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DIGITAL
ALTERNATIVE THINKING ABOUT INVESTMENTS

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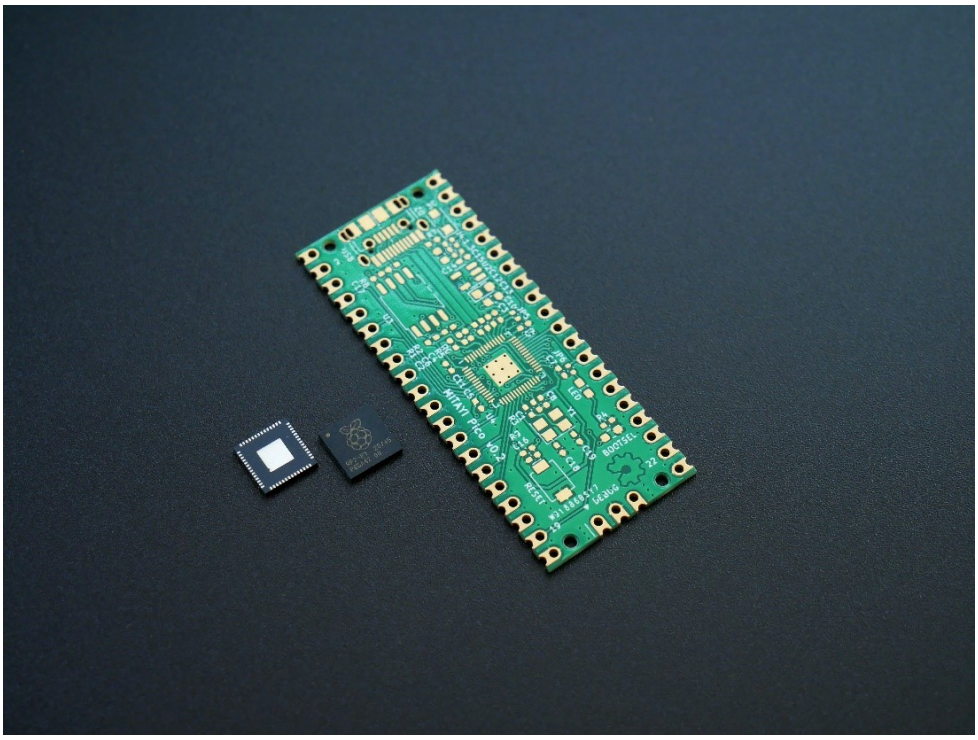
Exponential Software Requires Exponential Hardware



Q1 Macro Review

The Federal Reserve's 9th consecutive rate hike contributed to stresses in the banking system, leading to the closure of regional banks, a forced takeover of Credit Suisse, and private market panic as emerging technology startups feared losing access to their deposited funds. In short, March was a volatile month for the capital markets. Investors anticipate at least one more interest rate increase from the Federal Reserve at its meeting in May. The global downturn has affected every industry, but the Nasdaq-100 (NDX), home to some of the largest technology companies, topped the majors in March with a total return of 9.5%. The NDX experienced its best first quarter since 2012, rising 20.8%.[1]

Additionally, of the large-cap S&P 500 sectors, the Technology sector increased by 21.8% in Q1, driven by the semiconductor sector.[2] Meanwhile, the enthusiasm surrounding emerging technologies, like artificial intelligence, has held firm as market

uncertainty looms.

Computing Infrastructure: Semiconductors

The physical parts of a computer system responsible for processing, storing, and transferring data are called computing infrastructure or hardware. Some of these parts are the central processing unit (CPU), memory, storage, input/output, and communication interfaces. Depending on its intended application and capabilities, computing hardware can be divided into personal computers, servers, embedded systems, and supercomputers. New software depends on ever-more sophisticated and efficient hardware.

Electronic components, including transistors, diodes, and integrated circuits, can be made from semiconductors because of their electrical properties. Semiconductors are widely used in today's computing systems to create electronic circuits that carry out a variety of tasks, such as amplification, switching, and logic operations. Semiconductors are made utilizing intricate fabrication techniques, including photolithography, etching, and doping, and are composed of silicon, germanium, and gallium arsenide.[3] As technology develops, computing hardware and semiconductors advance, enabling new applications like artificial intelligence and big data analytics. The combination of computing hardware and semiconductors has enabled the development of robust and versatile computer systems that can perform complex computations, store and retrieve enormous amounts of data, and communicate with other devices over networks.

McKinsey & Company recently released a report titled "Artificial-intelligence hardware: New opportunities for semiconductor companies." The report reviews the prospects that the growing artificial intelligence (AI) hardware market offers to semiconductor manufacturers. The market for AI hardware is still in its infancy, but it is anticipated to expand dramatically over the next few years, estimated to reach $34 billion in revenue by 2025.[4]

The AI hardware market is expanding as a result of several significant trends. The rising need for devices with AI capabilities across various sectors, including healthcare, manufacturing, and retail, is one of the key motivators. These devices require specialized hardware that can handle the requirements of AI algorithms, including high-speed processing, low-latency memory access, and efficient power consumption.[5] As a result, there is a demand for specialized AI chips and processors that can be integrated into these devices.

Another tailwind for specialized hardware is the rise of edge computing, which processes data locally on devices rather than transferring it to the cloud, enabling real-time data processing and lower latency. As a result, edge devices ranging from cars, cameras, drones, and robots could integrate hardware compatible with increasingly complicated algorithms. These factors and others have driven innovation in the semiconductor industry, with companies investing in research and development to create advanced AI hardware. For instance, some businesses are investigating using neuromorphic computing, which imitates the composition and operation of the human brain.

Unrealized Opportunities

There is still much-untapped potential for semiconductor innovation in addition to these developments. For example, there is a substantial need for private investment in Research & Development and knowledge in machine learning and data science due to the complexity of AI algorithms and applications. In addition, performance and power

consumption must be balanced. AI algorithms can be quite computationally intensive, consuming much energy and producing heat. Due to the importance of power consumption in edge devices, this can be particularly difficult. As a result, semiconductor companies will need to develop hardware that can balance performance with energy efficiency, which is not an easy feat.

Meanwhile, deglobalization, or the lessening of global interconnectedness, has increased due to factors such as escalating geopolitical tensions, trade protectionism, and supply chain vulnerability concerns. Nation-states are striving to improve regional self-sufficiency in various fields, including trade, manufacturing, and supply chains, and the impact of deglobalization on the semiconductor industry has yet to be fully realized. Historically the industry has benefited from globalization, with the ability to leverage global supply chains to reduce costs, improve efficiency, and reach new markets. However, geopolitical unrest and trade restrictions may create new barriers to accessing key markets and securing the necessary manufacturing inputs. In addition, nations seeking to reduce their dependencies on foreign suppliers may also create new opportunities for investments in local talent, manufacturing operations, and R&D capabilities. Overall, the deglobalization trend will likely create opportunities and challenges for the semiconductor industry. One prevalent view is that semiconductors innovation is not just a matter of economic and technological rewards but also has vast implications for a geopolitical and national security framework, potentially creating a modern "arms race" leading to rapid innovation congruent with emerging software technology developments.

In Morgan Creek Digital's view, the rapid evolution and investment in emerging technologies and their underlying infrastructure create potential opportunity. We will continue to monitor trends in emerging technology sectors and the macroeconomic conditions influencing the research and development of exponential hardware for the digital age.

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[1]https://www.nasdaq.com/articles/march-first-quarter-2023-review-and-outlook
[2]Ibid.
[3]https://www.universitywafer.com/semiconductor-fabrication-process.html
[4]https://www.mckinsey.com/industries/semiconductors/our-insights/artificial-intelligence-hardware-new-opportunities-for-semiconductor-companies
[5]https://www.mckinsey.com/industries/semiconductors/our-insights/artificial-intelligence-hardware-new-opportunities-for-semiconductor-companies

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