

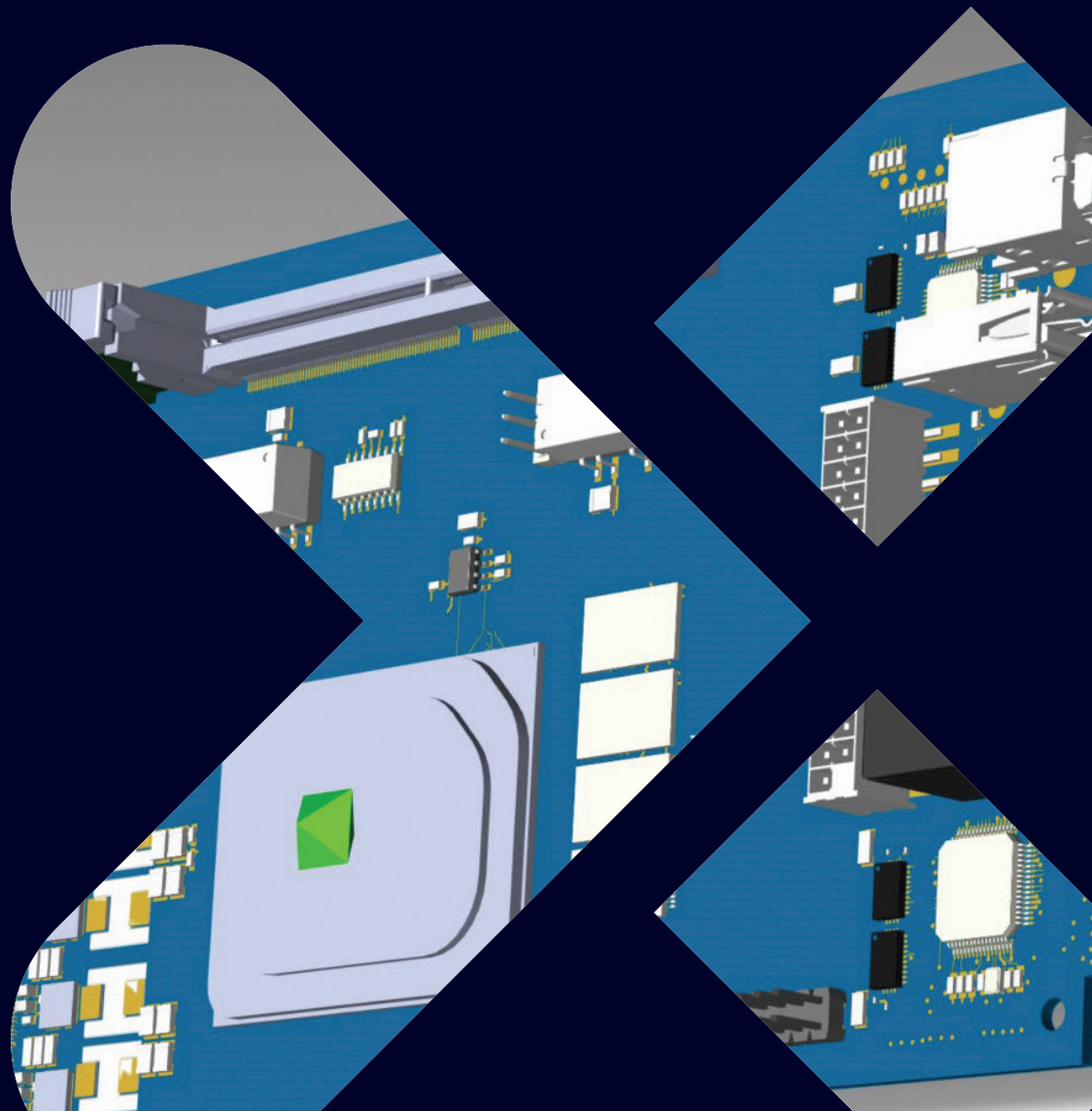
SIEMENS

DIGITAL INDUSTRIES SOFTWARE

Xpedition

Equipping enterprise engineering teams to handle complexities in electronics systems design

[siemens.com/pcb](https://www.siemens.com/pcb)



Announcing next-generation electronic systems design

The next generation of Xpedition introduces an industry-leading intuitive modern user experience, creating an adaptive and agile environment that enhances user productivity and accelerates the design process.

Intuitive

The full Xpedition portfolio offers the latest modern-UX principles, which include personalized user interfaces and command search engines.

AI-infused

Artificial intelligence-enabled design boosts productivity, bridging capacity gaps within development teams and enabling them to tackle complex challenges effectively.

Cloud connected

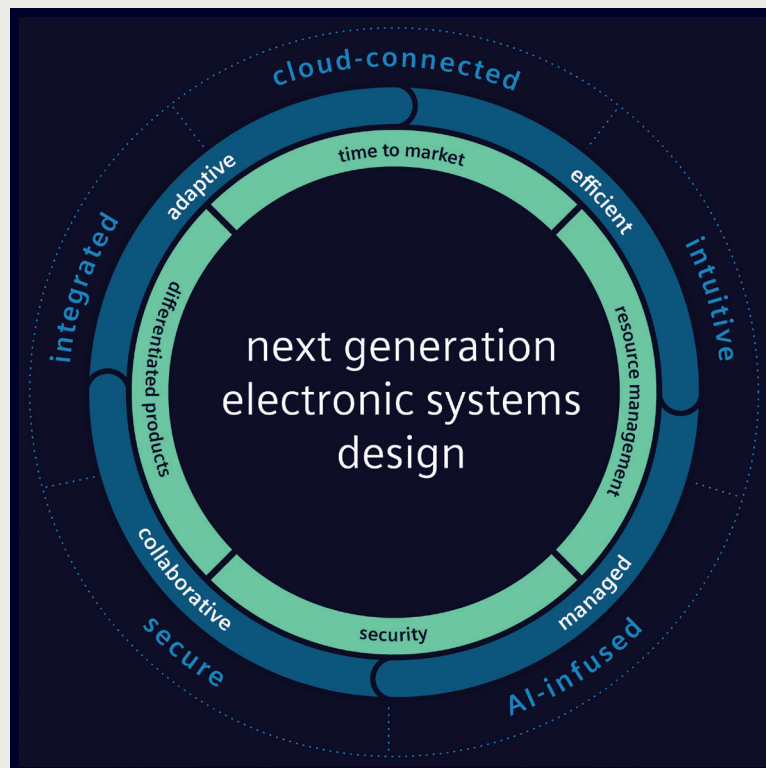
Facilitating collaboration across the entire ecosystem, from component selection to manufacturing, the Xpedition portfolio's cloud-connected environment ensures seamless communication and coordination.

Integrated

Xpedition supports the digital transformation of electronics system design by integrating digital threads across multiple domains, providing a comprehensive view of the entire design process.

Secure

Recognizing the importance of compliance with commerce and government regulations, Xpedition offers managed access within a secure environment, ensuring the protection of sensitive information.



Introduction

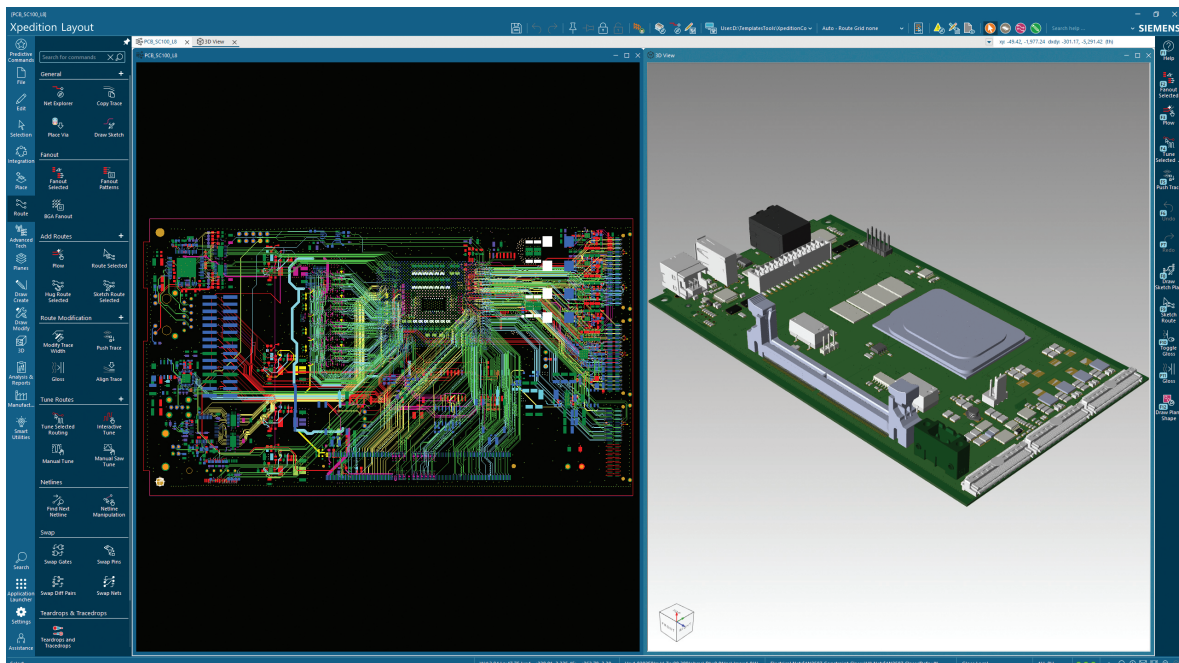
In today's electronic systems, complexity has reached unprecedented levels, challenging currently siloed and isolated design teams to work together transparently in order to deliver increasingly intricate products within tight timelines.

The complexities of modern printed circuit board (PCB) design necessitate a comprehensive approach that integrates various aspects of the entire design through manufacturing flow. The ideal design flow requires seamless cooperation and synergy across various domains, including electrical, mechanical, software, systems, test, and manufacturing.

Indeed, to circumvent the inherent inefficiencies of working across disparate teams, processes, and technologies, full collaboration across all of these domains is essential and top-tier, electronic systems design solutions are required.

As part of the Siemens Xcelerator portfolio, the Siemens Xpedition™ flow – including Xpedition, HyperLynx™, and Valor™ technologies – enables companies to effectively address increasing complexity across the entire electronics systems design ecosystem.

Xpedition provides a ground-breaking environment for PCB and other engineers to achieve the concurrency needed to develop today and tomorrow's complex multi-board systems and the mechanical enclosures within which they must function flawlessly. Xpedition's system design environment deploys a unique work-in-progress design data management hub, extending it to full systems design, including multi-board system definition, partitioning, optimization and implementation. This allows designers to catch errors before any hardware is constructed.



Leverage Xpedition's modern UX to optimize engineering efficiency.

The Five Pillars of PCB Design

The Xpedition flow clears the hurdles of modern-day product, process, organizational, and supply chain complexity by supporting five best practices in PCB design.

Digital integration and optimization

Engineering productivity and efficiency

Digital prototype-driven verification

Model-based systems engineering

Supply chain resilience

These five pillars of electronic systems design provide a roadmap for companies to navigate complexity through the digital transformation of their entire workflow. By implementing these five best practices pillars, companies can optimize their processes, improve team collaboration, reduce design time, lower engineering costs, and increase the reliability and quality of designs.

Pillar 1: Digital integration and optimization

A digitally integrated and optimized multi-domain environment enables efficient, secure, concurrent design across all engineering teams.

ECAD/MCAD co-design

Xpedition establishes the ongoing, relevant communication required for effective and seamless cross-domain collaboration. Electrical and mechanical design teams need to know what changed, when, and why – in real time.

Collaboration with MCAD systems

Xpedition enables digital PCB design teams to communicate design data to mechanical CAD systems, and vice versa, using a ProSTEP-approved data exchange standard. Both electrical and mechanical engineers can communicate within and between their respective disciplines at any time or frequency, thus participants can stay in their respective comfort zone – there is no need to learn new tools. The integration between Xpedition and NX has been optimized to include 3D model sharing, design intent, additional copper data, and improved rigid/flex support.

3D visualization

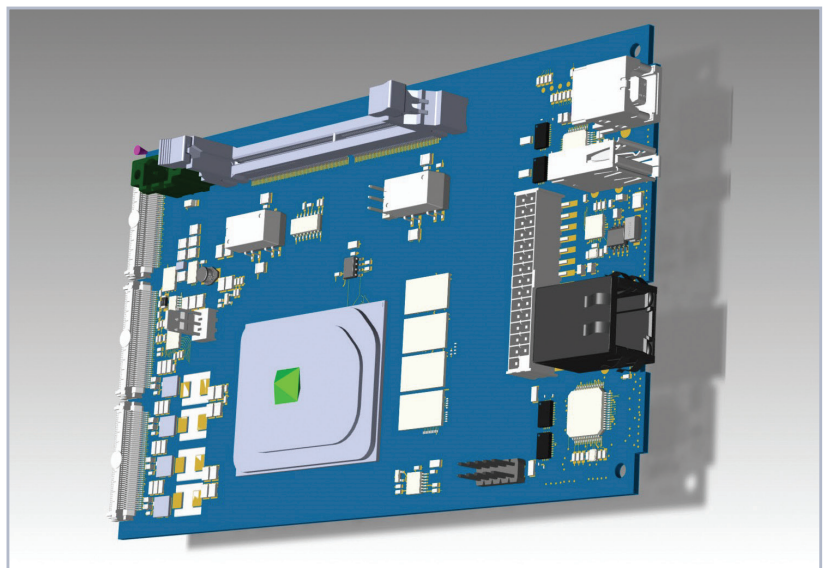
Visualization of the PCB and its enclosure within the Xpedition layout environment allows designers to optimize the layout based on mechanical and manufacturability constraints.

Preview proposed changes

To clearly identify a proposed design change, designers highlight the proposed ECAD/MCAD collaboration object within Xpedition's 3D viewer before applying the modification in their design.

Cloud-enabled remote collaboration

Xpedition cloud-based applications allow designers to share design data and other files with colleagues and remote stakeholders in a secure cloud workspace. Powerful viewers make it easy to visualize and markup files and engineering models to keep extended teams aligned.



Visualize in 3D and check clearances to other boards and enclosures.

Design and manufacturing collaboration

Technical queries have ripple effects on manufacturability in terms of time and cost. Xpedition allows users to avoid most manufacturing issues without leaving their design tool or halting the design process.

Automated concurrent DFM analysis

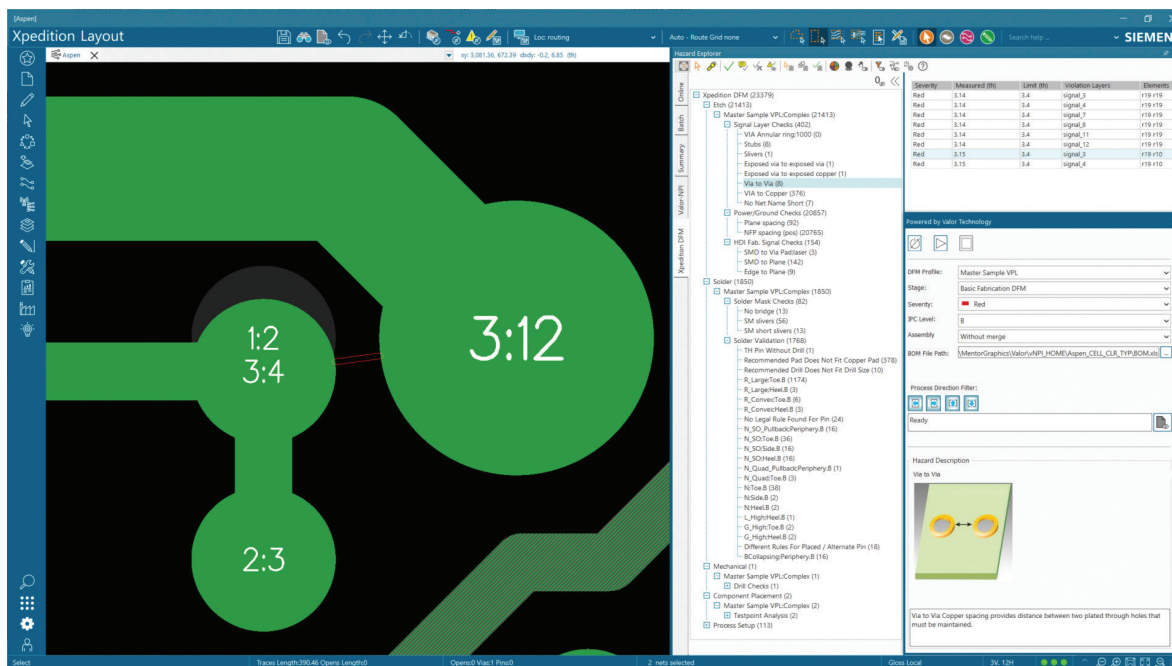
High-quality DFM analysis is based on a combination of PCB technologies and manufacturing constraints. By allowing DFM software to act on each of these constraints automatically, the Xpedition portfolio saves engineering effort and delivers the desired results consistently for every user, regardless of their manufacturing expertise.

DFM analysis for flexible and rigid-flex circuits

Xpedition DFM analysis technology helps electronics companies select and correctly implement the different materials and manufacturing processes required for flex and rigid-flex circuits.

Accurate and validated data for PCB fabrication

Xpedition supports the intelligent data formats, such as ODB++ and IPC-2581, that facilitate intelligent communication from engineering to manufacturing, minimizing errors and providing a continuous feedback loop of information from manufacturing back to design.



Review and fix DFM errors within one environment.

Library and design data management

Libraries are the foundation of PCB design. Xpedition users have access to a dynamic, central library that provides everyone involved with better visibility into what's going on at any given time.

Centralized environment for managing PCB design data

Xpedition offers a fully integrated PCB design data management infrastructure, from initial system definition through the design process, to release, to manufacturing. This improves individual and team design with enhanced security, consistency, metric collection, and process control.

Increased overall team productivity

Xpedition allows companies to control access of project team members to both design and design status information.

Reuse existing IP in the form of components and certified circuits for new products

Xpedition provides access to a library of certified circuits, allowing new product development teams to leverage past successes in their latest generation of products.

Direct access to comprehensive part intelligence

Through integrated parametric information and real-time component sourcing for parts at the point of design, Xpedition provides actionable insights at every stage of the design process and synchronization with both part request workflows and PLM systems.

PLM integration

Xpedition is integrated with all major PLM systems, enabling library and design synchronization and multi-domain collaboration across the enterprise. Integration between Xpedition and Teamcenter allows design team members to leverage single sign-on to streamline user authentication processes, provides seamless access to enterprise/PLM use cases in the WIP environment, and implements Teamcenter workflow controls into the WIP environment to seamlessly manage data locking and ECO processes.



Secure remote collaboration

Teams spread over different geographic locations need a platform for effective collaboration – without compromising data security. Xpedition supports remote teamwork through its robust, secure cloud-based services and enterprise solutions.

Efficient design reviews

Xpedition's integrated collaboration panel centralizes all processes and manages the status of design review feedback. It also supports the option for internal and external stakeholders, such as design teams and third-party design services, to share and view joint data.

Robust project notifications

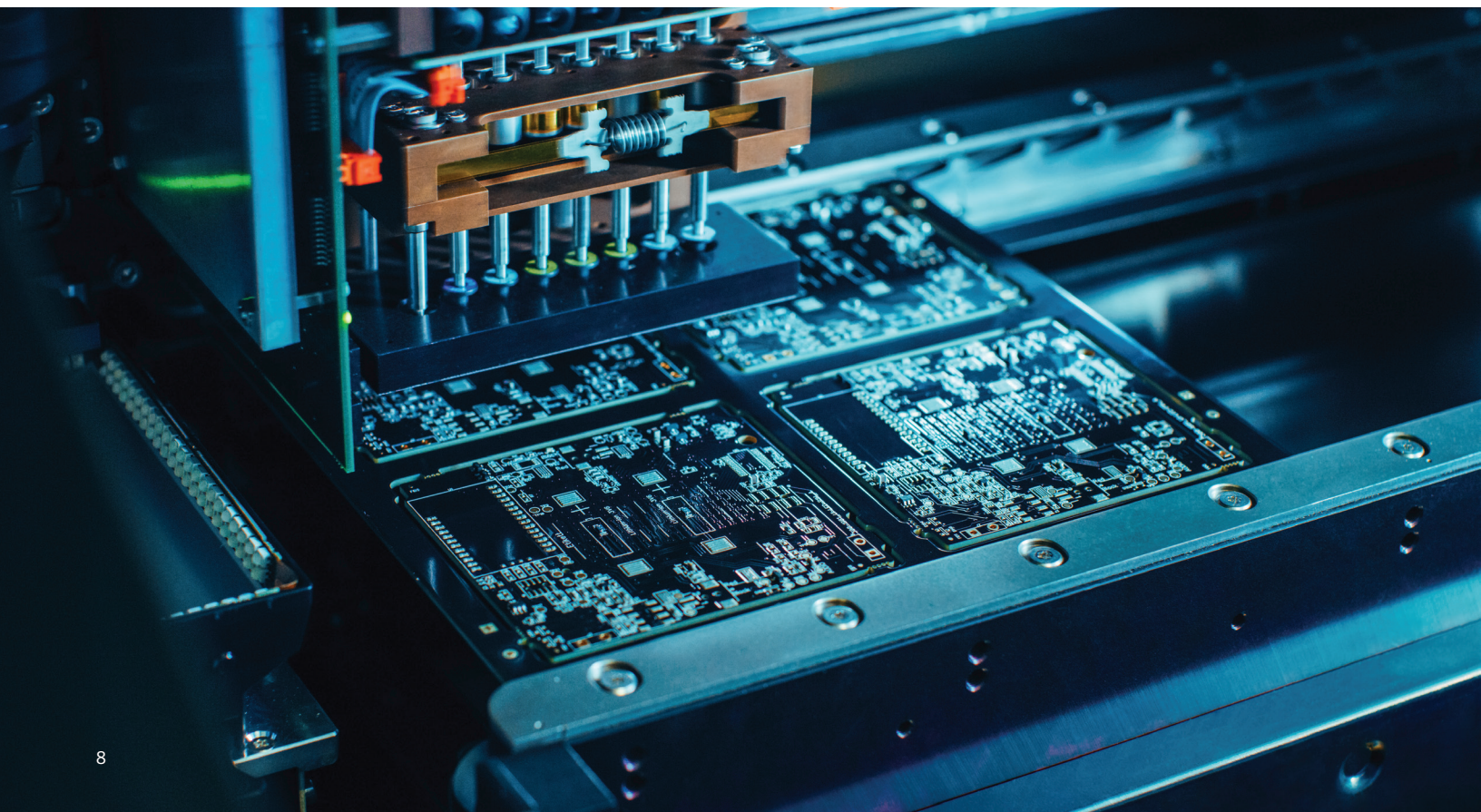
Adding comments to collaboration data provides much needed context. Teams can stay aligned by using notifications for comments, via tool-integrated email, or through a centralized notification panel to keep the whole team up to date.

Bill-of-materials view

Including bill-of-materials (BOM) data in the Xpedition collaboration platforms improves visibility for all stakeholders. It even allows companies to integrate BOMs with a component search engine, enabling early identification of component sourcing issues.

Security-driven collaboration process

Xpedition supports rigorous enforcement of international security standards when using cloud-hosted applications. It imposes a meticulous security process that requires admins to assign users with a license and a role, as well as access to specific projects, ensuring controlled, secured collaboration.



Pillar 2: Engineering productivity and efficiency

Optimize engineering productivity and efficiency to reduce design cycle time, reduce cost and lower risks.

Design automation

By automating repetitive tasks, Xpedition streamlines the PCB design workflow, leading to faster execution, fewer errors, increased efficiency, and more time to explore design alternatives and configurations.

Connectivity planning and PCB routing

Xpedition automatically unravels complicated net paths and pin escapes to minimize net lengths and quickly identify the best routing strategies.

Auto-assisted interactive sketch routing

Xpedition's sketch routing technology provides integrated automated PCB routing functionalities with intuitive user control, high quality, and exceptional performance. "What-if" scenarios can be explored and changes absorbed more easily.

Hierarchical placement planning and management

Xpedition gives designers the insight to quickly visualize and implement design intent for optimal component placement and to easily make PCB real-estate assessments, i.e., area studies.

True parametric 3D

Xpedition is built around a true parametric 3D mechanical kernel, with 3D constraints, dynamic collision detection, and batch verification. Dynamic validation of electro-mechanical designs delivers error-free results.

Mechanical component import

Xpedition allows users to easily import all physical constraints and mechanical components such as chassis or heatsinks, along with critical items and components along with their locations. Or for true multi-board capability, designers can import sub-assemblies from other PCB designs.

Analog/digital/RF co-design

Xpedition enables RF, analog, and digital circuits to be placed on the same PCB – eliminating the traditional “black box” approach to RF design and making siloed projects obsolete.

Streamline RF tool integration

Dynamic integration between the PCB design tool and industry RF tools eliminates manual data transfers. The Xpedition library is synchronized with the circuit-simulation model counterpart in the RF simulation environment to ensure that their behavior is identical.

Accelerate design time

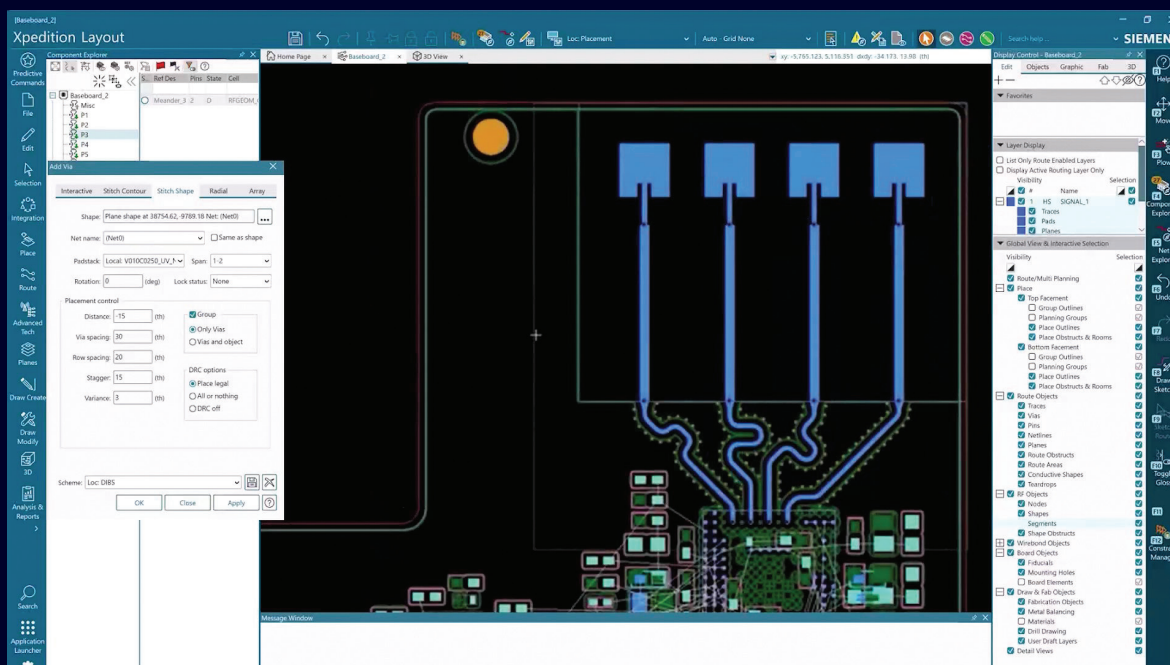
Xpedition gives designers the ability to edit RF elements within PCB layouts. Combined with efficient RF tool integration, this eliminates workarounds and increases engineering productivity.

Optimize RF circuits in context

Xpedition allows parametric RF elements to be modified within the Xpedition layout tool to optimize layout space efficiency and easily incorporate “what-if” scenarios.

Reuse verified RF circuits in other designs

With robust design reuse capabilities, teams can manage and share known-good circuits that are already approved and released, eliminating redundant design efforts.



RF circuits can be co-designed in context with analog and digital circuitry.

Concurrent design

Instead of waiting for one user to finish their work and then handing it off to another in serial fashion, Xpedition allows teams to carry out tasks concurrently in parallel, supporting optimization and encouraging team collaboration.

Schematic design

Multiple engineers can simultaneously design the same schematic. All edits appear dynamically to all concurrent users.

Constraint management

Xpedition allows engineers to work concurrently with other users who are editing the same constraint set, whether on the front-end or back-end.

PCB layout

Teams of layout designers can edit the same printed circuit board and work in a collaborative manner. There is no need to partition and reassemble layouts.

Concurrent verification

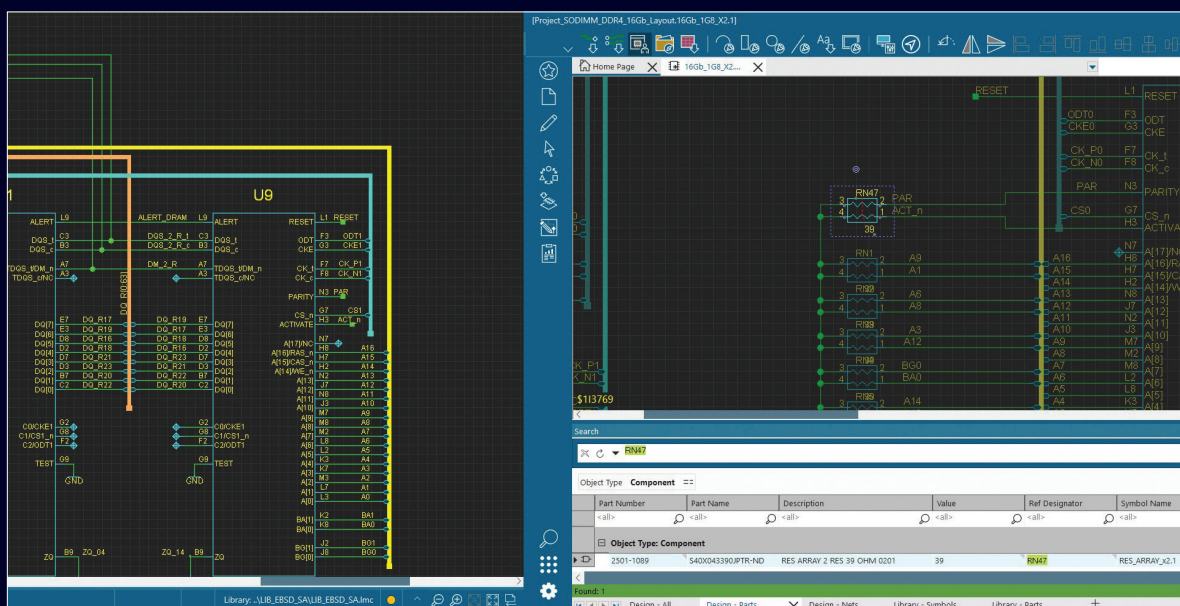
With Xpedition, engineering teams can virtually prototype a design in-process with concurrent verification of performance and manufacturability.

System design concurrency

Xpedition supports full design concurrency, so teams can define a multi-board system and the individual associated boards while the system definition is still in process.

Simultaneous review and collaboration

Xpedition allows controlling the edit mode for design reviews so that only one engineer can make edits while others can only view the design.



Two designers can work concurrently in the schematic.

Design reuse

Reusing existing, known-good circuitry and proven layouts is facilitated by Xpedition's library and data management infrastructures. Xpedition enables engineers to design entire systems much faster, eliminate repeated effort, increase quality, and minimize project risks.

Reduce cost and improve PCB design quality

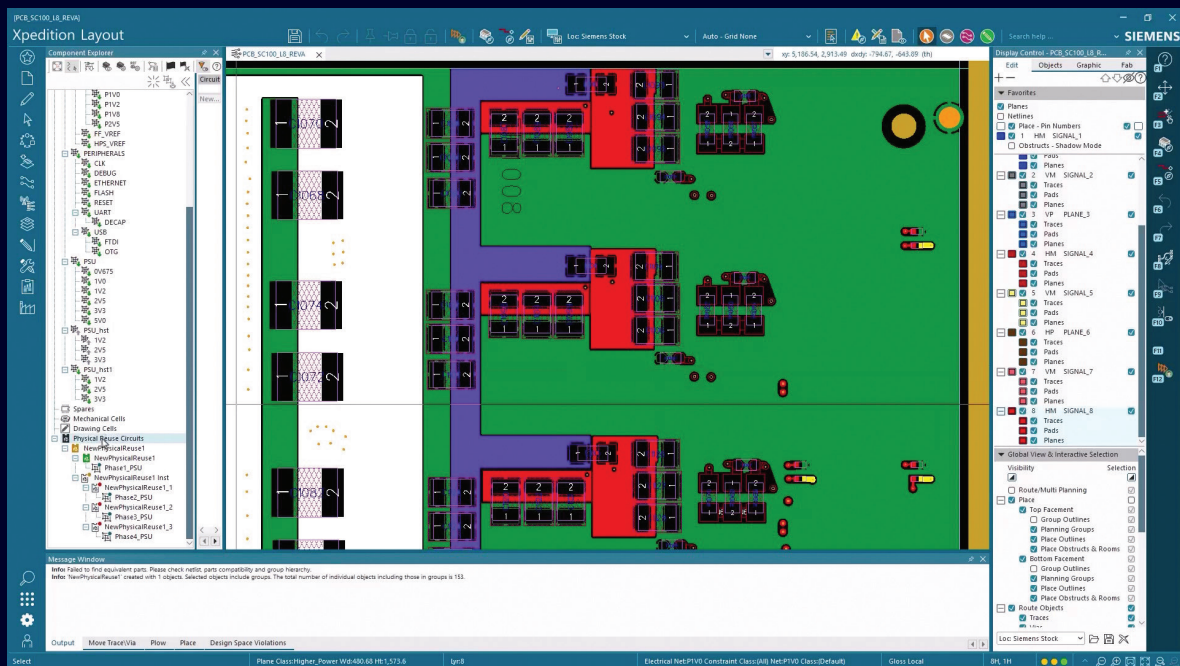
Once circuits and their respective layouts are validated, approved, and released, they can be saved in a master library as critical IP blocks. Then these IP blocks can be reused over and over again in new PCB design projects. This reduces engineering efforts and improves the quality of future PCB designs.

Increase collaboration and efficiency

Concurrent design is proven to be faster and more efficient, especially when it comes to multidomain and multidiscipline integration and collaboration.

Reuse proven logical and physical elements

Design teams can quickly build new products by publishing reusable logical and physical IP directly and then sharing this IP with others. Design reuse not only improves design cycles time, but also increases the potential that a design will function exactly as expected the first time.



Constraint-driven design

The ability to use design rules up front ensures PCB designs are correct-by-construction. Xpedition gives designers the controls to create design constraint templates and implement them, increasing the potential for consistent success.

Easy constraint entry

Xpedition offers constraint entry for a design in an easy-to-use spreadsheet-like GUI, which allows bidirectional cross-probing between schematic and layout applications.

Built-in automation

Xpedition's automation technology simplifies manual tasks such as identifying and assigning differential pairs.

Constraint reuse

Xpedition supports importing customizable constraint templates and modifying them with whatever new design constraint or requirements are necessary for a new design.

Design reviews and validation

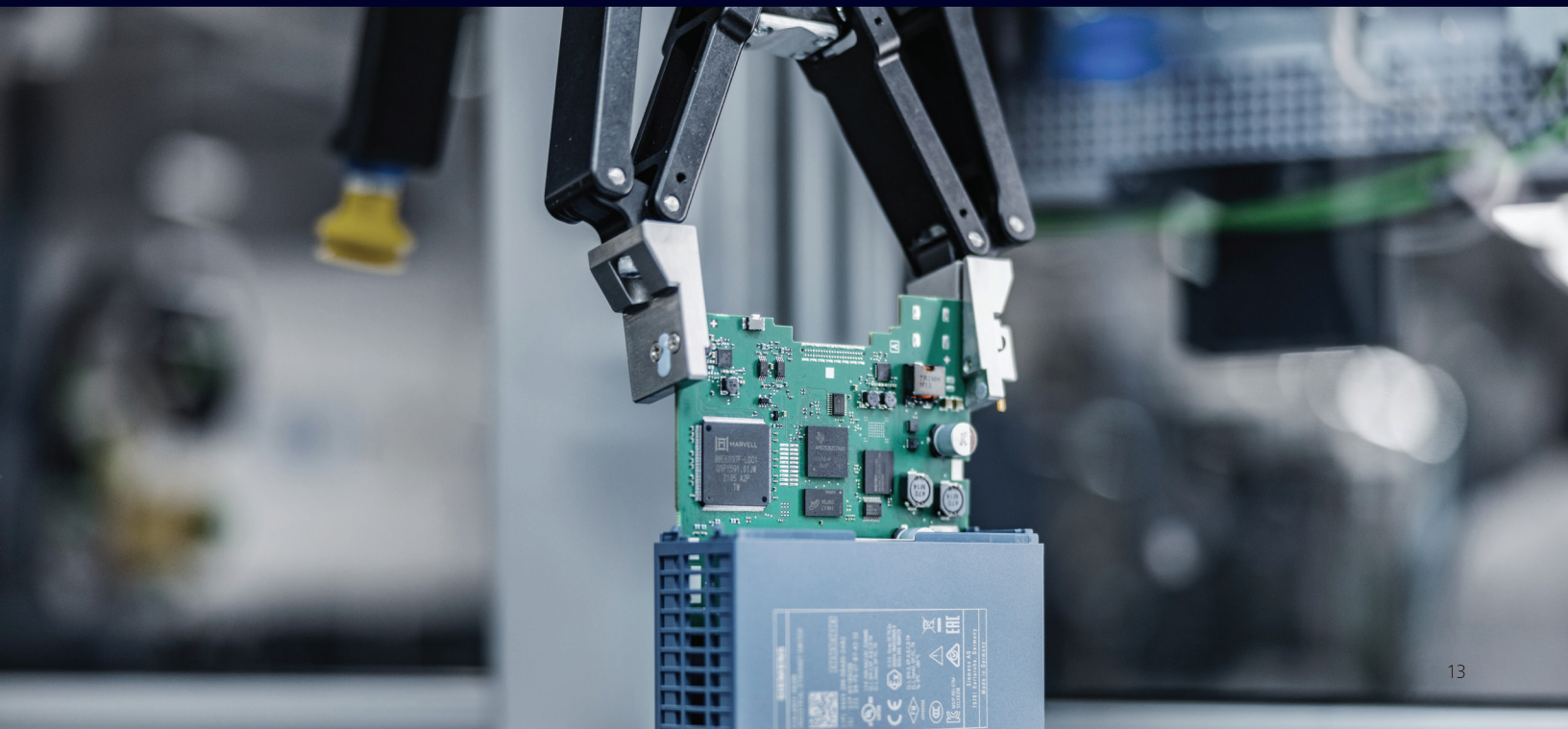
Utilizing constraints allows easier design reviews, making it easier to prove that design intent meets design requirements and secure customer satisfaction by validating the quality of the end-product.

Target length display

Designers can make sure that they stay within design parameters, such as minimum and maximum lengths and tolerance, when tuning nets.

Tool automation in layout

Xpedition enables automation of layout functions, such as creating/editing constraints, assigning net/constraint classes, tuning signal routing and traces, and checking design rules. This level of automation is a game changer when implementing a constraint-driven approach to PCB design.



Designing for advanced manufacturing technologies

Xpedition advanced manufacturing technologies accelerate time-to-market.

Rigid-flex PCB design

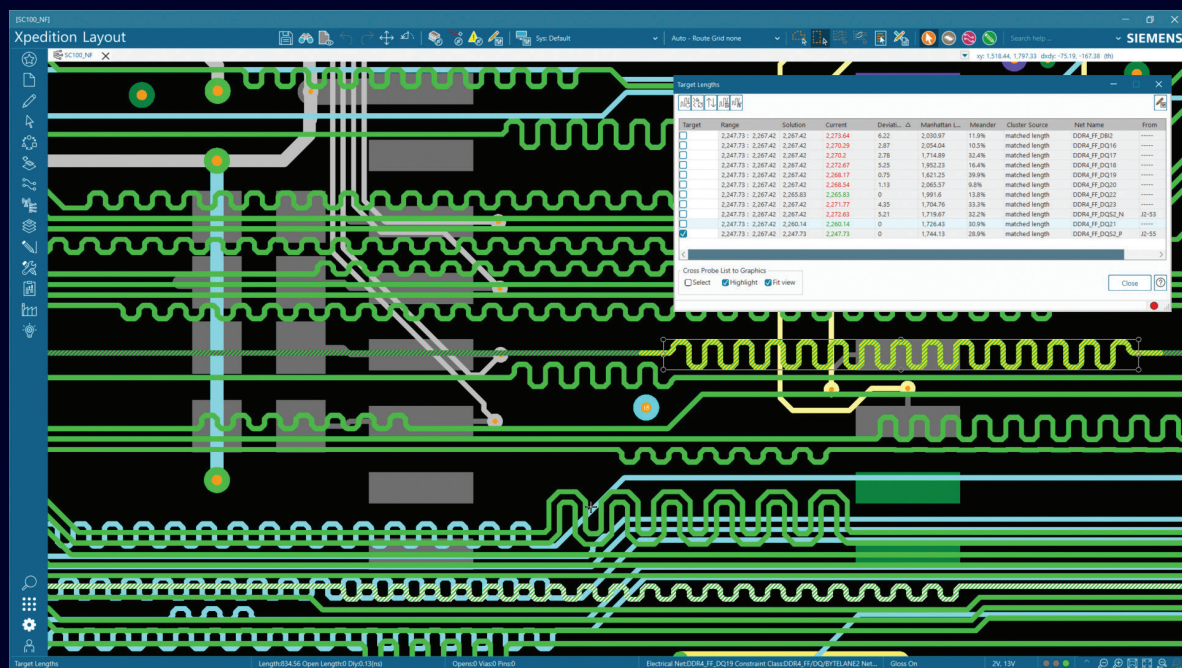
Xpedition ensures first-pass success with a design process that factors in the unique challenges of rigid-flex PCB design. This includes multiple unique stack-ups, PCB bend-areas, region rules, and design visualization – all in an integrated 2D/3D environment.

High-density interconnect

Many I/Os in a small area make it nearly impossible to route to the inner balls with normal PCB fabrication technology. Xpedition supports advanced via structures to route the most complex high-density interconnects.

Embedded actives and passives

Xpedition enables embedding of active (IC) and passive devices to achieve the highest densities and performance. These components are placed in cavities inside the PCB and are embedded within the PCB stackup.



Constraint-driven high-speed digital design using Xpedition.

Pillar 3: Digital prototype-driven design verification

A shift-left design methodology integrates design verification tools throughout the PCB design process to assist designers in finding and fixing errors where and when they happen, instead of waiting until later.

The integration of Xpedition with the HyperLynx, Valor, and Simcenter solutions for analysis and verification supports a shift-left approach to schematic analysis, thermal analysis, signal integrity, power integrity, and manufacturability.

Schematic analysis

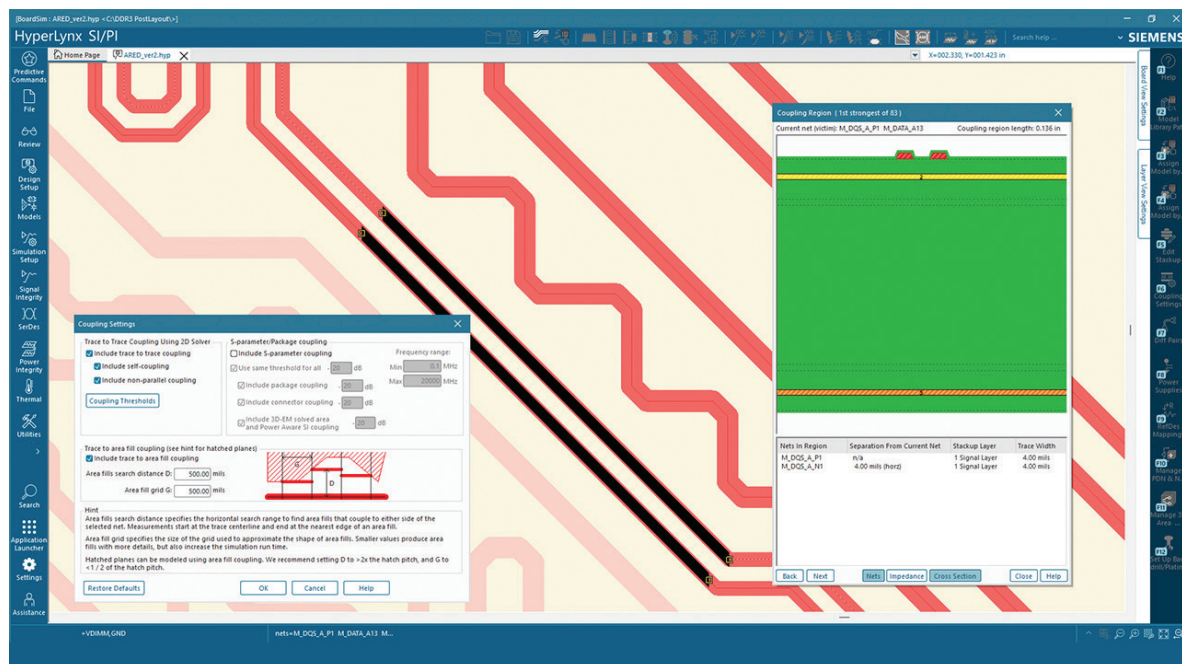
Fully inspect all circuitry and nets on a schematic using an extensive, intelligent model component library and perform schematic parametric analysis in parallel with design capture.

Signal integrity analysis

Explore signal integrity issues early in the design cycle to make key design decisions when options are easier to compare and implement.

Thermal analysis

Employ 3D computational fluid dynamics software to predict airflow and heat transfer in and around ICs, packages, boards, and electronic systems.



Explore signal integrity issues using HyperLynx SI.

Power integrity analysis

Accurately model power distribution networks and noise propagation mechanisms, during both pre- and post-layout phases of the PCB design process.

Analog mixed-signal analysis

Model analog and mixed signals, extending beyond basic SPICE-based circuit analysis to leverage industry advances in PCB modeling and simulation, accelerating circuit development and speeding verification.

Manufacturability

Run a set of automated checks to validate a design against fabricator and assembler capabilities and execute concurrent DFM checks from release to manufacturing.

Test analysis

Monitor testability considerations and calculate test point requirements as well as testability coverage from within the Xpedition environment.

Electrical rule checks

Identify design violations that lead to signal integrity, power integrity and EMI/EMC issues, eliminating manual inspection and bottlenecks.



Pillar 4: Model-based systems engineering

A digital twin allows teams to perform simulations early, enabling trade-off analysis and optimized system integration.

Multi-board systems design

Xpedition replaces inefficient paper and manual processes with an automated, fully-integrated, and collaborative workflow for electronic multi-board systems.

Systems design definition

Project architects can define the hardware description at the logical system level down to the logical/PCB level, including the logical definition of wires, cables and backplanes.

Built-in automation

Xpedition enables users to visualize and implement the system engineer's design intent to create optimal location of functionality and interconnectivity across the system.

System modeling

Virtually prototype multi-board systems for mechatronic behavior, signal, power, and thermal performance, and manufacturability within the Xpedition tool set.

System design reuse

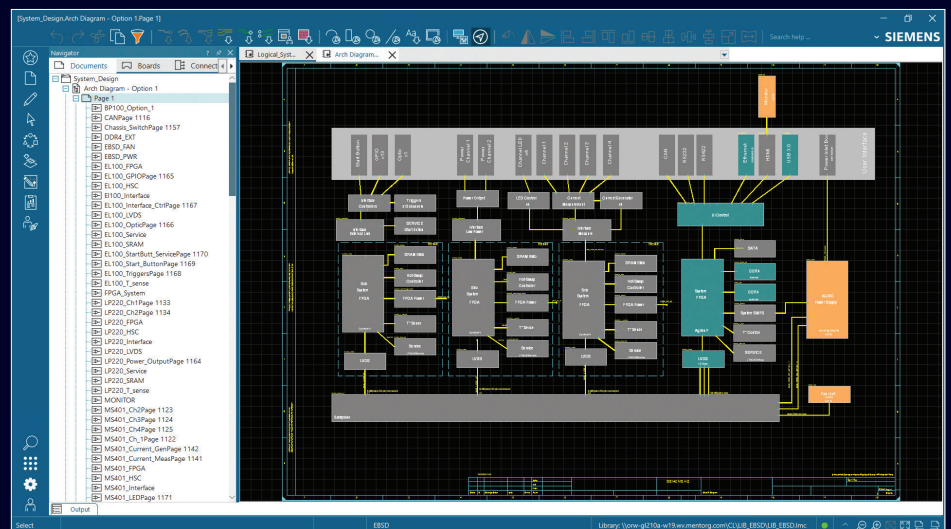
Xpedition keeps system design elements and their associated data intact and where designers can easily access them, even in a dynamically changing environment.

Cable design

Xpedition supports definition and optimization of cable connectivity from MCAD integration and management to BOM and manufacturing drawings.

Collaborative concurrent design

Xpedition empowers all-domain collaboration using versioned, unified data with notification, cross-probing, mark-up, and comments for consistent, integrated design process management.



Define multi-board architectures in Xpedition.

Electrical/electronic co-design

Circuit boards usually interface with other circuit boards via connectors, cables, or harnesses. Xpedition is tightly integrated with Capital, establishing a scalable digital thread to facilitate collaboration between electrical and electronic disciplines.

Connector management

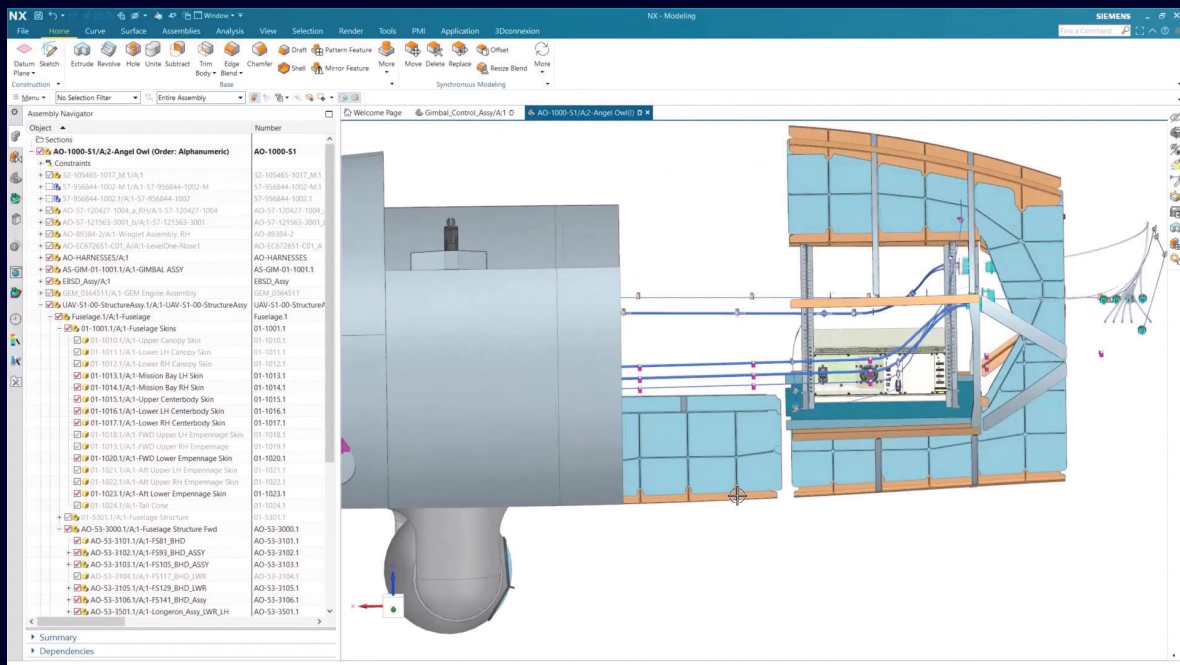
Add, manipulate and update connectors with Xpedition's on-the-fly creation of parameterized connectors along with connector expansion and pin number modification using simple stretch commands. With a high degree of automation, designers can create and modify connectivity using generic connectors without concerning themselves with the actual physical details of the connector.

Multi-PCB and cable integration

Xpedition employs a bi-directional process for synchronizing the content of logical boards and associated PCB schematics. As the PCB schematic is synchronized with associated logical boards, the PCB schematic contains connectors and system level blocks that are, in effect, hierarchical blocks. Therefore, board designers can push into these blocks and define logic on the underlying schematic to realize each specific function of the system.

Integrated cable design

Automate selection of parts by invoking Xpedition to automatically add wires, multicores, terminals, tapes, and other cable components for ready-to-manufacture cable designs, including BOMs and manufacturing drawings. Automatic calculation of quantities, such as "true" manufacturing wire lengths, ensures correct-by-construction cables.



Siemens-enabled cross-domain optimization of electronics in the context of mechanical enclosure and electrical cabling.

FPGA/PCB optimization

Powerful and extremely high pin-count FPGAs provide engineers with significant opportunities for increased features and functionality while reducing the cost of their final products.

Flow integration

Keeping schematic, PCB layout and FPGA databases in sync allows users to better control the project's design data flow. This can be managed automatically through a synchronization assistant.

Automated part and symbol generation

A set of powerful features makes symbol creation easy, fast and error free, while still allowing full control of the symbol creation process. Compared to manual symbol creation, time is reduced from hours or days to minutes.

Floor planning

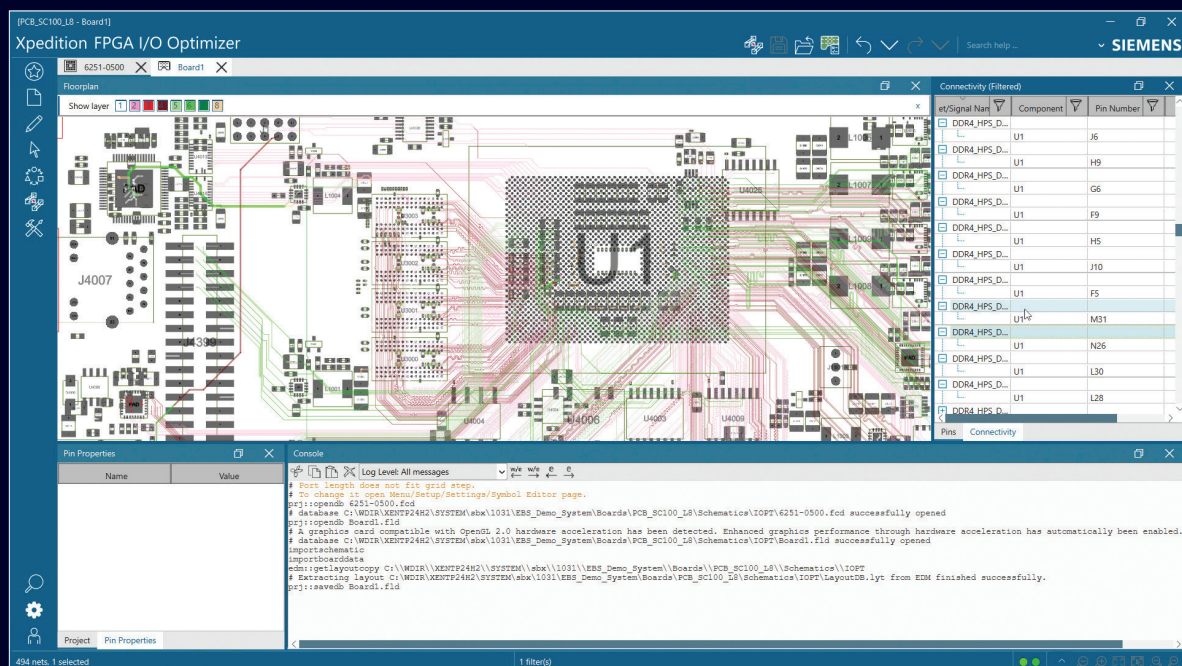
Floor planning can be done before and during the PCB layout process. Designers have the clear advantage when they can make FPGA pin assignment changes right from the project's early stages.

Net line unravelling

Automatic optimization of signal-pin assignments while respecting pin specific rules and constraints enables highly efficient net line unravelling.

Multi-FPGA optimization

Using an optimization algorithm, evaluate all possible connection combinations to arrive at the optimum interconnect. This minimizes net cross-overs arising from the initial assignment and enables higher route completion rates.



Optimize FPGA I/O in the context of the PCB layout.

IC, package, and PCB co-design

There are three primary considerations when assimilating design data from multiple IC, package substrate, and PCB design domains into a single environment. Xpedition supports them all.

Integration and assembly of design data

Visualizing multiple design domains together as a system within a single design tool is key to an ideal co-design process. Xpedition accomplishes this by generating and maintaining an abstract model of each design domain.

It is important to consider the level of layout detail required: the abstract model for PCB and package substrate designs should include detail of their trace routing and vias, internal component placement and wire-bond elements and definition of the internal logical connectivity.

Holistic connectivity management

As signals or power rails transition from die-to- package and from package-to-PCB, the logical net names may change or even be split into more than one connection. Connectivity management must support logical combining, splitting, aliasing, and pin mapping of signals as they transition from design domain to design domain.

A tremendous amount of flexibility is required to support the various traditional methods of capturing connectivity within each domain so that each domain expert can work in the mode most familiar to them or most convenient for a specific task.

Manage incremental changes across domains

When changes are made within the abstract model they must be propagated back to the original design domain. This may include changes to the connectivity, pins, changing pin pitch, or changing component locations and orientations.

A robust ECO process is required to identify and manage incoming changes through an “accept/ reject” model for each design instance. Using an “accept/reject” approach facilitates the co-design process by allowing control of the timing and type of changes that are propagated to or from each design domain.



Pillar 5: Supply chain resilience

Bringing supply chain information such as long lead times and potential shortages to the engineer's desktop can alleviate sourcing and production challenges before it's too late.

Respond effectively to challenging supply chain situations

Xpedition makes sourcing and component data available early in the electronic systems design process to provide awareness of long lead times and potential shortages.

Best known part availability

During the initial schematic creation phase of the design process, engineers typically start off by using approved best-known parts. However, supply chain disruptions often cause parts to be either unavailable or available only at an increased cost that is beyond initial targets. Real-time access to detailed intelligence for availability, price, and parametric criteria can help prevent such choices which will have to be replaced later in the process, with greater repercussions.

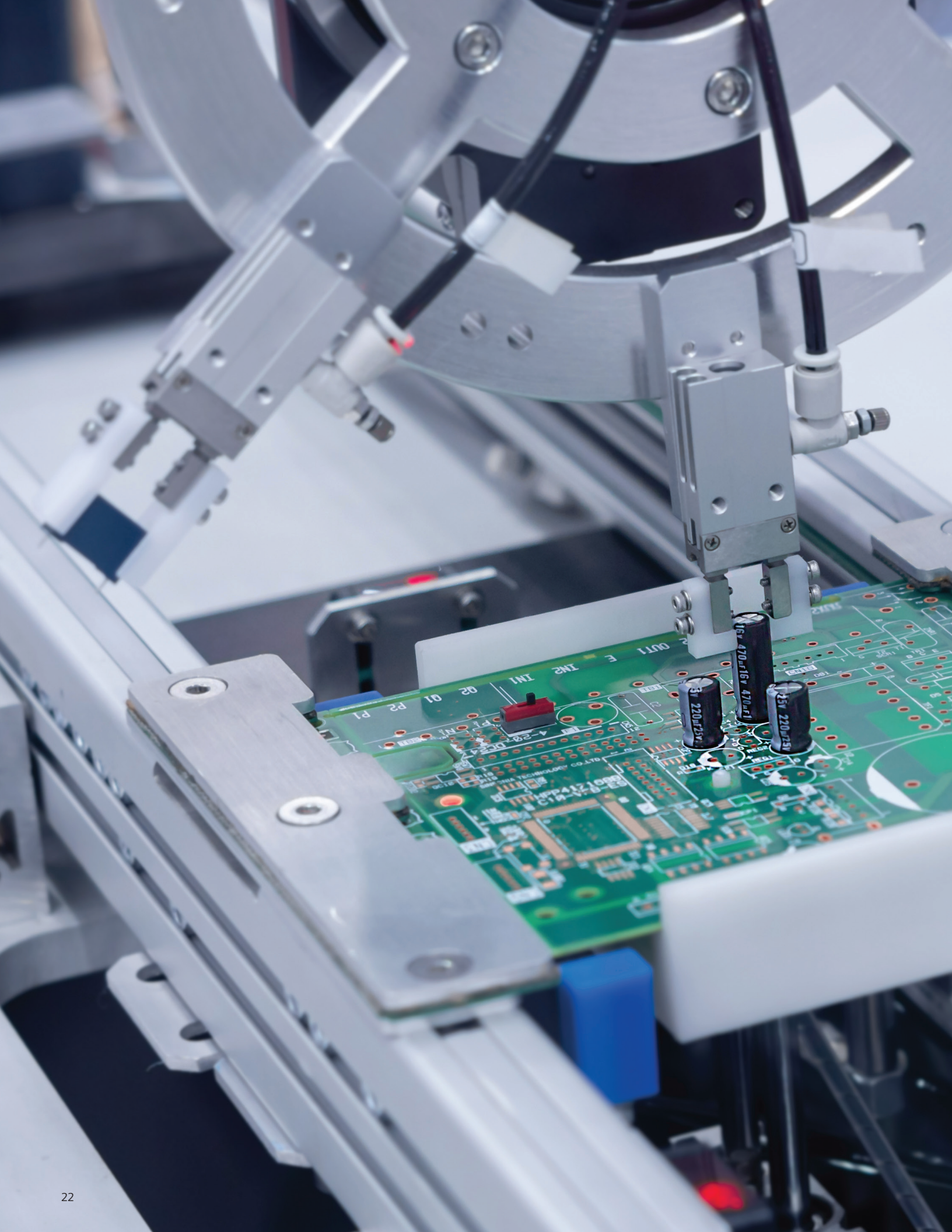
BOM validation

By the time initial BOM analysis and validation are completed, it is late in the design process. This causes loopbacks. Compounded by inefficient collaboration, sourcing validation takes days to weeks before part issues are identified and before feedback is received by engineering. The best practice would be dynamic analysis of BOM "health" for requirements, pricing, availability, suppliers, and risk mapped to the part master list.

Validation of alternates

Validation of alternates is a daunting manual task for engineering because there is no formal way to compare alternates, which means that validations take more engineering effort. This can be eased by an online search through a direct connection to the content provider of your choosing. When you find a suitable alternative part or set of parts, it would map directly to the supplied data model with no additional intervention.



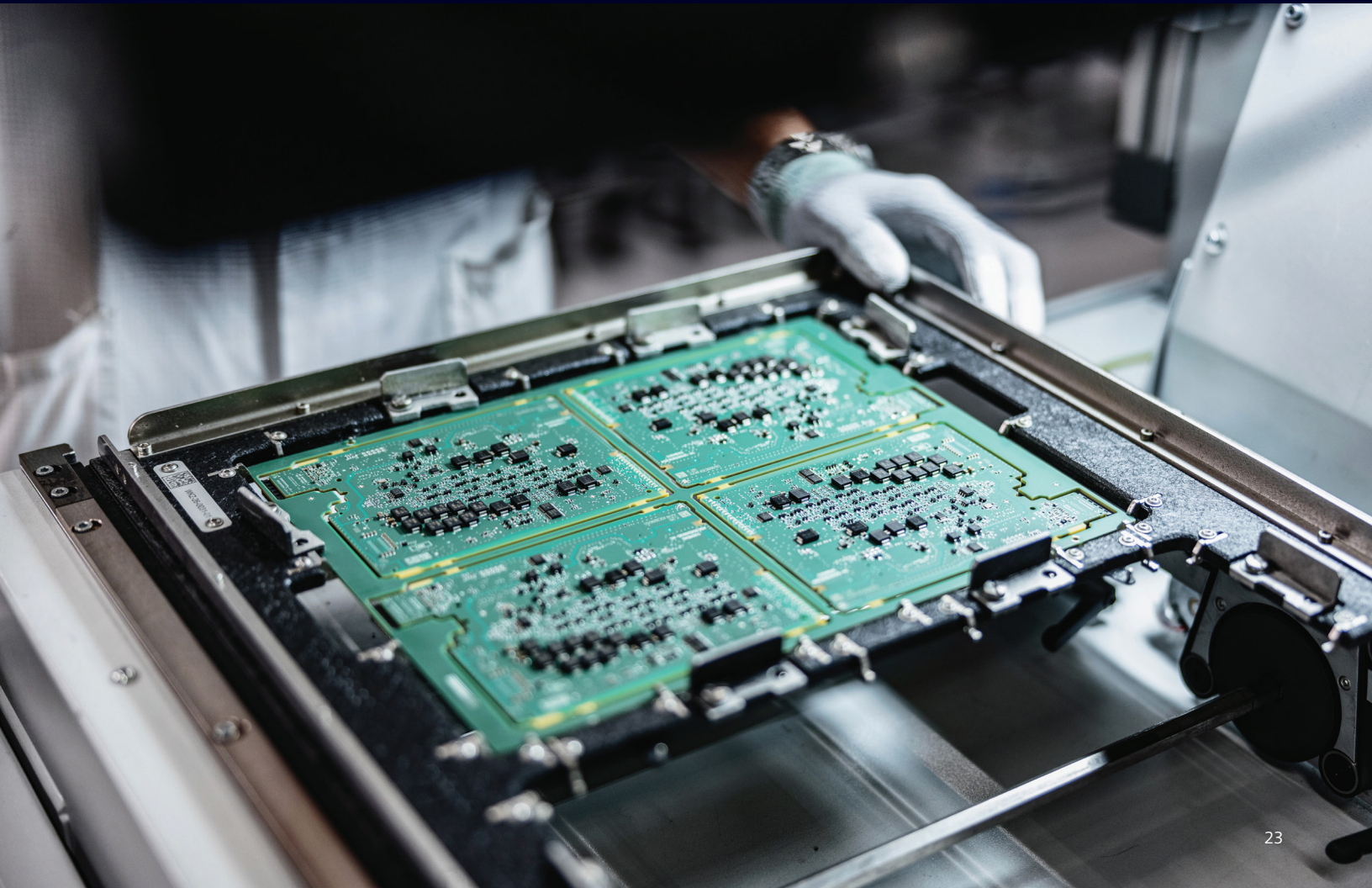


Conclusion

The future of electronic systems design lies in harnessing the power of digital transformation, offered by the Xpedition flow. By doing so, companies can stay ahead of the curve, delivering innovative products that meet customer expectations and drive the industry forward.

As part of the Siemens Xcelerator portfolio, Xpedition is integrated with all major PLM systems, enabling library and design synchronization and multi-domain collaboration across the enterprise. Integration between Xpedition and Teamcenter leverages single-sign-on to streamline user authentication processes, provides seamless access to enterprise/PLM use cases in the work-in-progress (WIP) environment, and implements Teamcenter workflow controls into the WIP environment to manage data locking and ECO processes seamlessly.

Embracing these best practices in PCB design is not just about surviving in a complex electronics landscape; it's about thriving and leading the way in technological innovation. The journey of PCB design is ongoing, and as we look to the future, these five pillars will continue to guide your company to success.



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.

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