

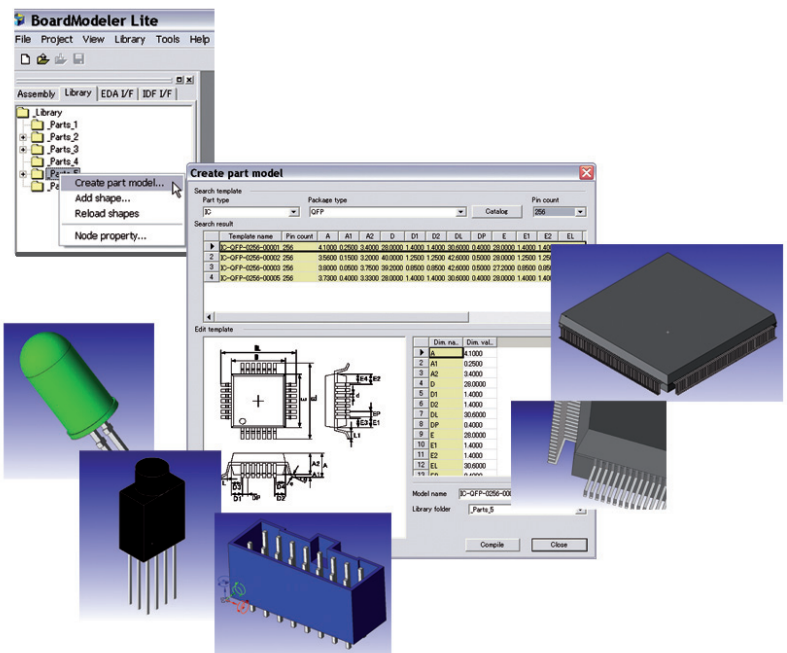
PCB DESIGN – THE EPICENTRE OF COLLABORATION

W H I T E P A P E R

Printed circuit board design is getting tougher. Advanced devices with high density pin-outs and multiple voltage levels are appearing on even the simplest boards. With the aim of staying competitive and delivering product differentiation, the role of board designers is expanding fast. Not only must they tackle these technology challenges, but they must also meet commercial constraints such as tight time-to-market targets and cost reduction. Zuken's CADSTAR distribution manager Jeroen Leinders explains how, supported by the right tools, PCB design is becoming the epicentre of today's electronic product development process.

Introduction – expanding role of PCB Design

In all but the smallest electronics design departments, there have always been walls between the electronics designers and the board layout experts. But increasingly, these walls are dissolving, and we are seeing the role of PCB design growing in importance within the new product development process. Board layout engineers have to learn more about the electrical characteristics of the designs they are dealing with, while electronics engineers have to keep a closer eye on component placement and layout constraints. Between the PCB design and layout teams lies the minefield of analysis. Power analysis, signal integrity, EMC, thermal management and 3D collision checks have become weighty and critical issues as devices increase in complexity. The situation is exacerbated by the continuing trends towards miniaturisation and the virtually universal requirement for wireless capability.



For most medium to large projects, collaboration and concurrent design are the incoming trends featuring strongly in today's methodology strategy. In many small companies, more of the design is being undertaken by the same person, demanding a concurrent approach and interoperable tools. Increasingly, the PCB design function is becoming the focus point for other electronics disciplines within the product development process, such as FPGA design, IC package design and RF design. Each has to be specifically optimised to the target board design.

Collaboration with electronics (chip and system) engineers on one side and mechanical designers on the other, gives PCB designers a usefully broad perspective of the physical design as a whole. And it is often the PCB designers that follow a product into and through the procurement and manufacturing processes. For these reasons, PCB designers are rapidly becoming the pivotal point in the product development process and throughout the product lifecycle. Many of them don't yet realise it, but they can have a major influence on a project's progress and subsequent success. All in all, the PCB design function has the potential to make a big difference to the bottom line.

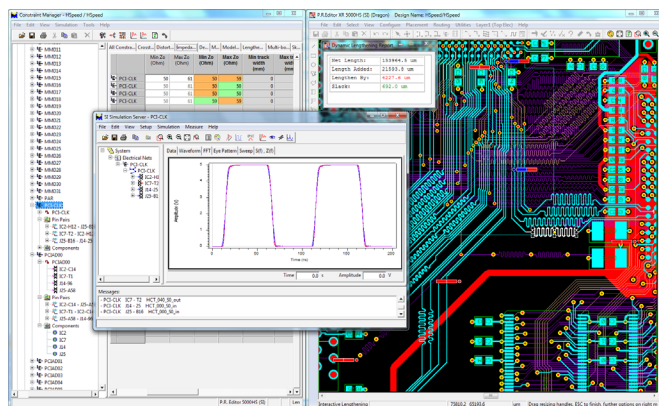
Collaboration & Data sharing

Together with collaboration, a consistent database is essential, with two-way, effective data-sharing throughout the design cycle. The PCB design function has become a gathering point for data from all aspects of the design, prior to interfacing to other design processes. For example, component models are acquired and stored for running test simulation suites. Parts lists can be generated to create a bill of materials for procurement and manufacturing teams. The same data is used to maintain the design, with automatic alerts if components become obsolescent. This becomes especially important in the case of design reuse or when a design needs to be changed.

If design-for-manufacture or design-for-test feature in your methodology, then the PCB design function is a good launch point. In the chip design world, design reuse is essential, as designer productivity levels have severely lagged the exponential expansion in the number of transistors available on ICs. Today, at board level, design reuse is proving just as important. In this case for creating new variants swiftly in fast moving, highly competitive markets. It is the most cost-effective solution for building multiple product versions to suit different geographic regions; or a range of models to conform to various communications or interface protocols, for example; or to meet varying national or regional, safety or environmental legislation.

In many firms, PCB design has become the new bottleneck. Project managers are talking about 'board-centric' design, in recognition of form-factor constraints, making PCB design the centre of attention. Only a few years back, chip design was the glamorous job, while PCB design was regarded as a task for the technicians in what was once the drawing office. Ironically, it is the ready availability and low cost of advanced ICs, in the form of SoCs, ASSPs and especially FPGAs, that is driving the shift in status. Due to reduced IC geometries, only the

highest performance and highly integrated devices in the mobile world are severely limited by silicon real estate. But at board level, engineers are faced with significant design challenges brought about by advanced devices that are now commodity components.



Highspeed Design with constraint support, automatic lengthening and concurrent signal integrity simulation.

The primary challenge at board level is handling high speed devices. For example, high-speed serial interfaces, standards-based wide, parallel buses and interconnect protocols, as well as fast memories like DDR2/DDR3, are no longer just for applications at the cutting edge. They have become standard features. Even if the board itself does not run at high speed, it is likely to be loaded with components that operate at high speeds. Power delivery design is another tricky aspect, with multiple voltage rails, and lower voltage rails to supply every more high performance devices, creating high current issues. Both the high speed and power delivery design challenges have an impact on PCB layout, requiring far greater interaction between the electronics engineers and the layout experts than before. These aspects exacerbate the analysis phase, necessitating further collaboration and tool sharing. One engineer's efforts at optimising the design for signal integrity can be at odds with another's attempting to modify component placement to avoid thermal mismatches, for example.

PCB design tool selection

Control is crucial in today's electronic product development process. Clearly, given the new technology challenges facing even small to medium projects, and that PCB design is now at the heart of the process, it is logical that low cost PCB design tools are expanding in functionality. Already, innovative and dynamic companies have recognised the importance of investing in PCB design tools that can deliver on their promise to help ensure complex designs are right-first-time and meet tight delivery deadlines. Indeed, there is a growing demand for low cost PCB design tools to support collaboration, interaction and the sharing of a common design database.

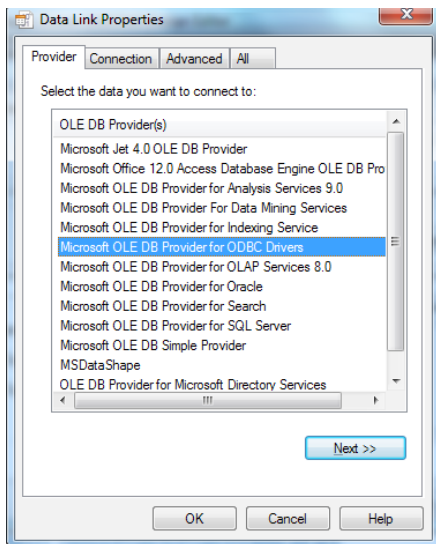
For some companies, PCB design tool selection is going to require careful consideration, especially if this is an area that has been overlooked until recently. It may mean more than just upgrading the last package, and it is well worth investigating thoroughly what the different

vendors are offering today. Choosing a vendor you can trust is as important as choosing a tool set that offers the right capability and value for money. An established, stable multinational company is more likely to be focused on long-term innovation and growth.

Zuken, for example, has more than 30 years experience in the PCB design tool market, underpinned with solid financial foundations.

Its market position is far more robust than its competitors prefer to admit, supplying best in class EDA software solutions and consulting services to leading world class multinational companies as well as a host of smaller firms. Zuken's proven experience, technological expertise and agility combines with transparent working practices and a belief in integrity in all aspects of business. This creates an environment of trust and produces long lasting and successful customer partnerships.

When it comes to tool selection it is important to base your selection on what you need, not just on what is readily available. The tools should combine seamlessly with physical design, in one interactive and automated place and routing environment under an intuitive Windows interface. It is essential that designers can move easily between schematic entry and board layout, keeping both in sync.



Database Link

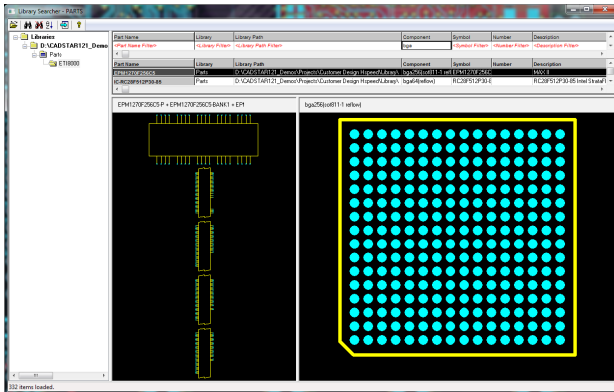
CADSTAR 12.1, for example, is Zuken's low cost PCB design tool suite that supports an intuitive work flow, from schematics creation, board and FPGA level system design, through to PCB layout, seamless communication with your MCAD department (supporting ACIS, STEP, STL and IDF), running collision checks in an 3D environment, and the necessary design rule checks before creating your manufacturing output. High speed design is supported and Signal Integrity and EMC analysis can be included.

The suite is further complemented by extensive data management capabilities and a massive component library accessible over the internet. Not only does CADSTAR 12.1 incorporate in one environment, all the necessary PCB design technologies, but it is also scalable, supporting small, growing and mid size teams. Migration to CADSTAR from other packages is easily achievable too.

CADSTAR 12.1 enhancements and highlights

- Throughout the integrated tool suite, a consistent and intuitive user interface is the key to ease of use, guiding designers efficiently through their design process. Within CADSTAR 12.1's Schematic Editor and PCB Design Editor, the menu items and options are all in the same location and buttons have a customisable appearance. Other recent enhancements include collapsible menus, dockable menu bars and tabbed documents.
- For analysis and verification, two packages, SI Verify for signal integrity and EMC Adviser, are seamlessly integrated with CADSTAR. SI Verify uses IBIS and Spice models, and can be used as an estimator, in 'what if' mode or will run a complete signal integrity simulation on the design. Meeting the needs of today's high speed, high density boards, geometry extraction and analysis allows engineers to consider the parasitic impact of vias and microvias. EMC Adviser is driven from the CADSTAR PCB Design Editor. It requires no external net or component lists, exchanges files or translators, and can be used by both EMC experts or non-specialists.
- A new feature now supported in the PCB Design Editor, is the ability to show overlapping items in a mixed colour mode. This is particularly useful for seeing how a connection is routed on different layers.
- At the heart of CADSTAR 12.1 is the P.R.Editor XR HS (Place & Route High-Speed). Taking a 'right-first-time' approach, this powerful placement and routing tool is optimised for speed and accuracy, to tackle today's dense PCB designs. It handles a wide range of circuit rules and routing constraints that can be set early in the design process to ensure designs are implemented correctly first time.
- Intelligent automation is theme behind the enhanced features in Embedded Place & Route Editor, with the interactive ability of the Placement Tools and Move Components facility.
- Of particular interest to designers of mixed signal boards, is support for true star-point routing in both the PCB Design Editor and the Place & Route Editor tools. The important differentiator with the Zuken star-point router is that not only does it facilitate the interconnection of different GNDs, but it fully respects the constraints within the Design Rule Checker to ensure there are no subsequent errors.
- CADSTAR's extensive OnLine component libraries contain more than 250,000 ready-made parts and are updated and expanded constantly. Library elements are ready to download and use, complete with all the information a designer requires. Accessing a ready-made and constantly maintained library can save a great deal of time and money.
- With the ability to store Parts Libraries into an ODBC-compliant database, searching your libraries for the correct component becomes not only faster, but as well the integration with MRP, ERP

or e-PLM systems becomes now much easier. It's easy to verify that parts, components, and symbols used are the latest versions available. Warnings can be issued on obsolescent or obsolete parts selected, and component updates with alternatives can be obtained, to ensure old designs can be maintained. Custom symbols, components and footprints can be easily created, along with customised datasheets in HTML for every part in the library. These can be viewed and shared locally or on-line; vital for manufacturing and procurement.



Library Searcher

- Board Modeler Lite is Zuken's solution for a 3D view of the physical design of the completed PCB. Features include:
 - Simple or detailed 3D component models automatically displayed in 3D layout
 - 3D model wizards for easy creation of your detailed 3D component models
 - Support of STEP, ACIS, STL and IDF format for easy interfacing with your MCAD department
 - Import new board outlines to meet the CAD design, with automatic board layout changes
 - Back-annotation of newly imported or modified board shape and component placement data into PCB Design Editor
 - Easy control icons to perform operations on separate elements, like moving components or running collision checks.
 - View individual collisions between board and case and make placement changes to resolve them
- Zuken's Dragon Autorouter first analyses designs for potential routing problems and steps through a set of expert steps to generate an optimal routing strategy. Engineers have access to a number of innovative routing algorithms, including a new tuned native 45-degree autorouter for single trace. This is optimised for high performance in high density areas and a native 45 degree Differential Pair autorouter and topology checker. This routes differential pairs in order to minimise skew and uncoupled length. Recent enhancements include advanced fan out generation features, as well as support for fan-out for BGA and FPGA type devices.

Take-care bundles

Unlike some of its competitors, Zuken does not merely offer a 'one size fits all' software package. Its 'take-care' strategy is to develop software modules that not only help simplify and streamline the PCB design flow, but which also meet differing budgets and project complexities. The aim is to help customers take advantage of technology developments, optimising their investment in the PCB design environment.

- **CADSTAR Lite** is the most cost effective take-care bundle, at less than 2€ per day. It provides Schematic Editor, Library Editor, PCB Design Editor to a maximum of 2000 pins/pads, P.R.Editor XR (Place & Route) with unlimited number of interactive routing layers, ODBC-compliant database support, Datasheet Publisher, and optional 3 year upgrades and support (including access to the OnLine library and migration tools).
- **CADSTAR Dynamic** adds to this package a four layer autoroute capability, Variant Manager, EMC Adviser and Migration tools, and includes the 3 year upgrades and support as standard. The cost is less than 9€ per day.
- **CADSTAR Kynetic** at less than 16€ per day, adds unlimited pins/pads capability, unlimited manual routing and autoroute layer facilities, and the Rules by Area tool designed for space constrained boards.
- **P.R.Editor XR HS, Dragon Autorouter, SI Verify, Board Modeler Lite (3D) and FPGA Design** are optional available.

Summary conclusion

The demanding technical challenges and commercial constraints facing PCB designers today is placing board design at the epicentre of the product development process. Through careful selection of the most appropriate design tools, board designers can grow their skill set and expand their role, while ensuring that new board designs take full advantage of the latest technology on a timely basis.

Support for design reuse, variant management and version control, plus links to allied disciplines and processes, such as FPGA design, IC package design, 3D and mechanical design, as well as procurement and manufacturing, demonstrates a comprehensive tool set capability. Collaboration and concurrent design are the watchwords of this new approach, requiring tools that are integrated, data coherent, interoperable, versatile and easy to use.

An established and financially stable vendor will ensure the tools are regularly enhanced and upgraded to meet new challenges, while providing continuous support for legacy designs.