



Ansys

**ENVIRONMENTAL
SUSTAINABILITY IN FOCUS**

**/ SIMULATION PRODUCT HANDPRINT:
SEMICONDUCTORS**

Ansys is the global leader in engineering simulation software and services widely used by engineers, designers, researchers and students across a broad spectrum of industries and academia, including aerospace and defense, automotive, electronics, semiconductors, energy, materials and chemical processing, turbomachinery, consumer products, healthcare and sports.

Engineering simulation is the application of physics-based software solutions across the product lifecycle from ideation, to design, manufacturing and operation, enabling engineers to virtually test operational performance and predict how product designs will behave in real-world environments. Applying engineering simulation solutions significantly reduces cost, shortens time to market and reduces risk of failure by improving product quality.

Ansys is committed to the conservation and sustainability of the planet's resources by operating our business in ways that reduce our environmental impact and carbon footprint. As part of Ansys' environmental sustainability efforts, we submit to the Carbon Disclosure Project (CDP) annually and are committed to taking steps to measure and mitigate the carbon footprint of our operations.

As the global leader in simulation software, Ansys is well positioned to also provide technology solutions that support and enable the sustainability goals of our customers across diverse industries. **Our solutions can have a positive impact on the environment by helping our customers** to reduce their use of resources while increasing their efficiency and productivity. Discovering and implementing efficient means of innovative product design and operation — with minimal use of physical resources — is at the very heart of our vision of pervasive simulation.

While measuring and reducing our own environmental impact is essential, the benefits from this process are finite. By contrast, our **product handprint** — the use of simulation by customers to reduce their own carbon footprint and the footprint of their products — is nearly infinite.

Here we present one in a series of use cases illustrating how Ansys simulation creates these handprint benefits.



USE CASE / SEMICONDUCTORS FULFILL THE NEEDS OF MODERN SOCIETY

Semiconductors make it possible to miniaturize electronic components, with hundreds of millions of transistors packed into a single computer, for instance. From that small beginning, enormous data centers have grown to fulfill the needs of modern society. A data center may house thousands of computers to act as servers, data storage devices, network equipment, power transformers and for many other uses. Together, they consume a lot of power and generate a lot of heat, requiring the data center to be cooled to prevent the computers from overheating and crashing.

The electricity to power a data center comes from power plants that burn fossil fuels and emit greenhouse gases (GHGs) that contribute to global climate change. Electricity accounts for ~20% of a data center's total cost of ownership (TCO), being the largest single contributor to data center TCO. ⁽¹⁾ In 2019, data centers emitted as much carbon as the aviation industry. Emissions from data centers are expected to double by 2025 due to 5G, autonomous vehicles (AVs), the internet of things (IoT) and other trends that rely on computing⁽²⁾. Improving data center energy efficiency with more efficient semiconductors will reduce a company's electricity cost and GHG emissions.⁽³⁾

Experts estimate that between 2019 and 2025, GHG emission in data centers will be reduced by 134 to 144 million tonnes of CO2 equivalents (mtCO2e) through the deployment of more energy-efficient IT equipment and infrastructure.⁽⁴⁾ Internet protocol (IP) traffic is expected to grow at a compound annual growth rate (CAGR) of 24% during the same period.⁽⁵⁾

Semiconductors are crucial for achieving energy efficient data center equipment, the most common being power semiconductors, integrated circuits and LEDs for lighting.



Simulation solutions are important in developing IT equipment with higher performance per watt to improve energy efficiency in data centers.

Power Analysis⁽⁶⁾

Simulations during design phase can help to achieve energy efficiency gains.

Using Ansys PowerArtist Qualcomm engineers were able to identify redundant switching to improve GPU power efficiency of key design blocks by 10%.

Thermal Degradation⁽⁷⁾

Simulations can help engineers optimize the placement of LEDs into electronics based on thermal stress.

Fairchild engineers have improved inverter design process by using a reduced-order model to predict thermal performance in a minute or two.⁽⁸⁾

Electromagnetic Interference / Compatibility (EMI / EMC)⁽⁹⁾

STMicroelectronics has developed a workflow that combines full-wave frequency domain with circuit simulation to identify and fix EMI/EMC issues early in the design process, improving development time by 20%.

Advanced Packaging⁽¹⁰⁾

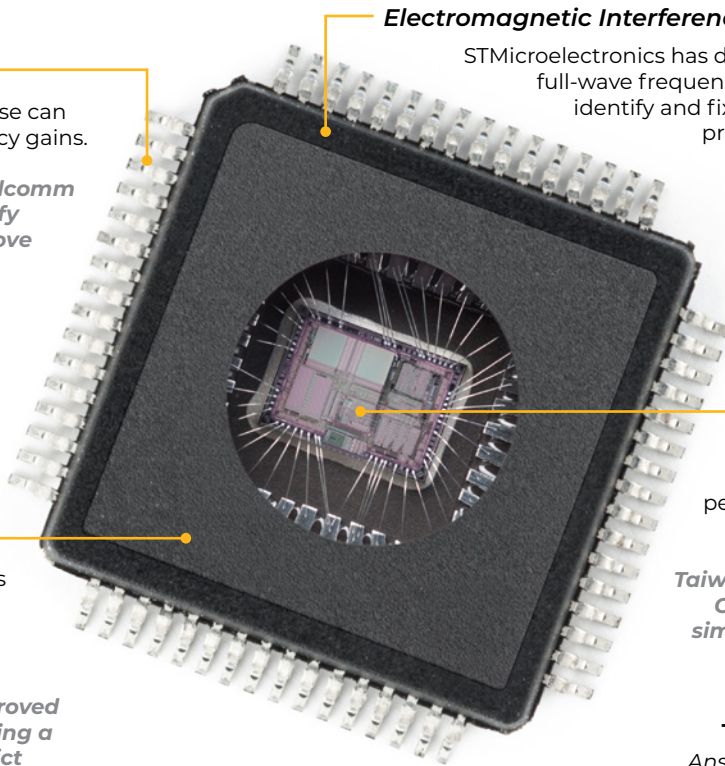
Advanced packaging technologies improve the power efficiency and performance of high-speed cloud and data center electronic systems.

Taiwan Semiconductor Manufacturing Company (TSMC) certified Ansys to simulate its latest 3D integrated chip (3D-IC) packaging technology.⁽¹¹⁾

TSMC: "This collaborative effort with Ansys to deliver a thermal solution flow for full chip and package analysis is of great value to our customers."

Suk Lee

Vice President of the Design Infrastructure Management Division at TSMC⁽¹²⁾



ANSYS / CUSTOMER SUCCESS STORIES

Nvidia: Improving signal integrity and power consumption is important at NVIDIA, which means being electromagnetically aware. Because they are constantly pushing the envelope on high-speed, high-frequency design, they have built an effective, efficient methodology to root out crosstalk issues in a way that does not bog down the schedule or tie down too many engineering resources.

“With Ansys RaptorX and Ansys Exalto, we were able to do a very large-scale extraction efficiently in a short time that allowed us to push the physical design to its limit while minimizing the associated risks.”

Dai Dai

Mixed-Signal IC Design Manager, NVIDIA, Santa Clara, U.S.A.⁽¹³⁾

Xilinx: Xilinx relies on leading-edge field-programmable gate arrays (FPGAs) for their performance and flexibility. Owing to their unique programmable architecture, FPGAs have always been relatively larger devices than standard integrated circuits or custom systems-on-chips (SoCs), and lately the explosion of new features on the company’s Versal ACAP products has only made them larger and more complex.”

“With simulation data sizes growing to unmanageable dimensions, Xilinx leveraged Ansys SeaScape and its map-reduce analytics to prune chip-scale designs for faster timing analysis.

Nitin Navale

CAD Manager, Xilinx, San Jose, U.S.A. ⁽¹⁴⁾

Qualcomm: Engineers at Qualcomm, a global leader in mobile technologies, are always exploring ways to improve the performance of semiconductor components in mobile devices. The graphics processing unit (GPU), in particular, is a critical component for consumer applications such as gaming.

“Qualcomm’s differential energy analysis early in the design flow using Ansys PowerArtist delivers 10% higher performance per watt”

Yadong Wang

Staff Engineer, Qualcomm, San Diego, U.S.A.⁽⁶⁾

ANSYS / SUMMARY

Ansyes' range of semiconductor simulation solvers for chip, board and package challenges, including power analysis, thermal analysis, design for reliability, electromigration, EMI, EMC, and ESD are critical in helping semiconductor companies reduce power usage in semiconductor data centers, leading to a reduction in greenhouse gas emissions.

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