The Data Explosion

Contributing Factors and Test Solutions

By 2025, it is predicted 463 exabytes of digital data will be created around the world every day. It's an almost unimaginable number, with a single exabyte containing 1018bytes. This data explosion is being mostly driven by new technologies such as artificial intelligence, 5G, streaming media, the internet of things (IOT), data encryption, and virtual meetings.

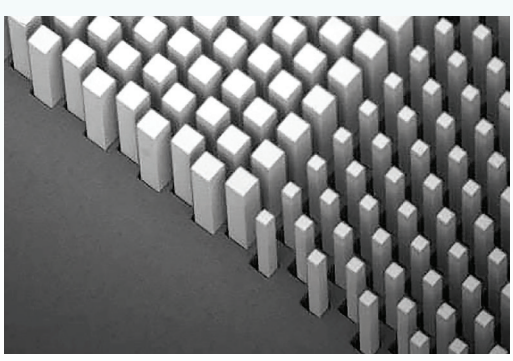
At some point, most of these bytes flow through a data center of some kind. Perhaps the most dramatic example is the emergence of the hyper-scale data center, which illustrates both the promise and problems of handling this surging global data flow. In the process, such centers consume vast amounts of energy. As a result, some projections estimate that global data generation and traffic will consume more than 10% of the planet's power output by 2030.

Semiconductor Technology Innovation Providing Progress.

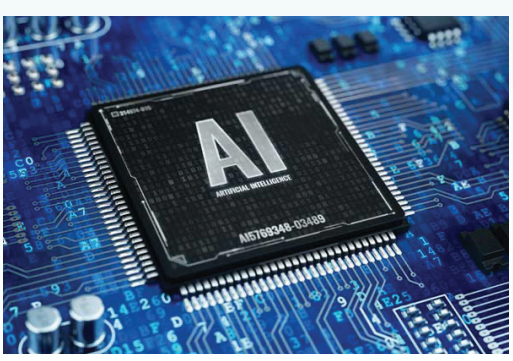
Fortunately, several innovative technologies now aim directly at optimizing data center performance in terms of both throughput and energy efficiency. The reduction of on-chip feature sizes for more efficient transistor switching, now at the 7nm and 5nm technology nodes, reduces chip power while simultaneously increasing speed Advanced packaging technologies for 2.5D and 3D ICs, such as high bandwidth memory (HBM) and heterogeneous integration, reduce interconnect lengths to further contribute to speed and energy efficiency. When combined, they enable faster processing coupled with reduced energy consumption—up to 90% less than older generation chips.

FormFactor Providing Test Solutions for New Technologies.

FormFactor's test technology leadership enables the development and high-yield production of the latest generations of semiconductors. We continue to enhance our MEMS probe technology that provides very large numbers of contacts (hundreds of thousands of probes across a 300mm wafer surface) on wafer pad and bump diameters as small as 25 µm, each potentially carrying currents of more than one amp. To achieve these breakthroughs, we formulate special metal alloys that resist extreme heat and pressure, carefully tune the probe force, and utilize robotics to precisely place each probe on the card. CPUs for AI applications especially demand these advanced capabilities.

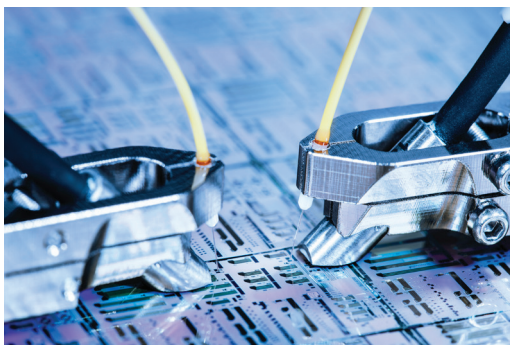


Hybrid MEMS probing technology for high bandwidth memory

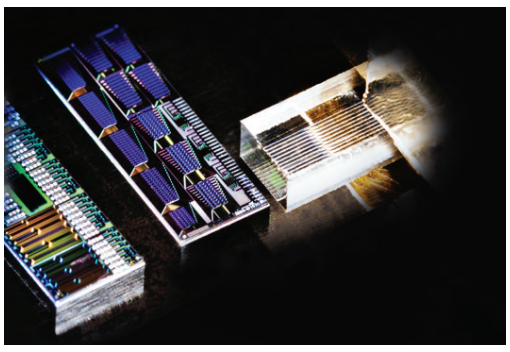


Artificial Intelligence CPU testing requires probes with special alloys which resist extreme heat and pressure

We're also facilitating the industry shift from copper cabling to fiber optics, which can send and receive data with a 98% energy reduction, while significantly increasing the transmission distances. A technology called silicon photonics has turned fiber optic cabling into a viable alternative by placing the electron/photon interface on a silicon substrate, which can be manufactured in volume at low cost. To help make it possible, we developed an innovative probe solution that delivers precise testing of the optoelectronic interface to assure proper performance.

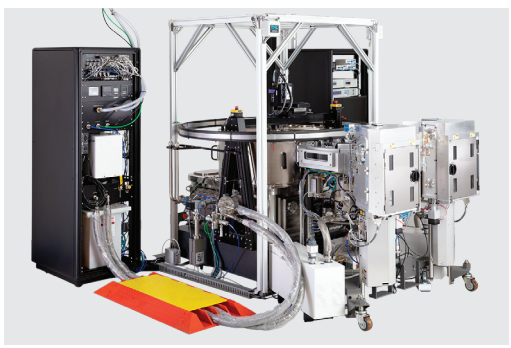


Silicon Photonics wafer-level vertical coupling

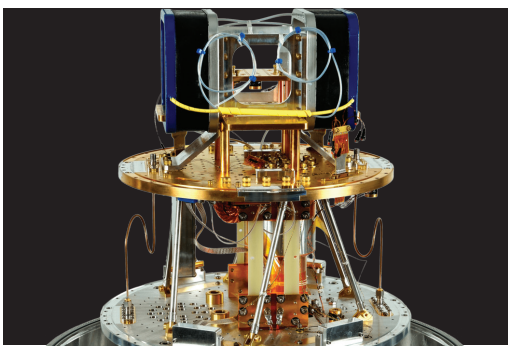


Silicon Photonics horizontal die-level coupling

Looking to the future, we see quantum computing and cold logic development in full steam and their eventual migration into data centers, where they promise to combine massive processing power with very low energy consumption. Quantum technologies operate at ultra-low temperatures, and we're already responding with sub-Kelvin cryostats and automated cryogenic wafer probe systems (link to quantum) dedicated to closing the gap between classic computing and the quantum world.



The HPD 4 K Cryogenic Wafer Prober



FormFactor provides a broad line of chip-scale cryogenic probe systems and cryostats

At FormFactor, we're committed to doing our part in keeping data centers a step ahead of the remarkable flood of data that now envelops the globe. **For more details please visit https://www.formfactor.com/testexpertise/dataexplosion**

FormFactor™
Test insight from lab to fab.

LEARN MORE