

LUCINTEL INSIGHT
JULY 2021

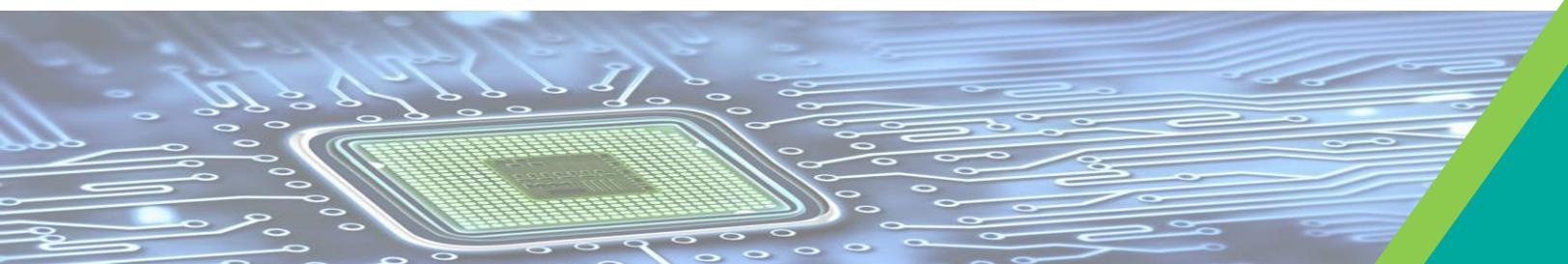
EIGHT TRENDS SHAPING THE FUTURE OF THE SEMICONDUCTOR MARKET

Semiconductors can be found in virtually every electronic product made today, from toys to automobiles, from cell phones to supercomputers. We are in an ever-changing era of an increasingly rapid digital transformation in societies around the globe. This is an era where the world is experiencing explosive growth, expansion, and proliferation of electronically enabled technologies. The exponential introduction of new, game-changing products and electronically

enabled capabilities is being made possible by steady advances in semiconductor technology. Key among those paradigm-shifting events are the rise of artificial intelligence and the launch of next-generation wireless cellular technology, increased use of electronics in automobiles, improvements in smartphones, and others. These game-changing improvements and advances in products impact and are impacted by the advances in the semiconductor design and manufacturing industry.

However, it is important to note that the semiconductor industry is not a monolith. The semiconductor industry is divided into segments of integrated circuits, optoelectronics, sensors, and discrete semiconductors. While there are numerous small entities capable of making semiconductor devices, including larger and smaller universities, and the fab houses ranging from those of smaller to massive wafer producers such as TSMC in Taiwan. Key players in the semiconductor market on the product development side include such powerhouses as Samsung Electronics, Intel, SK Hynix, Micron Technology, and Broadcom, all of which have been working on different strategies to drive sales using highly influential marketing approaches; however, as we examine the challenges and opportunities ahead in this market, companies can benefit from a strategy of developing capabilities in the miniaturization of electronic components, along with their heterogeneous integration, to drive toward the key target market trends we have identified. Lucintel predicts the global semiconductor market will be valued at \$501.8 billion by 2025, with an expected CAGR of 2% to 4% between 2020 and 2025.

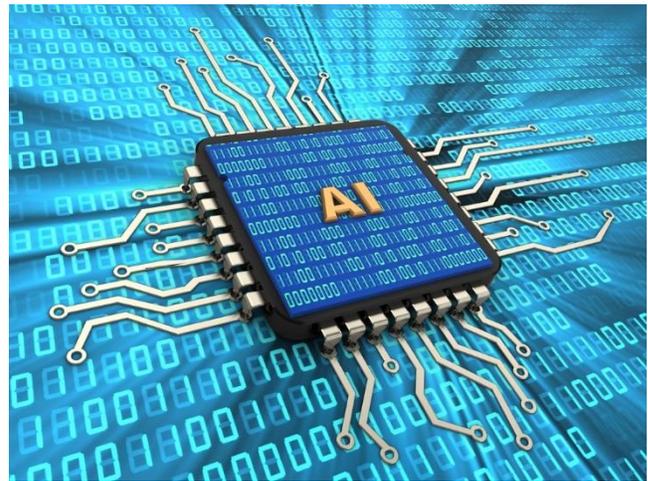
Lucintel identifies eight trends set to influence the global semiconductor market. Most of the industry players and experts agree that these eight trends will accelerate developments in the semiconductor industry in the near future. In terms of the widespread knowledge about the semiconductor industry already on the horizon, there is still a lack of unified perspective on the direction the industry is moving to proactively address developments. To help bring more clarity to this gap, our study aims to provide insights concerning the direction that changes are taking and how these changes will impact the semiconductor market.



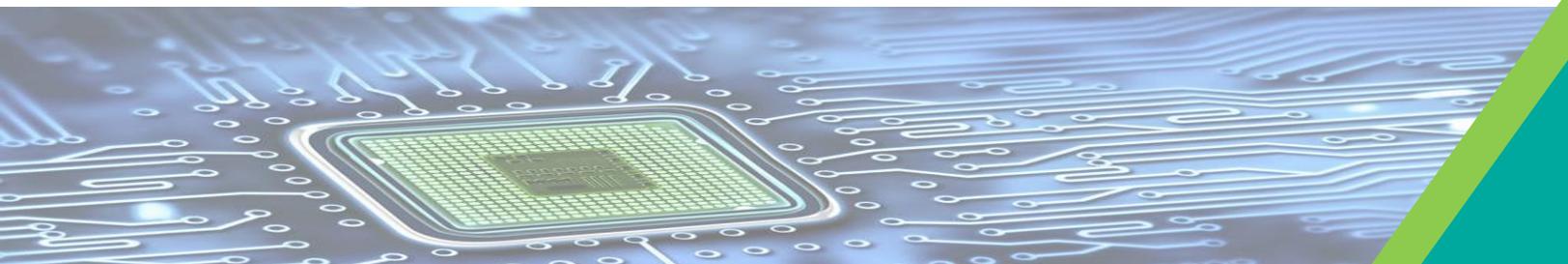
1. Emergence of Artificial Intelligence

Achieving artificial intelligence (AI) has been a stated objective of the computer industry almost since the industry's inception. Artificial intelligence is the ability of machines to perform functions associated with observing, thinking, and learning. AI can take the form of programs or toolkits that help a system behave intelligently.

Artificial intelligence is creating various opportunities for the semiconductor industry by speeding up the manufacturing process, boosting chip performance, reducing production cost, and increasing output. The AI integrated memory solution offers 4.5 times higher bandwidth compared to traditional memory. AI enables big data applications to handle vast stores of data. The semiconductor companies are exploring various ranges of AI incorporated chips, and this is accelerating the growth of artificial intelligence in the semiconductor industry.



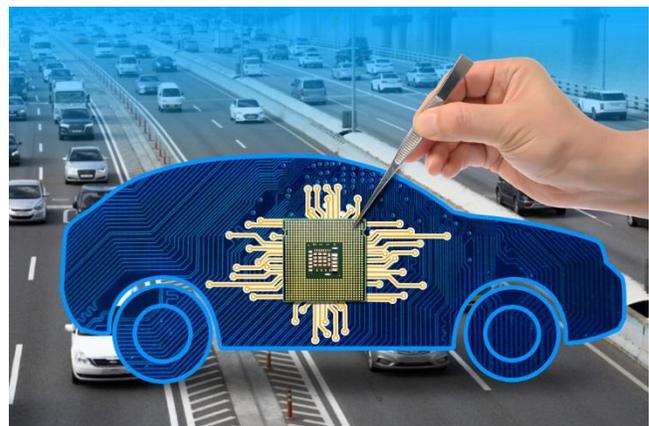
2. Growing Demand for Smartphones and IoT Devices



The ever expanding smartphone market requires innovations and new designs with superior storage space, better display and battery, and flexibility in design and form factors. These innovations must also enable maintenance of form, fit, and function in fashionable design formats. These advancements are made possible by the application of innovative electronic components in smartphones, thus increasing the demand for the semiconductor market. The IoT revolution has not only multiplied the demand for semiconductor chips, but has also shifted the value capture to software and solutions. The use of IoT for automation, tracking and monitoring, and efficient use of resources has increased the demand for new-generation semiconductors. Each IoT device contains small but sophisticated product-embedded microchip designs designed to communicate wirelessly, enabling Industry 4.0. Each IoT device contains sophisticated microchip designs, thus, growth in smart devices and IoT leads to the growth of the semiconductor market.



3. Increasing Electronic Content Automotive



in

The automobile industry has been moving at a steady pace to integrate electronics into cars in innovative ways to augment safety (radar and collision avoidance, automatic braking), infotainment (satellite radio and Bluetooth), navigation (GPS mapping), system monitoring, on-board computers and many more, including in emerging self-driving cars. This has resulted in a significant increase in demand for electronic components. The growing automotive market presents a huge opportunity for automotive semiconductors to support battery performance in EVs, increased connectivity, enhanced sensors, and other technologies. The use of

semiconductor content in electric and hybrid cars is higher compared to that of conventional cars. Hybrid and electric vehicles need high-performance microcontrollers, microprocessors, application-specific integrated circuits, and power MOSFETs.

4. Proliferation of 5G Infrastructure and Devices

Proliferation of 5G and IoT devices in the market will lead to increased demand for high-performance and reliable semiconductor chips.



The projection is that this will result in an increase of one or two orders of magnitude in data rates, enabling an equal increase in the number of connected devices with 5x reduction in latency and up to 100x reduction in power requirements. In addition to this, global data use is expected to increase tenfold and reach ~165 Zettabytes by 2025, as data storage, analysis, and processing will play crucial roles in 5G and IoT infrastructure. This will lead to increased demand for integrated chips (ICs). With new opportunities also come new challenges, and this is also true for 5G services. Working on higher frequencies to ensure higher transmission rates and low latency result in power efficiency problems. Developments in RF power semiconductors using WBG materials like gallium nitride (GaN), silicon carbide (SiC), and gallium arsenide (GaAs) are playing a key role in solving technical challenges posed by 5G.

5. Semiconductors Buoyed Increasing Memory Sales

Memory components represent more than 30% of the total semiconductor market.

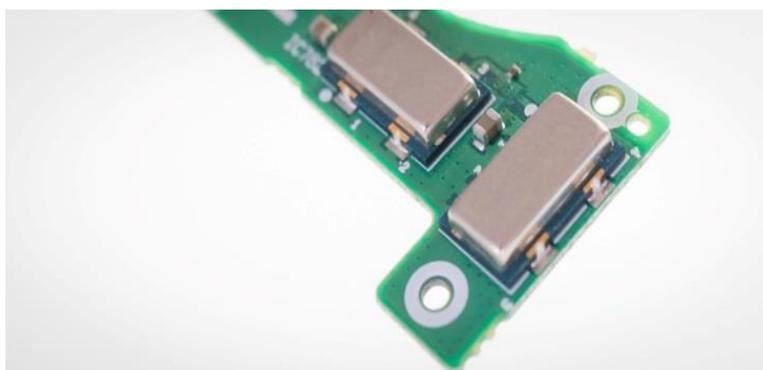


by

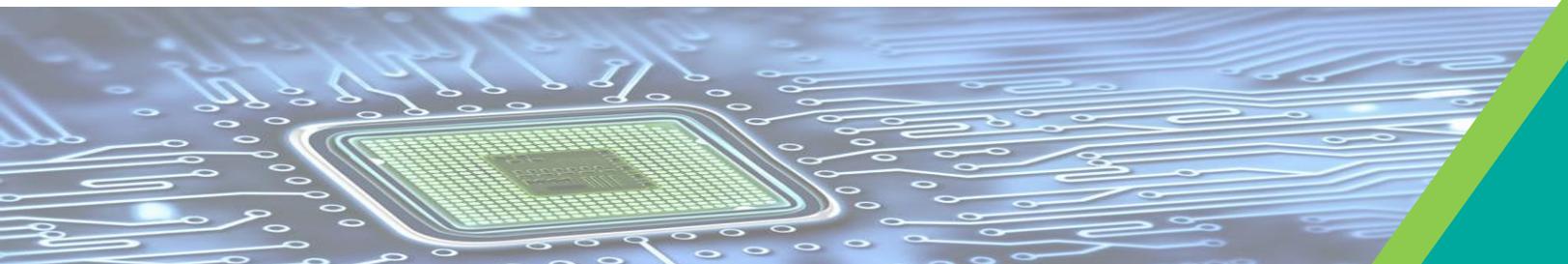
Dramatic growth in memory sales is fueling the semiconductor market and will do the same in future. Increased demand for data storage devices like PCs, laptops, phones, cameras, and commercial IT applications such as datacenters and telecoms driven by various factors including multi-media usage, big data, and virtualization will result in increased demand for semiconductors in general and, specifically, memory components. The emerging non-volatile memory market is expected to grow at a >50% CAGR, driven by the demand for embedded magnetic random-access memory (MRAM) and standalone phase change memory (PCM).

6. Surging Demand for Sensor Fusion Technique

The growing adoption of MEMS as well as the advent of sensor fusion technology will drive the demand for the semiconductor sensor market. MEMS technology, which uses a microfabrication technique to manufacture miniaturized mechanical and electro-mechanical elements, is

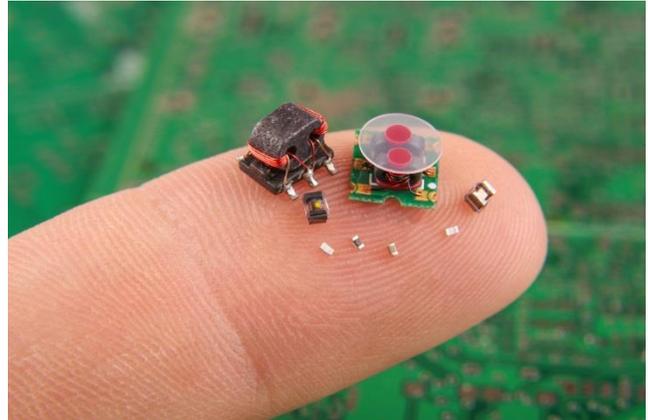


seeing increased adoption, driven by increasing use of miniaturized semiconductor components in consumer electronic devices. Hence we are presently witnessing increased adoption of MEMS due to the increased use of miniaturized semiconductor components in current and future-generation electronics devices. In addition, as the demand for integrating semiconductor sensors in smart electronic devices and systems grows across end user segments, the demand for sensor fusion will rise. This technology provides a highly accurate and reliable view of data and enables smart devices to combine data from various sensors including gyroscopes, compass, and accelerometers to calculate elevation, linear translation, gravity, direction, rotation, and more, including numerous medical applications.



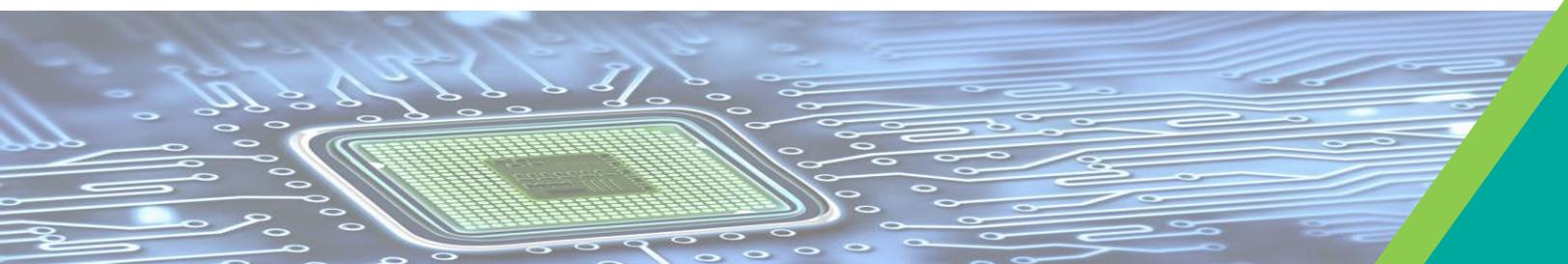
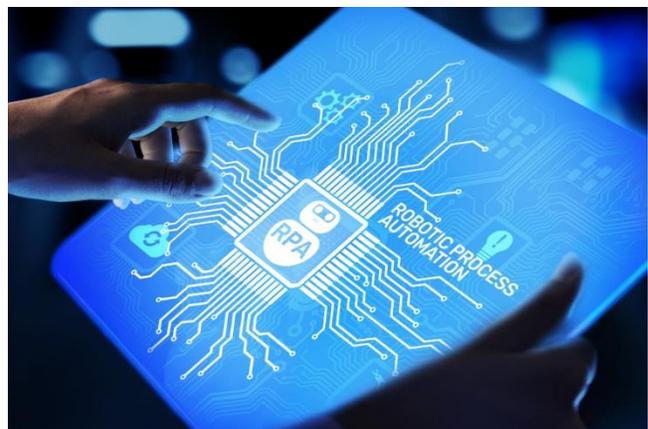
7. Miniaturization of Electronic Devices

Increasing demand for compact electronic devices is fueling the demand for reduced size integrated circuits offering high power and high-speed processing, and this is driving the semiconductor market. The chips in every electronic device have become smaller, more powerful, and cheaper. Small chips equate to transistors with more power, which enables superior performance of electronic devices such as mobile phones and PCs with high operational capabilities and functionality. Miniaturization allows for increased application of electronic devices in every vertical, including automotive, communication, consumer electronics, healthcare, and others. In simple terms, the continuing miniaturization of electronic devices offers low power consumption combined with high performance.



8. Growing Demand for Industrial Automation

Automation is key to higher productivity and reducing the cost of manufactured products. Growing adoption of industrial automation technologies such as industrial robotics, process automation, digital manufacturing, and the industrial internet of things to gain production efficiencies and increase productivity are driving the semiconductor market. Industrial automation includes IoT and artificial intelligence based



devices, which enables communication within the industrial process from logistics to manufacturing. A sensor tracks individual products and creates a digital record. Industry 4.0. industrial automation offers the ability to adjust and learn from data to make the process more responsive, proactive, and predictive.

Strategic Considerations for Key Players in the Semiconductor Market

The semiconductor industry is dynamic and ever-changing. Successful industry players are masters of innovation, change, and adaptation. But to retain this status, they need to be attentive to current trends. We believe there will be promising opportunities for semiconductors in the communication, consumer electronics, automotive, and industrial sectors. As per Lucintel's latest market research report (Source: <https://www.lucintel.com/semiconductor-market.aspx>), the [semiconductor market](#) is expected to grow with a CAGR of 3.4% between 2020 and 2025, and reach \$502 billion by 2025. This market is primarily driven by the growth in wireless communication, increasing demand for advanced safety features in automotive, and continuing growth in the use of internet connected devices.

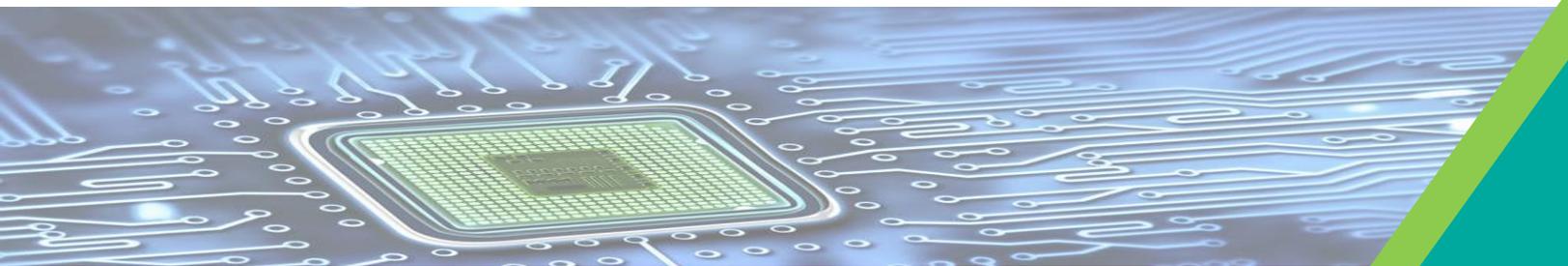
**Trends and Forecast for the Global Semiconductor Market
(US \$B) (2014-2025)**



Source: Lucintel

Whether you are new to the semiconductor market or an experienced player, it is important to understand the trends that impact the development process, as these trends as listed above will lead players to create long-term strategy formulation that will allow them to remain competitive and successful in the long run. For example, to capture growth momentum, semiconductor market players can develop capabilities in RF power semiconductors using WBG materials to solve power efficiency problems; they can also focus on advancements in sensor fusion, evolving non-volatile memory semiconductors, and advanced materials used in semiconductor manufacturing. Players can also focus on artificial intelligence as it speeds up the manufacturing process, and boost the performance of the chip, which is expected to lead future trends.

Note: In order to gain better understanding, and learn more about the scope, benefits, and companies researched, as well as other details in the semiconductor market report from Lucintel, click on <https://www.lucintel.com/semiconductor-market.aspx>. This comprehensive report provides you in-depth analysis on market trends and forecast, segment analysis, regional analysis, competitive benchmarking, and company profiling of key players. In addition, we also offer **strategic growth consulting** to meet your customized needs. We have worked with many PE firms and corporate customers in the process of their market entry and M & A initiatives.



Lucintel - At a Glance

- Premier management consulting and market research firm. Founded in 1998.
- Deep global insights into major industries. Team of over 120 analysts / consultants across globe
- Management comprised of PhDs, MBAs, and subject matter experts. Head quarter in Dallas, USA.

Conducted 500+ consulting projects across industries for 3M, Audi, Dupont, Carlyle, GE, etc.

Consulting Services



Why Lucintel

Trusted insights: Reliable insights. Widely cited in Wall Street Journal, Financial Times, Forbes, etc.

Clients we serve: Over 1000 clients from 70 countries – Fortune 500 companies

Strategic advice: Over 20 years of proven global strategic management consulting experience

Industries Served



Contact Us



Sanjay Mazumdar, Ph.D.

CEO, Author, & Strategist

Email: sanjay.mazumdar@lucintel.com

Tel.: 972-636-5056



Eric Dahl, MBA, Harvard University

Senior Executive Advisor

Email: eric.dahl@lucintel.com

Tel.: +1-323-388-6971



Brandon Fitzgerald

Director of Client Engagement

Email: brandon.fitzgerald@lucintel.com

Tel.: +1-303-775-0751



Nigel O'Dea

Business Development Manager

Email: nigel.odea@lucintel.com

Tel.: +44 (0) 7413571716