)

Statistical modeling in .lib Variation Format (LVF) is used for .libs at the most advanced process nodes to model on-chip variation. For 3nm and 2nm libraries, LVF values may impact overall timing characteristics by 100 percent or more.

LVF .libs contain statistical variation information per timing arc, so each data point requires Monte Carlo-equivalent analysis at 3 sigma or above. As a result, even with aggressive runtime optimization, SPICE-characterized LVF data requires 10X+ characterization runtime and 100x+ simulations compared to nominal .lib data.

LVF .libs are also more prone to errors and inaccuracies, due to approximations taken to reduce characterization runtime. Due to the statistical nature of LVF, as well as the large amount of data in .libs, verification of LVF .libs is a significant challenge that requires the correct tools to address.

Issues in LVF data, such as characterization inaccuracies leading to spikes or noisy results, cannot be identified reliably using rule-based checks. In addition, verification by checking against reference SPICE-simulated Monte Carlo results is only feasible for a small number of sampled points, and does not provide adequate coverage for production usage.



Analytics detects LVF issues across the entire .lib dataset using artificial intelligence outlier analysis, and also helps users visualize and understand LVF data using intuitive plots.

Verifying LVF .libs and accelerating LVF characterization using Solido Analytics and Generator

Solido Analytics' artificial intelligence outlier analysis detects LVF issues across the entire LVF .lib dataset in a fraction of time required by other methods, allowing users to verify entire LVF .libs within 24 hours. Solido Analytics also allows users to visualize LVF moments (standard deviation, skewness, mean shift) by displaying probability density functions, normal quantile plots and other information that helps users understand LVF moments data in an intuitive way.

Analytics detects LVF issues across the entire .lib dataset using artificial intelligence outlier analysis, and also helps users visualize and understand LVF data using intuitive plots.

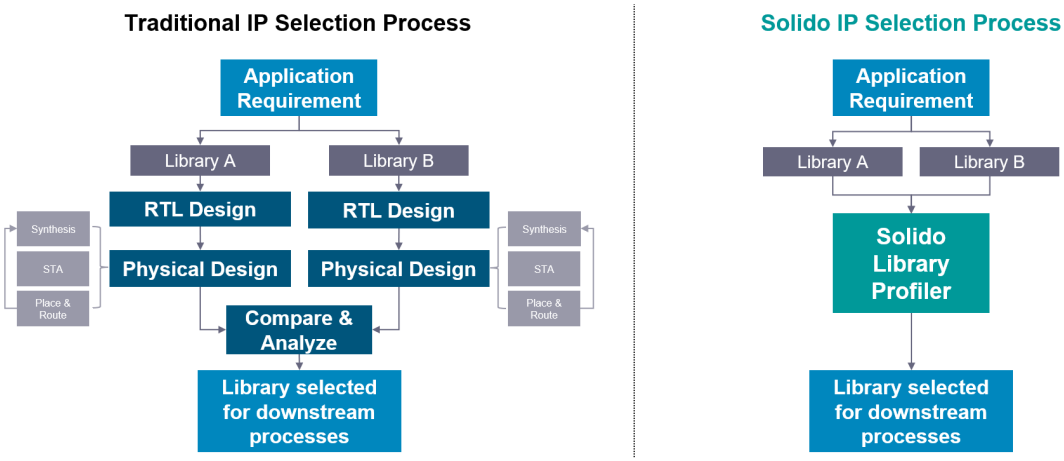
Solido Generator provides massive acceleration to characterizing LVF .libs using artificial intelligence, using SPICE-characterized anchor LVF data. Since LVF characterization runtime dominates total characterization turnaround time for advanced process node .libs, Generator enables library teams to significantly speed up characterization times.

Overall, Solido Analytics and Generator provide a comprehensive solution to accelerating library characterization schedules and verifying LVF .libs, resulting in less LVF-related silicon production issues, and faster time-to-market.

Solido Library Profiler

Solido Library Profiler is the newest tool within the Solido Characterization Suite. It is built for comparing PPA across libraries directly from the .lib file. The basis of the comparison uses intelligent apples-to-apples alignment of .lib data, regardless of the source provider or technology node.

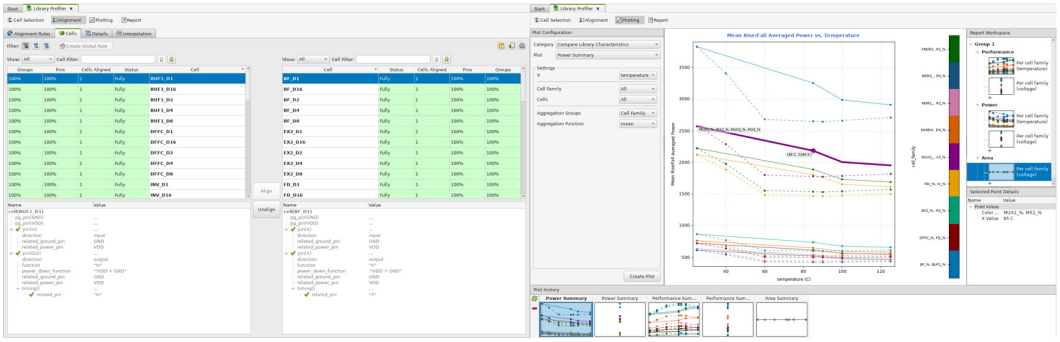
This allows IP selection teams to efficiently choose the optimal library early in the physical design flow, minimizing reference design runs through the static timing analysis (STA), place & route, and synthesis cycles. This drastically saves on engineering time, compute resources, and tool usage for all downstream development steps, eliminating the bottleneck in the IP selection process. Library Profiler includes:



Multiple iterative runs of physical design required for each library alongside comparison and analysis to select library; Right: Reduced iterations for library PPA validation and selection through Solido Library Profiler.

Solido Library Profiler - *continued*

- Smart Automatic Alignment: This technology quickly and correctly maps out the key differences across IPs from the cell level all the way down to pins and arcs. Alignment is crucial for effective and fair comparisons.
- PPA plots and tables for library comparison: Rich and customizable visualizations and tables provide the context to understand key PPA differences across IP.
- Configurable and modular reporting: Enables users to leverage the insights gained from Library Profiler and summarize effectively to broader audiences.



Solido Library Profiler is enabled with smart auto-alignment for accurate apples-to-apples comparison of libraries from different sources and built-in customizable plots for detailed analysis of PPA.

Solido Characterizer

Solido Characterizer is a high-performance, high-throughput, library characterizer to create modern .lib views for standard cells and IO. Please reach out to the Solido Characterization Suite team for additional information.

solidochar.support.disw@siemens.com

Siemens Digital Industries Software

siemens.com/software

Americas
1 800 498 5351

Europe
00 800 70002222

Asia-Pacific
001 800 03061910

For additional numbers, click here.

81742-D18 7/25 K