Spintronics - Market Share Analysis, Industry Trends & Statistics, Growth Forecasts 2019-2029

Market Report | 2024-02-17 | 116 pages | Mordor Intelligence

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Report description:

The Spintronics Market size is estimated at USD 1.49 billion in 2024, and is expected to reach USD 7.03 billion by 2029, growing at a CAGR of 36.43% during the forecast period (2024-2029).

Key Highlights
-Spintronics studies the intrinsic spin of the electron and its associated magnetic moment in solid-state devices, in addition to its fundamental electronic charge. Spintronics is the driving technology behind next-generation nano-electronic devices to increase their memory and processing abilities while reducing power consumption. In these devices, the spin polarization is controlled by magnetic layers or spin-orbit coupling. The current application of spintronics is in the read/write heads of the hard disk drives used in computers and portable music players.
-Furthermore, a notable impact of the pandemic has been observed on the market as various containment measures were taken by governments across multiple countries, such as lockdowns, which significantly impacted the growth of the industrial sector. As a result, a slowdown was witnessed in the studied market, especially during the initial phase. However, the scenario expanded the scope of the market studied as enterprises like data centers and cloud computing witnessed a surge in demand and adoption.
-The contemporary data revolution has, in part, been fostered by decades of research into magnetism and spin phenomena. For instance, milestones such as the observation of giant magnetoresistance and the resulting evolution of the spin-valve read head continue to motivate device research. However, the ever-increasing need for higher data processing speeds and more extensive data storage capabilities has significantly increased energy consumption and environmental concerns. Therefore, ongoing research and development in spintronics should reduce energy consumption while increasing information processing capabilities. This is crucial as data storage capacity continues to increase, leading to a corresponding increase in energy consumption.
-Spintronics can enhance computing performance by enabling faster and more energy-efficient logic operations. Spintronics devices like spin-based transistors and spin logic gates have the potential to overcome the limitations of traditional CMOS

(complementary metal-oxide semiconductor) technology and enable high-speed, low-power computing.
-This demand is fueled by several factors, including the growing penetration of 5G networks. The deployment of 5G networks requires higher data transfer speeds to support the increased bandwidth and connectivity demands. Spintronics technology can enable faster data transfer rates, making it suitable for 5G applications.
-The easy availability of substitute technologies and materials is one of the significant challenges in the market studied. The spintronics market is still in its nascent stage and faces challenges at both the system and device levels that need to be addressed to integrate spintronic materials and functionalities into mainstream microelectronic platforms.
-The spintronics market is in its nascent stage, in which a significant portion of the market is still highly dependent on research and technological innovations. Moreover, the supply side of the market was affected in the initial phase of COVID-19 due to nationwide lockdowns and factory closures across the world. However, the scenario expanded the scope of the market studied as industries like data centers and cloud computing witnessed a massive surge in demand and adoption.

Spintronics Market Trends

Semiconductor-based Devices are expected to Witness Major Growth

- According to the Semiconductor Industry Association (SIA) and WSTS, 2023 semiconductor sales were expected to reach USD 515.1 billion worldwide. Semiconductors are crucial components of electronic devices, and the industry is highly competitive. The year-on-year decline rate in 2023 was 10.3 percent, although a swift recovery is expected in 2024. The growing semiconductor industry is expected to aid the studied market's growth.
- Spin diode, spin filter, and spin field-effect transistor are considered for the market study. A spin diode is a semiconductor device that can measure the current flow in an electrical circuit. Several trends are shaping the spin diode industry. In the case of memory applications, spin diodes are being explored and offer potential advantages in terms of their nonvolatility, speed of access to power, and energy savings.
- Spin filters play an essential role in different applications in spintronics, which uses electron spin to perform information processing, storage, and manipulation. These instruments are vital for generating, modifying, and measuring spin-polarized currents, making them a fundamental element in spintronic technology's evolution.
- Currently, spin filter devices based on quantum dots are gaining traction. Adhering to this, in January 2023, an international team of scientists demonstrated a leap in preserving the quantum coherence of quantum dot spin qubits as part of the global push for practical quantum networks and quantum computers. The application of these technologies will transform many industries and research efforts, from the safety of information transfer to the search for materials or chemicals with new properties, such as measurements of fundamental phenomena that require accurate time synchronization between sensors.
- According to the American Institute of Physics, high spin-injection-efficiency (SIE) and thermal spin-filter-effect (SFE) from a magnetic material to a barrier material are crucial to the high performance of a spintronic device and a spin caloritronic device, respectively.
- Spin field effect transistors (Spin-FET) are an iconic spintronic device class exploiting gate-tuned spin-orbit interaction in semiconductor channels interposed between the ferromagnetic source and drain contacts to elicit transistor functionality. Recently, a novel type of spin-FET has been suggested. It could lead to exciting analog applications such as frequency multiplication due to its unique oscillatory transfer characteristics in the form of gate-tuned strain on quantum materials.

Asia Pacific is Expected to Hold a Major Market Share

- An increase in the number of research activities related to spintronics, global dominance in semiconductor manufacturing,

foundries, and lead in global industries such as electronic product manufacturing are some of the major factors expanding the scope of spintronics technologies in the Asia-Pacific region.
- Countries like China, Japan, Singapore, and South Korea are prominent investors in the market studied due to increasing investments in research related to spintronics technologies. In addition to that, countries like India and others in Southeast Asia are emerging as significant end users for these technologies due to the high level of manufacturing.
- The demand for spintronics is on the rise for the region, owing to the rising demand for scientific, industrial, and medical applications. The major market players are trying to expand their business in other regions to increase their market share and profitability. For instance, in August of 2023, scientists at S.N. Bose National Centre for Basic Sciences, India, developed the first-of-its-kind 2D Composite Quantum Material that exhibits the exotic quantum property of Rashba splitting, which is useful for Spintronic devices such as Spintronic transistors & Diodes. The material can interface with 2D substrates (Graphene, for example) in Spintronic Devices such as Spin Transistors, Spin Diodes, and Spin Filters that exploit the quantum property of electron spin for higher performance.
- Moreover, The semiconductor industry in the Asia-Pacific region is majorly driven by China, Japan, Taiwan, and South Korea, which together constitute around 35% of the global semiconductor market revenue. South Korea has more than 20,000 semiconductor-related companies, including 2650 semiconductor equipment enterprises, 4078 semiconductor material enterprises, and 369 IC manufacturing enterprises. The estimated growth of the electronic industry in the Asia-Pacific region is higher compared to other regions.

Spintronics Industry Overview

The spintronics market is marked by continual product penetration, limited product distinction, and intense competition. Innovation plays a pivotal role in securing a competitive edge. Notably, key market players like Avalanche Technology, Everspin Technologies Inc., Synopsys Inc., NVE Corporation, and Crocus Technology Inc. (Allegro Microsystems, Inc.) have secured funding to bolster their product innovation in recent years.

In June 2023, Crocus Technology introduced the CT40x, a groundbreaking current sensing solution that redefines current sensing in dynamic, high-demand environments. With exceptional performance and accuracy, it caters to both contact and contactless current sensing applications, seamlessly integrating into diverse power systems. The CT40x TMR sensor ensures uncompromised performance compared to traditional Hall and MR alternatives, facilitating widespread adoption of TMR technology across the market.

In May 2023, NVE expanded its range of smart magnetometers by unveiling the SM223, a high-sensitivity variant of its tunnel magnetoresistance (TMR) smart magnetometers. The heightened sensitivity of this new component enables more precise position control for enhanced robotics and finer current measurement for more efficient motors.

Additional Benefits:

- The market estimate (ME) sheet in Excel format
- 3 months of analyst support

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