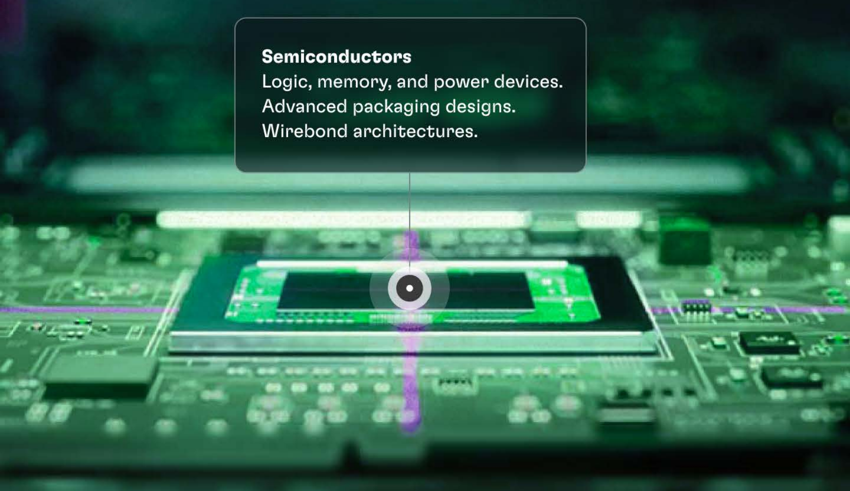
Henkel Adhesive Technologies

SUPPORTING NVIDIA AT THE **FOREFRONT OF THE AI REVOLUTION**



Semiconductors
Logic, memory, and power devices.
Advanced packaging designs.
Wirebond architectures.

NVIDIA is unparalleled in its success in leading the AI revolution. But innovation can never rest. As next-gen semiconductors and packaging designs push the boundaries of what is possible, highly engineered materials are even more vital because they enable the next generation of semiconductors and packaging designs.

Every industry can benefit from AI and NVIDIA-named AI factories. That means across AI applications, semiconductor packaging must answer the demand for more miniaturization, higher functionality, and increased reliability. To maximize performance, novel, component-level materials help manage heat, provide protection, and enhance reliability. The result? Higher power densities for intense AI compute loads, leveraging thermal management, and using less energy—as in the NVIDIA Blackwell GPU or NVIDIA Grace CPU.

Collectively, we need to keep progressing forward. With the support of Henkel's highly engineered materials, thermal management solutions, and reliable global supply, NVIDIA has a partner to help answer the world's most demanding challenges and advance AI capabilities everywhere.

HIGHLY ENGINEERED MATERIAL SOLUTIONS

Wafer-level encapsulation
Underfills
Lid and stiffener attach
EMI shielding

PERFORMANCE
FUNCTIONALITY
RELIABILITY
HEAT

A LOT HAS HAPPENED SINCE

Semiconductors are built on millions of transistors and are fundamental to every electronic device.

1948. Bell Laboratories announced the first transistor, and more than 100 could fit in the palm of your hand. source

1999. NVIDIA introduced the first GPU built with a few billion transistors.

1948

Today. More than 100 billion transistors can fit in the palm of your hand. NVIDIA's Blackwell GPUs, the world's most powerful chips, comprise over 200 billion transistors. source

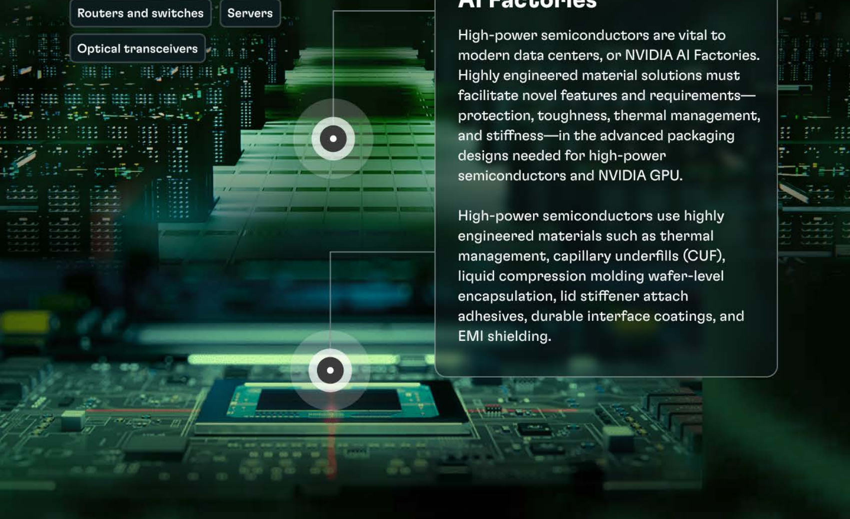
Since 1948, about 13 sextillion (21 zeros or a trillion billion) transistors have been manufactured. source

What's a sextillion? Jeremy Harper counted to a million in 89 days using 16 hours per day. At that pace, it would take more than 243,000,000,000,000 years to count to a sextillion.

AI FACTORIES (DATA CENTERS)

Application

- Routers and switches
- Servers
- Optical transceivers



AI Factories

High-power semiconductors are vital to modern data centers, or NVIDIA AI Factories. Highly engineered material solutions must facilitate novel features and requirements—protection, toughness, thermal management, and stiffness—in the advanced packaging designs needed for high-power semiconductors and NVIDIA GPU.

High-power semiconductors use highly engineered materials such as thermal management, capillary underfills (CUF), liquid compression molding wafer-level encapsulation, lid stiffener attach adhesives, durable interface coatings, and EMI shielding.

Top 5 challenges in AI Factories

Power density and heat can create reliability issues

Wafer-level handling of large, thin dies can create warpage and cracking

Larger packaging gaps must be properly filled to ensure robust performance

Unstable packages can decrease operational yields

Complex assembly and integration can hinder productivity

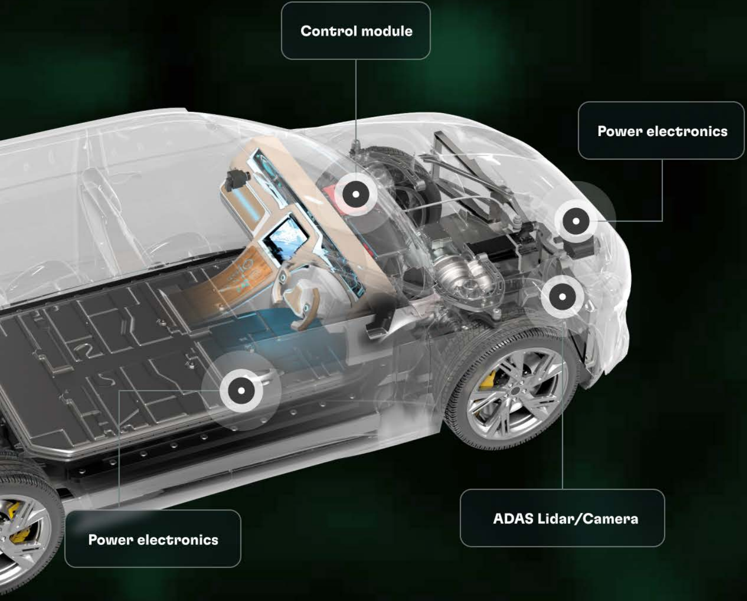
TRADITIONAL, ELECTRIC, AND AUTONOMOUS VEHICLES

Semiconductors are at the heart of electric vehicles (EV), autonomous vehicles (AV), and essential elements in traditional internal combustion engine (ICE) automobiles. The devices enable operation and improve safety, performance, and comfort. In addition, the NVIDIA DRIVE platform is paving the way for AVs and the creation of autonomy at scale with high-performance AI computing and the supporting infrastructure.

An average **ICE car has about 1500 semiconductor chips** while an average electric vehicle with **L3 automation has at least 3,000 chips.**

Application

- Advanced driver assistance systems (ADAS): sensors, cameras, connectivity
- Vehicle-to-everything (V2X) connectivity
- Power steering
- Engine control units (ECU)
- Automotive displays



Top automotive semiconductor challenges

- Power density and power conversion efficiency
- Denser packaging and thermal management
- Manufacturing complexity and costs
- Longer reliability and automotive-grade solutions
- Application sophistication and application-specific solutions

5G, WI-FI, AND TELECOMMUNICATIONS

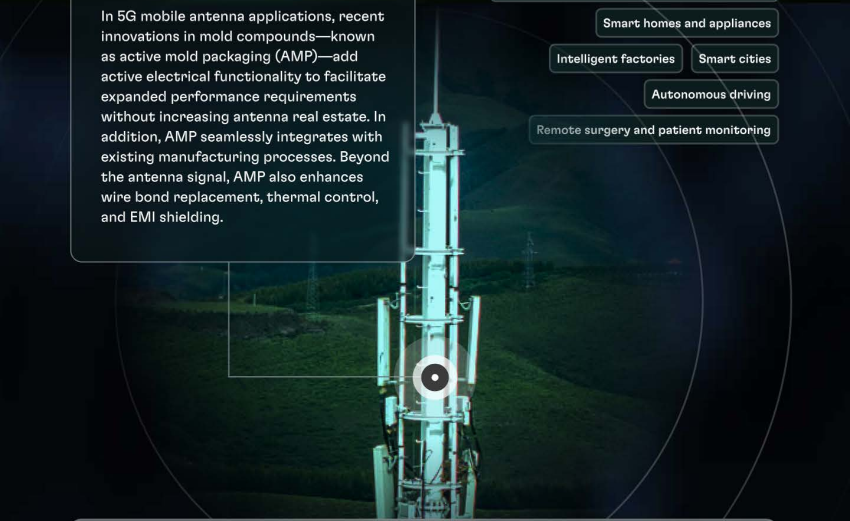
5G, 6G, and Wi-Fi technology must now support AI at low latency while maintaining a high quality of service. This requires a new class of reliable, responsive, AI-powered broadband capability that, in turn, requires innovative, highly engineered materials for semiconductors in base station devices: high thermal die attach sintering materials to manage the heat from greater power density; underfill materials fortify functionality and reliability in denser packaging; encapsulants boost durability in challenging environmental conditions.

5G mobile antenna

In 5G mobile antenna applications, recent innovations in mold compounds—known as active mold packaging (AMP)—add active electrical functionality to facilitate expanded performance requirements without increasing antenna real estate. In addition, AMP seamlessly integrates with existing manufacturing processes. Beyond the antenna signal, AMP also enhances wire bond replacement, thermal control, and EMI shielding.

Application

- 5G base stations (radio frequency technology)
- Smart homes and appliances
- Intelligent factories
- Smart cities
- Autonomous driving
- Remote surgery and patient monitoring



Top 5 challenges in 5G, WI-FI, and telecommunications

- Power density and device size
- Data loads and energy efficiency
- Processing and transmit speeds and complex signal processing
- Resistance to environmental conditions
- Stable, fast and reliable signals

Summary

Semiconductors are the essential elements that power our world. As NVIDIA leads the global AI revolution, Henkel stands ready to deepen our partnership, providing supply chain reliability, advanced thermal management, and collaboration to solve emerging challenges.

As global partners, NVIDIA and Henkel are better together, pioneering accelerated computing to advance possibilities for industries, communities, and humankind.

Please visit: nvidia.henkel-adhesives.com