EE Times

How to reduce design iterations and time to market while greatly increasing reliability

By Altair 09.01.2021

Reliability is a very broad term in the electronics world. It covers many different criteria, such as signal integrity, thermal management, environmental protection, power conversion and distribution, vibration, and many other electrical and mechanical considerations. Depending on the application, there may be a high focus on reliability. Aerospace, medical, automotive, and other safety- or mission-critical applications require several redundancies coupled with high-stress testing.

What about other applications that benefit from high reliability but may not necessarily see the same design focus? No matter the product or system, reliability is almost always a top priority. Though pre-existing ECAD systems haven't really had a complete toolset that cover these kinds of protections, Altair has delivered a physics-based analysis platform that links both the ECAD and MCAD worlds, providing solutions to ensure timing, performance, compliance, and, of course, reliability at the PCB level. PollEx offers a variety of services spanning PCB verification, thermal assessment, design for manufacturing (DFM) checks, several kinds of advanced electrical and mechanical simulations, and detailed performance analysis, while integrating with several industry-standard ECAD design suites and their file types. The result is a complete integrated PCB system verification and simulation environment that helps to quickly identify errors and build a more robust, upfront design before production. But before we dive into the software and its features, let's revisit why reliability is so important.

Why Reliability is Important

There are many examples in today's world in terms of "reliability gone bad", such as product recalls across several industries like automotive, medical, and consumer electronics. These recalls are generally due to poor reliability and failures that can result in harm to equipment and personnel, not to mention the manufacturer's loss of business and tarnished brand name.

Quality assurance varies throughout these industries and although certain policies and procedures may be in place for a product development process, having the Design for Reliability (DFR) mindset and a set of tools/resources to assist can greatly help lower the risk for field failures in the field while increasing the devices robustness. With extensive upfront testing and failure analysis (along with any field data that is collected), certain functions such as the Weibull Distribution can be used to help characterize failures and how the design is prone to either early failures (perhaps containing defective items), environmental or external based failures, or end-of-life failures such as wear and tear. Conducting risk assessments

for more serious products that are used in critical applications can also help to identify and address problematic areas before the design is completed. Whatever the case, using tools to help identify improvements and increase reliability greatly increases a products chance for success.

Brief overview of PollEx

On that note, let's jump into PollEx and take a look at what it has to offer. PollEx is a software by Altair that offers PCB-level review, analysis, and manufacturing assistance that aims to significantly reduce the number of development cycles while providing a common application for schematic/PCB engineers and manufacturing personnel to communicate with. The software is compatible with many of the major ECAD systems such as Altium, Cadence, Eagle, and Mentor Graphics. After importing a PCB design, the user can perform a design review, analysis, rule-based verification, and manufacturing assessment (see Figure 1).

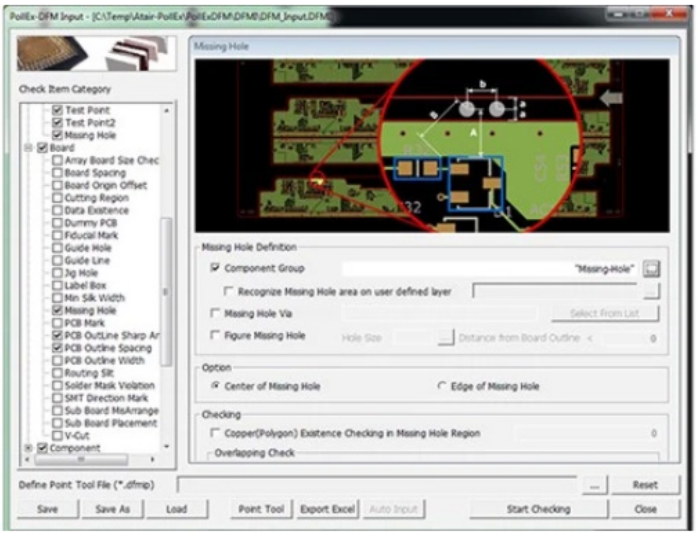

Figure 1: Rule-based verification tool PollEx DFM

PollEx has export functions that produce data compatible with physics simulators and production line machines, which help to provide additional design support and increase efficiency of PCB fabrication, assembly, and end-of-line testing. This helps to determine errors in electronics designs that affect manufacturing and production-related activities, while also helping to identify potential issues with electromagnetic interference (EMI), power/signal integrity, and electrostatic discharge that may crop up either during certification or, worse, after distribution to the field. PollEx can also be used with Altair's Feko program for determining more detailed system-level EMI and electromagnetic compliance. This is especially useful when designing products for consumer goods.

Worth noting, Altair's Simulation environment is a modeling solution that includes mechanical fatigue analysis, computational fluid dynamics, and others. It can be used alongside PollEx to provide a complete design solution (see Figure 2).

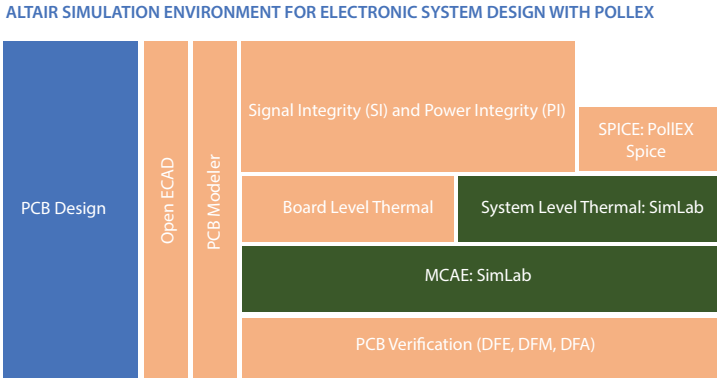

Figure 2: A complete Electronic System Design verification — Altair's Simulation technology for PCB paired with PollEx

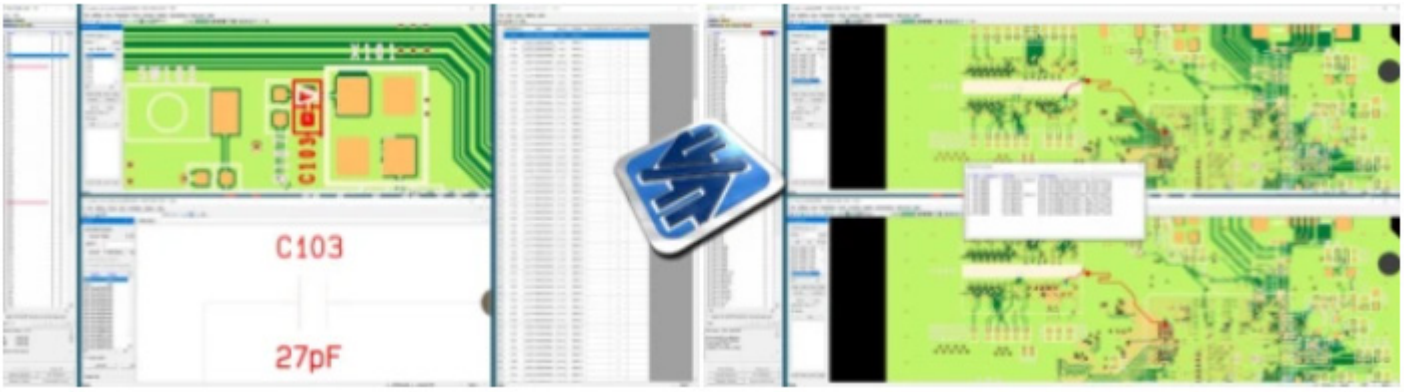

Figure 3: PollEx PCB modeler comparing PCB designs PollEx

A unified parts library contains files called unified parts files that review footprint validity against its corresponding package, as well as ensuring that all engineering teams involved have the same physical characteristics of the PCB, including physical, logical, thermal, electrical, and assembly attribute data, which are all maintained in one place.

The PollEx PCB Modeler (Figure 3) can be used to view the schematic layout, explore actual layered PCB structures in 2D or 3D, and create components and BOM lists. It can be utilized to visualize, search, explore, measure, re-mark, compare, share, and manipulate pads/vias while viewing netlists and other associated documentation.

All of these features are connected with other Altair flagship simulation products, including thermal analysis (conduction, convection, and radiation) and structural analysis (drop testing, vibration, bending, and solder fatigue). Figure 4 shows an example of a thermal PCB analysis along with a detailed diagram showing what thermal characteristics of the PCB are examined.

Finally, Altair's Embed tool can be used to model firmware for embedded systems, including analog and digital communication, motor control, IoT

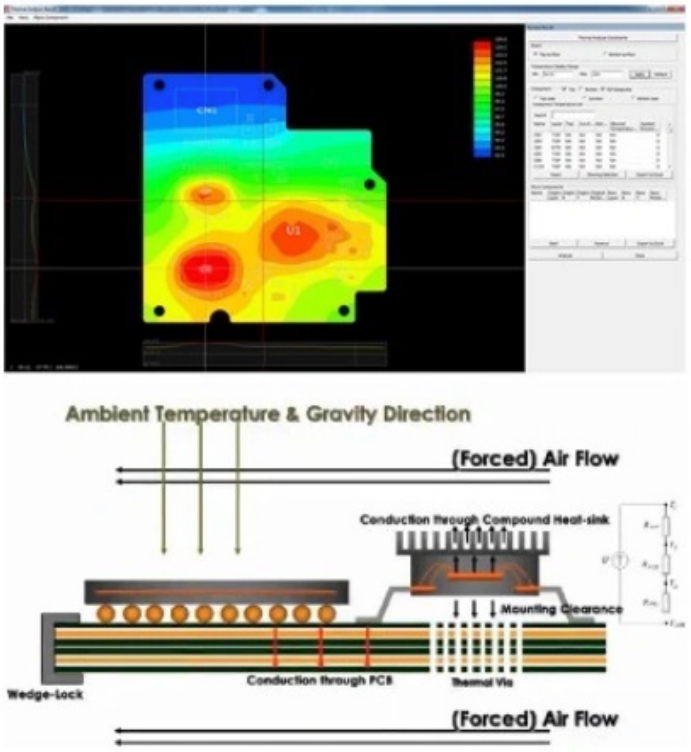

Figure 4: Altair's thermal PCB analysis and a diagram of the thermal properties for a PCB

devices, and vision systems. With Embed, the designer can analyze and simulate your code using block diagrams and state charts, then automatically generate compact, optimized code to run on an extensive selection of microcontrollers — a digital complement to hardware verification.

Samsung case study

Samsung SDI (a business segment of Samsung specializing in battery technology) has recently adopted Altair PollEx to manage a transition from digital display control circuits to battery control circuits. The change required a strong focus on PCB design review and verification for both existing and new products that kept centrally managed design rules and a user environment.

After an evaluation process of the PollEx software, Samsung designers began integrating PollEx into their design while linking in PCB designers, hardware engineers, test engineers, and manufacturing engineers from different locations (see Figure 5).

Figure 5: An overview of the Samsung SDI collaboration environment with PCB verification capabilities

Checking a design against a central set of design rules and verification specifications in many different remote locations (regardless of what CAD systems were currently in use) was critical to the application, and Altair had worked closely with Samsung to ensure a smooth transition with PCB verification. Several engineers were able to review the PCB designs with PollEx's toolsets while collaborating with each other remotely, and over the course of two months, Samsung SDI saved an estimated $6 million a year thanks to a reduction of design iterations from 20 down to nine, with a number of revision checks from six down to three.

PollEx is now used as a standard PCB design review process to detect manufacturing faults in its early stages of PCB design.

The future of PollEx

While PollEx's customer base is still growing, Altair's software is headed toward a "digital twin" solution, or a virtual representation of a process in real-time, digital form. The goal of this approach is to continuously improve the product design process and its life cycle.

Altair's Activate, a multi-disciplinary system simulation, blends physics and data-driven twins to support optimization throughout the product's lifecycle. This technology could see emulation of software on real PCBs, demonstrating a close relationship between software and reliability. It could also help firmware and software developers learn more about EMI (or other environmental variables) and their association with embedded code.

In conclusion, PollEx already has a strong customer base and a leading position in South Korea, including top players such as Samsung and LG. PollEx integrates with the rest of Altair's broad product development suite to provide an extensive problem-solving toolset, while maintaining compatibility with most industry-standard ECAD and MCAD platforms. History shows that, typically, 12 design iterations are needed to bring an idea to production and that during this process, upfront simulation and detailed design verification helps to weed out issues before it hits production. With PollEx (and other associated Altair solutions), a designer can drastically reduce design iterations and time to market while greatly increasing reliability and overall chance for success.