

Researchers produce industry's first 7nm node test chips

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Dr. Michael Liehr (left) of SUNY Polytechnic Institute's Colleges of Nanoscale Science and Engineering and Bala Haran (right) of IBM Research inspect a wafer comprised of 7nm (nanometer) node test chips in a clean room in Albany, NY. IBM Research, working with alliance partners at SUNY Poly CNSE, has produced the semiconductor industry's first 7nm node test chips with functional transistors. Credit: Darryl Bautista/Feature Photo Service for IBM

An alliance led by IBM Research today announced that it has produced the semiconductor industry's first 7nm (nanometer) node test chips with functioning transistors. The breakthrough, accomplished in partnership with GLOBALFOUNDRIES and Samsung at SUNY Polytechnic Institute's Colleges of Nanoscale Science and Engineering (SUNY Poly CNSE), could result in the ability to place more than 20 billion tiny switches—transistors—on the fingernail-sized chips that power everything from smartphones to spacecraft.

To achieve the higher performance, lower power and scaling benefits promised by 7nm [technology](#), researchers had to bypass conventional semiconductor manufacturing approaches. Among

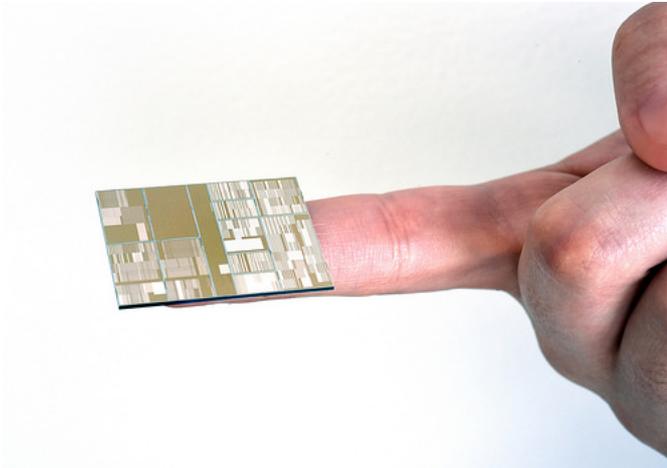
the novel processes and techniques pioneered by the IBM Research alliance were a number of industry-first innovations, most notably Silicon Germanium (SiGe) channel [transistors](#) and Extreme Ultraviolet (EUV) lithography integration at multiple levels.

Industry experts consider 7nm technology crucial to meeting the anticipated demands of future cloud computing and Big Data systems, cognitive computing, mobile products and other emerging technologies. Part of IBM's \$3 billion, five-year investment in chip R&D (announced in 2014), this accomplishment was made possible through a unique public-private partnership with New York State and joint development alliance with GLOBALFOUNDRIES, Samsung, and equipment suppliers. The team is based at SUNY Poly's NanoTech Complex in Albany.

"For business and society to get the most out of tomorrow's computers and devices, scaling to 7nm and beyond is essential," said Arvind Krishna, senior vice president and director of IBM Research. "That's why IBM has remained committed to an aggressive basic research agenda that continually pushes the limits of semiconductor technology. Working with our partners, this milestone builds on decades of research that has set the pace for the microelectronics industry, and positions us to advance our leadership for years to come."

Microprocessors utilizing 22nm and 14nm technology power today's servers, cloud data centers and mobile devices, and 10nm technology is well on the way to becoming a mature technology. The IBM Research-led alliance achieved close to 50 percent area scaling improvements over today's most advanced technology, introduced SiGe channel material for transistor performance enhancement at 7nm node geometries, process innovations to stack them below 30nm pitch and full integration of EUV lithography at multiple levels. These techniques

and scaling could result in at least a 50 percent power/performance improvement for next generation mainframe and POWER systems that will power the Big Data, cloud and mobile era.

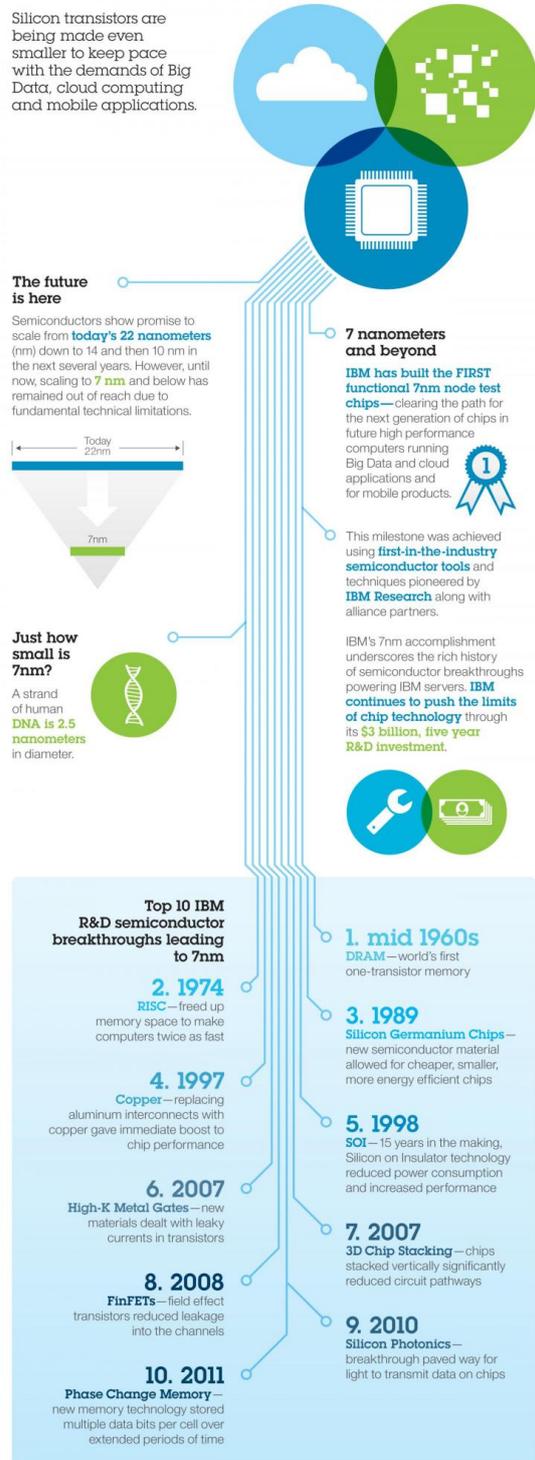


Close up of IBM 7nm node test chip produced at SUNY Poly CNSE in Albany, NY. Credit: Darryl Bautista/Feature Photo Service for IBM

"Governor Andrew Cuomo's trailblazing public-private partnership model is catalyzing historic innovation and advancement. Today's announcement is just one example of our collaboration with IBM, which furthers New York State's global leadership in developing next generation technologies," said Dr. Michael Liehr, SUNY Poly Executive Vice President of Innovation and Technology and Vice President of Research. "Enabling the first 7nm node transistors is a significant milestone for the entire [semiconductor industry](#) as we continue to push beyond the limitations of our current capabilities."

IBM pushing limits of chip technology to 7 nanometer and beyond

Silicon transistors are being made even smaller to keep pace with the demands of Big Data, cloud computing and mobile applications.



Beyond 7 nanometers, the challenges dramatically increase, requiring new types of materials to power systems of the future. IBM is exploring new materials such as **carbon nanotubes**, and non-traditional computational approaches such as **neuromorphic computing** and **quantum computing**.

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Credit: IBM

The 7nm node milestone continues IBM's legacy of historic contributions to silicon and semiconductor innovation. They include the invention or first implementation of the single cell DRAM, the Dennard Scaling Laws, chemically amplified photoresists, copper interconnect wiring, Silicon on Insulator, strained engineering, multi core microprocessors, immersion lithography, high speed SiGe, High-k gate dielectrics, embedded DRAM, 3D chip stacking and Air gap insulators.

Provided by IBM

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