



DIGITAL INDUSTRIES SOFTWARE

How AI is transforming IC signoff and manufacturing

Executive summary

Artificial intelligence is transforming semiconductor design and manufacturing, but success depends on trust. Companies need AI solutions that deliver transparent, explainable results—not opaque automation. Siemens approaches AI integration with a foundation built on decades of dependability in IC signoff and manufacturing.

Open, secure and customizable AI capabilities are embedded thoughtfully across the design-to-manufacturing workflow, which compress schedules and improve yield while maintaining control over critical decisions. From AI-powered physical verification that organizes violations by root cause to machine learning that accelerates optical proximity correction by two-thirds or more, these solutions amplify engineering expertise rather than replacing it. Looking ahead, AI will evolve from a focused tool into a predictive engine spanning the entire design lifecycle, enabling teams to make data-driven decisions that balance performance, power and cost while reducing respins and compressing time to silicon.

Author: Juan Rey

Contents

How trusted AI is transforming IC signoff and manufacturing

Siemens Fuse EDA AI: Building reliable, integrated AI on a tradition of trust

Siemens' Calibre platform: Bringing AI to signoff and manufacturing

Trust is the Calibre legacy

Looking forward: AI for progress, not shortcuts

Conclusion: Putting trustworthy AI to work, from IC design to manufacturing

How trusted AI is transforming IC signoff and manufacturing

At Siemens, we approach chip design and manufacturing from a foundation built on trust. Calibre solutions are dependable and predictable, and that legacy of quality is central to everything we do. Our focus is clear: delivering reliable results for our customers and their end products.

Artificial intelligence isn't just a buzzword or an experiment for us—it's a practical tool that lets engineers and manufacturers overcome growing complexity in IC design and production. As design rules multiply and manufacturing pushes new boundaries, we keep customer needs at the center. We're committed to quality, reliability and performance—not hype.

This is where Siemens' AI approach stands out. Calibre embeds AI deeply and thoughtfully—helping engineers clear bottlenecks and accelerate progress from design through production. Tasks that used to take days are finished in hours. Engineers gain time to innovate, debug and optimize, supported by AI that connects design decisions to manufacturing outcomes.

We know our customers are asking how AI can help them achieve faster signoff, higher yield and greater confidence. Our answer: trustworthy, robust and dependable solutions that build on our tradition and make real improvements, not just automation for its own sake.

Siemens Fuse EDA AI: Building reliable, integrated AI on a tradition of trust

Our Fuse EDA AI system was created to extend the legacy of dependability that Calibre is known for. Where others may bolt AI onto isolated tools, Siemens takes a different approach. Fuse EDA integrates AI, data and reasoning agents across our entire EDA portfolio, reinforcing our longstanding commitment to quality and transparency.

We don't add intelligence as an afterthought. Fuse was architected for the unique demands of chip design and manufacturing, providing clear data governance and strong IP protection every step of the way. This means customers maintain total control over how and where AI is applied—no surprises, no opaque automation.

Figure 1 illustrates how the Fuse EDA architecture connects in-tool assistants, rich documentation, and engineer-in-the-loop workflows, providing transparency and control as artificial intelligence is woven directly into the design and manufacturing process. Human expertise stays in the loop, ensuring that every improvement is practical, reliable, and explainable.

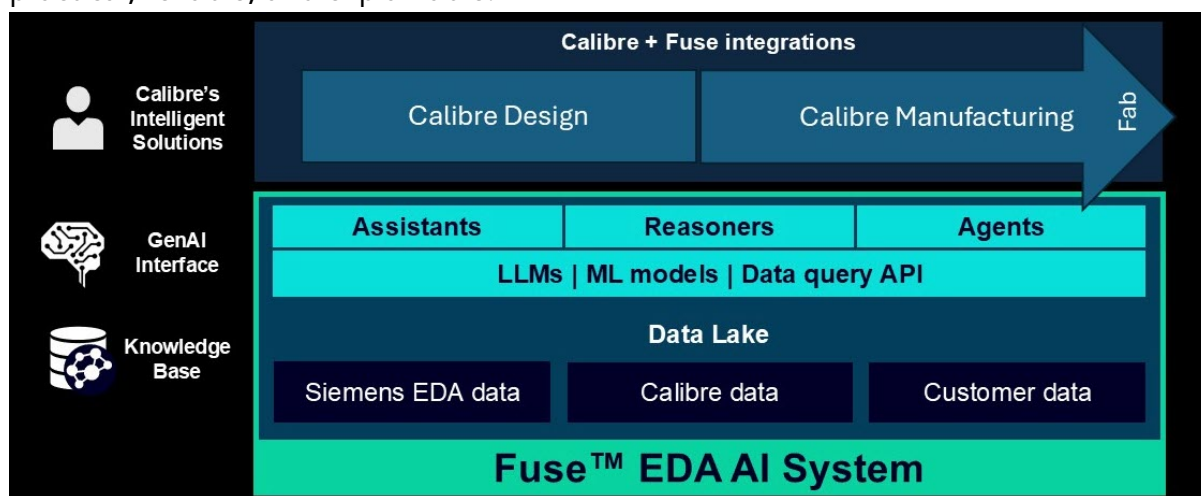


Figure 1. Fuse EDA AI links Siemens tools for integrated design-to-manufacturing AI.

Key principles built into Fuse:

- Open and secure for every customer
- Scalable from design through manufacturing
- Designed for transparency, so engineering know-how is always preserved

We focus on practical outcomes, holding our AI features to the same standard as every Calibre solution: they must deliver concrete, reliable improvements in productivity, accuracy and throughput.

Siemens' Calibre platform: Bringing AI to signoff and manufacturing

In today's changing EDA landscape, we remain focused on transparent automation that serves both design and manufacturing. Here's how Calibre AI is advancing every stage of the IC lifecycle.

Faster IC signoff. Built with Calibre

Calibre's strength in physical and electrical signoff comes from deterministic engines designed for accuracy, consistency and process compliance. Foundries and design houses know you can trust results that are built with Calibre.

Around this foundation, we integrate AI thoughtfully. With the Fuse EDA AI platform, Calibre delivers practical AI-driven features that help engineers accomplish more, with less effort. For example, our AI-based DRC debug tool—Calibre Vision AI—takes enormous volumes of violations and organizes them into targeted groups tied directly to real root causes. No need for complicated setup or expert retraining. This process makes verification faster and gives engineers precise insights exactly when they're needed. Figure 2 describes Calibre Vision AI's key values.



Figure 2. The Calibre Vision AI tool speeds up full-chip physical verification with intuitive navigation, intelligent error clustering, and collaborative results sharing—making debug and signoff faster for everyone involved.

Calibre’s AI-powered analytics help teams get the most from their resources. Real-time job setup and compute allocation mean hardware is used more efficiently. Engineers get actionable advice for configuring verification runs—reducing both trial-and-error and reliance on specialized knowledge. At every step, the system is transparent, with engineers retaining full control, supported by intelligent automation.

Collaboration becomes easier, too. By mirroring familiar collaborative workflows, Calibre tools let teams share debug context, assign issues and align on resolutions—no matter where they’re located. This preserves institutional knowledge and keeps everyone moving forward efficiently as teams and projects scale.

We believe AI should empower engineers and teams. It’s never about replacing their insight or making critical flows hard to understand. Calibre combines deterministic engines with actionable, explainable AI, so customers achieve both speed and certainty in signoff—always with confidence.

Speed, precision and fab management in next-generation IC manufacturing

Manufacturing complexity keeps rising as advanced nodes and EUV push the boundaries of silicon. Every phase after tapeout—and every fab management step—needs more speed, precision and dependability. Calibre Manufacturing is trusted by foundries and partners worldwide because we stay focused on practical integration of artificial intelligence and machine learning, always backed by our legacy of quality. Figure 3 describes our machine learning foundation infrastructure for layout analysis.

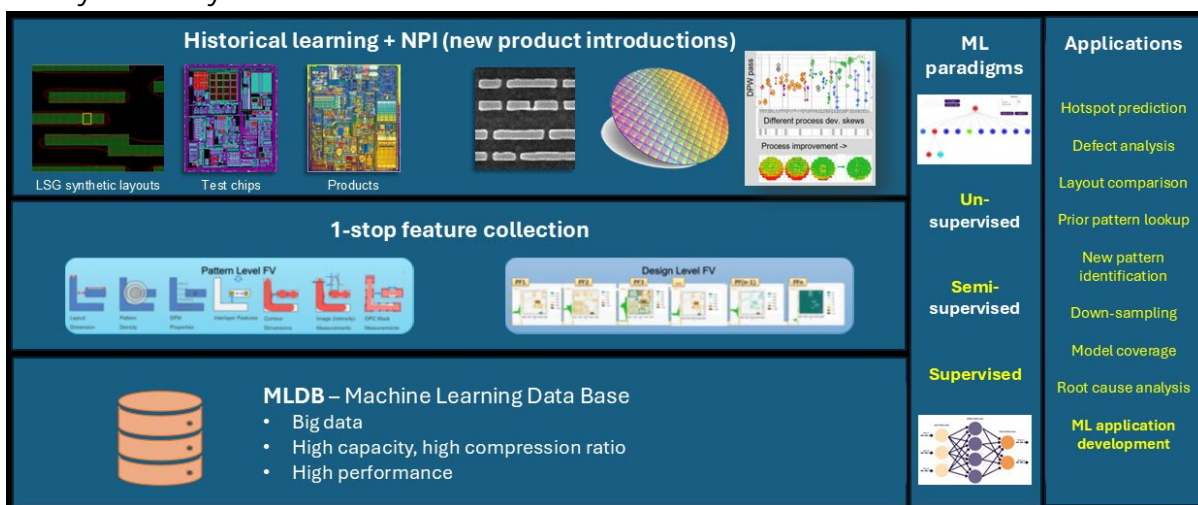


Figure 3. The foundation infrastructure for Calibre's post-tapeout applications.

Calibre deploys multiple machine learning approaches across the manufacturing workflow. Supervised learning models enable hotspot prediction, root cause analysis and defect classification with high accuracy. Semi-supervised techniques identify new pattern variations while reducing data labeling overhead. Unsupervised learning accelerates layout comparison without requiring extensive training datasets. This forms part of a comprehensive manufacturing digital twin, enabling virtual prototyping and development of new processes, including detailed equipment characterization.

AI/ML transforms optical proximity correction (OPC). Our neural network–assisted models raise accuracy, keep performance high, and cut OPC runtimes dramatically, for both Manhattan and curvilinear mask shapes. Calibre uses AI to accelerate OPC and reticle enhancement, achieving speed improvements by two-thirds or more and helping customers ramp to volume faster and with greater reliability.

In inverse lithography, Calibre achieves speed and precision that set a new standard. Monotonic machine learning lets teams optimize ILT hundreds of times faster, all while maintaining industry-leading accuracy.

In addition to completing modeling and verification faster, yield is protected at every stage and ramping new nodes feels far more manageable. It's not just about speed—it's about dependability. Calibre's AI and ML innovations help our partners move confidently from layout to manufacturing, with tools that are transparent, reliable, and always engineered to meet real-world needs.

Trust is the Calibre legacy

Calibre has earned its place as the leading signoff tool for semiconductors because it delivers, year after year, across every major foundry and process node. Our reputation isn't built on big promises—it's built on consistent results, rigorous engineering, and steady, reliable partnership with both foundries and design teams. What keeps Calibre on top is simple: customers trust every result Calibre produces.

Our engineering approach is all about helping designers achieve more—identifying issues earlier, streamlining flows and cutting the time from concept to silicon. It's about making sure engineering teams are effective at every step.

Looking forward: AI for progress, not shortcuts

Artificial intelligence is reshaping EDA, but our commitment doesn't waver. For Calibre, trust, explainability, and practical value always come first. Through the Fuse platform and open collaboration with customers, we make sure our AI solutions empower engineers and amplify their expertise – never just automation for the sake of automation. We partner with you on each new challenge, always aiming to improve and fulfill your silicon ambitions.

In the short term, AI will mature as a focused tool for high-value tasks like power analysis, thermal prediction, yield forecasting and design-rule checking. Where the data is robust, we train and validate rigorously. The industry is moving toward real standards for transparency and auditability, and customers—especially in regulated sectors like automotive and aerospace—will demand defensible, provable AI-driven results.

Looking further ahead, AI will become a predictive engine for the entire design lifecycle—from RTL synthesis through manufacturing. Imagine submitting your design concept and getting back clear, quantified roadmaps: “This topology has a 94% chance of meeting timing at 3 nm with standard cell X, 87% with cell Y. Yield is forecasted at 78%, highest risk in region Z.”

This vision requires more than isolated point tools—it needs an interconnected intelligence layer running across the whole flow. And it means our standards for trust go even higher: predictions like, for example, a 94% forecast should actually succeed 94% of the time. Uncertainty must be quantified and every number needs to stand up to scrutiny.

The business impact is profound: design teams compress schedules from months to weeks, reduce respins from 2–3 to 0–1, and make real, data-driven calls balancing performance, power and cost. Manufacturers will see yield gains through earlier, smarter intervention and constant learning on the fab floor.

Conclusion: Putting trustworthy AI to work, from IC design to manufacturing

With Calibre's AI solutions, chip designers and manufacturing teams get the best of both worlds: the rigor of core deterministic engines and the power of modern AI, all in a system that puts transparency and partnership first. Whether you're launching a new flagship SoC or boosting yield on a bleeding edge or legacy node, we're here with trusted tools and technology, relied on by foundries and manufacturers worldwide.

Contact Siemens to learn more about how Calibre can transform your signoff process with unmatched speed, confidence and innovation.

Siemens Digital Industries Software

Contact

Americas (USA)

1-800-498-5351

EMEA (United Kingdom)

0800-279-0464

APAC (India)

1-800-202-6796

For additional numbers, [click here](#).

About us

Siemens Digital Industries Software helps organizations of all sizes digitally transform using software, hardware and services from the Siemens Xcelerator business platform. Siemens' software and the comprehensive Digital Twin enable companies to optimize their design, engineering and manufacturing processes to turn today's ideas into the sustainable products of the future. From chips to entire systems, from product to process, across all industries. [Siemens Digital Industries Software](#) – Accelerating transformation.

About the author

Juan Rey

Juan C. Rey is Sr. Vice President, Segment Leader/General Manager for Siemens EDA. He previously led the Central Engineering Solutions Team as part of a government program focused on 3D flows. Juan served as Vice President of Calibre Engineering from 2001 to 2021. Juan holds a degree in Nuclear Engineering from Universidad Nacional de Cuyo, Argentina. The author or co-author of numerous papers and conference presentations, he serves on the Executive Technology Advisory Board of Semiconductor Research Corporation (SRC) and the UCLA Center for Domain-Specific Computing.