

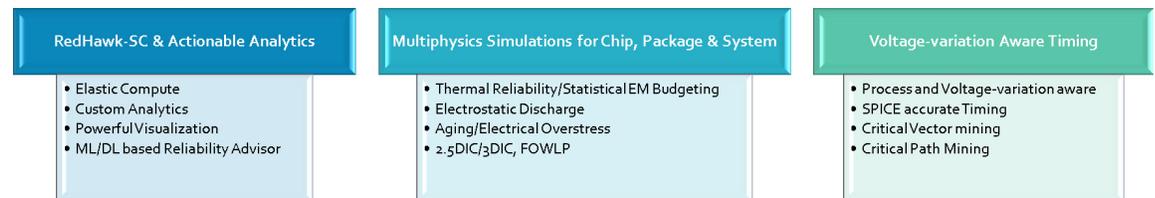
Empowering Customers... *Beyond Signoff*



ANSYS simulation technology empowers you to predict with confidence that your products will thrive in the real world. Chip, package and system design engineers trust our software to ensure the integrity of their products and drive business success through innovation.

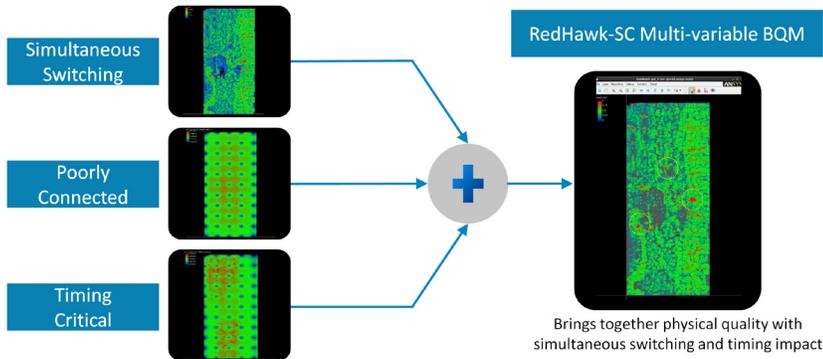
Computing and connectivity requirements are growing at an exponential pace. A new era of semiconductor ICs is giving rise to transformational products that will enable seamless connectivity, smarter end node devices, embedded artificial intelligence and autonomous vehicles. These cutting-edge electronic systems require sub-16nm Systems-on-Chip (SoC) and complex packaging technologies to deliver the required performance and functionality. Traditional margin-driven, siloed design methodologies are increasing the vulnerability of silicon and system failures at advanced process nodes. With the supply voltages for advanced technology nodes reaching well below 500 mV, design margins are quickly diminishing for voltage drop and timing analysis. These margins inherently build pessimism into the design process and prevent designs from achieving the best **possible power, performance and area (PPA)** metrics. **ANSYS empowers customers beyond signoff by breaking down margin barriers with its enabling technologies for multiphysics simulations, big data analytics and chip-package-system (CPS) co-analyses to exceed PPA and reliability goals.**

ANSYS Enabling Technologies



RedHawk-SC and Actionable Analytics

With unparalleled scalability across thousands of cores using big data techniques, ANSYS RedHawk-SC helps you sign off billion+ instance designs within a few hours on commodity hardware. No dedicated machines are needed — RedHawk-SC runs the largest designs, using low memory cores, even if they reside on different machines. Because RedHawk-SC can utilize unused cores, it increases utilization rates of compute farms, thereby decreasing overall hardware costs; unlike other tools it does not require dedicated hardware, even for the largest designs. This elastic scalability is what enables RedHawk-SC to process designs of unprecedented size with flat-accuracy, high-resolution extracted networks and multiple scenarios. ANSYS RedHawk-SC offers you the most comprehensive dynamic analysis coverage by enabling you to sign off SoCs with confidence using a wide variety of simulation modes — RTL and gate vectors; smart vectorless analysis for functional and scan mode; mix-mode simulation (vectorless + VCD); and power-transient and power-up analysis.



ANSYS RedHawk-SC's powerful data analytics give you key insights into design weaknesses early and help you prioritize design fixes by overlaying various design attributes. With its customizable analytics you can create unique metrics that represent design quality based on various physical, electrical and simulation parameters. For instance, trying to fix low-timing slack paths going through a high-dynamic voltage drop area requires knowledge of all timing paths along with all voltage drop scenarios. Similarly, trying to find instances

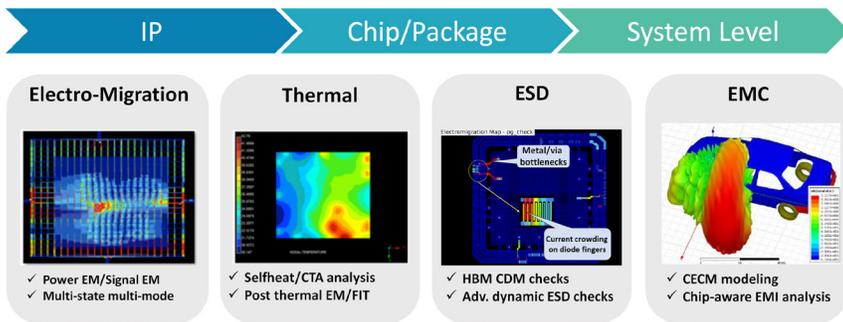
that have a high peak current and a high resistive path requires knowledge of the effective resistance map along with the instance load versus current models. Using a targeted design-fixing approach with these analytics is a much more efficient way to fix issues at 7nm than a shotgun approach. Leverage RedHawk-SC's GUI-driven analytics without writing a single line of code to create powerful visualizations and capture design weaknesses.

ANSYS' SeaScape-based machine learning technology platform enables a wide range of applications — like identifying missed systematic design weaknesses and automating time-consuming rigorous manual procedures — by aggregating key insights across different designs using continuing and prior simulation and design data. This platform has been used in production workflows to reduce time-to-market efforts and accelerate design convergence for next generation designs (e.g., EM advisor).

Multiphysics Simulations for Chip, Package & System

Design for reliability is a key consideration for the successful use of advanced SoCs in 5G communication electronics and ADAS systems for autonomous driving. ANSYS' chip-package-system reliability signoff solutions address thermal, electromigration (EM), electrostatic discharge (ESD), aging, electrical over-stress (EOS) and electromagnetic compliance to create robust and reliable electronics systems for these applications. ANSYS provides comprehensive workflows for multiphysics simulations that capture the various failure mechanisms and provide signoff confidence. This not only guarantees first-time product success, but also ensures reliability and regulatory compliance. ANSYS solutions for CPS challenges include:

- ANSYS PowerArtist
- ANSYS Totem
- ANSYS RedHawk-SC
- ANSYS PathFinder ESD
- ANSYS Chip Thermal Analysis
- ANSYS EOS FX/Aging FX
- ANSYS medini analyze



Advanced packaging technologies and 3DICs will be key drivers of heterogeneous integrations for next-generation HPC and cloud computing electronics. High performance and bandwidth requirements are driving the need to simultaneously simulate the entire chip, package and system rigorously. The existing margin-driven approach of independently validating the chip, package and board severely limits the ability to optimize these systems without over-designing. This silo-based approach affects cost and schedule, and does not guarantee optimal

system performance. ANSYS Chip Package Analysis (CPA) is used for detailed package aware chip design. Similarly, ANSYS Chip Power Model (CPM) and Chip Model Analyzer (CMA) are used for IC aware package and board design. Using the following comprehensive suite of CPS platforms, you can elevate your design methodology to design better products:

- ANSYS Chip Model Analyzer
- ANSYS Chip Power Model
- ANSYS Chip Package Analysis
- ANSYS SIwave
- ANSYS Icepak

Voltage-Variation Aware Timing

ANSYS Path FX is a high-performance SPICE accurate timing solution that accurately captures both high sigma process variations and supply noise impact for timing closure. It can help you uncover otherwise missed silicon failures by accounting for both temporal and spatial variability on timing-critical paths by leveraging the power of ANSYS RedHawk-SC for accurate voltage variations and ANSYS Path FX for process variations. Combined with ANSYS RedHawk-SC, ANSYS Path FX accurately simulates the impact of dynamic voltage drop on critical timing paths, helping you understand the true limits of the built-in margins. Capturing true post-silicon behavior allows you to drastically improve the functional yield of your chips with ultimate confidence. ANSYS Path FX is the industry's only high-speed and high-accuracy simulation platform, purpose-built for critical path simulations. It is 100 times faster than traditional Monte Carlo SPICE. ANSYS solutions for this application include:

- ANSYS Path FX
- ANSYS RedHawk-SC

Silicon Proven

ANSYS tools have been used for thousands of successful tape-outs across the semiconductor industry. All ANSYS semiconductor platforms are supported by certifications from major foundries for every manufacturing process technology down to 5nm, enabling you to trust the accuracy and facilitate first-time silicon success.

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If you've ever seen a rocket launch, flown on an airplane, driven a car, used a computer, touched a mobile device, crossed a bridge or put on wearable technology, chances are you've used a product where ANSYS software played a critical role in its creation. ANSYS is the global leader in engineering simulation. We help the world's most innovative companies deliver radically better products to their customers. By offering the best and broadest portfolio of engineering simulation software, we help them solve the most complex design challenges and engineer products limited only by imagination. Visit www.ansys.com for more information.