

Industry outlook - Semiconductor business in India

What are Semiconductors and their use?

A semiconductor is a substance that has specific electrical properties that enable it to serve as a foundation for computers and other electronic devices. It is typically a chemical compound that conducts electricity under certain conditions. This makes it an ideal medium to control the flow of electrical current in electronic devices.

A substance that can conduct electricity is called the 'conductor' and a substance that cannot conduct electricity is known as the 'insulator'. Semiconductors have properties that sits between the conductor and insulator. As a result, it is a popular component for computers, laptops and a variety of electronic devices.

Owing to the fact that we live in a digital world today, the need for semiconductors has increased manifold. These chip components are used in almost all the electronic devices whether it is mobile phones, computers, televisions, cars, electrical appliances or any other, thus making semiconductors the linchpin of the electronics industry.

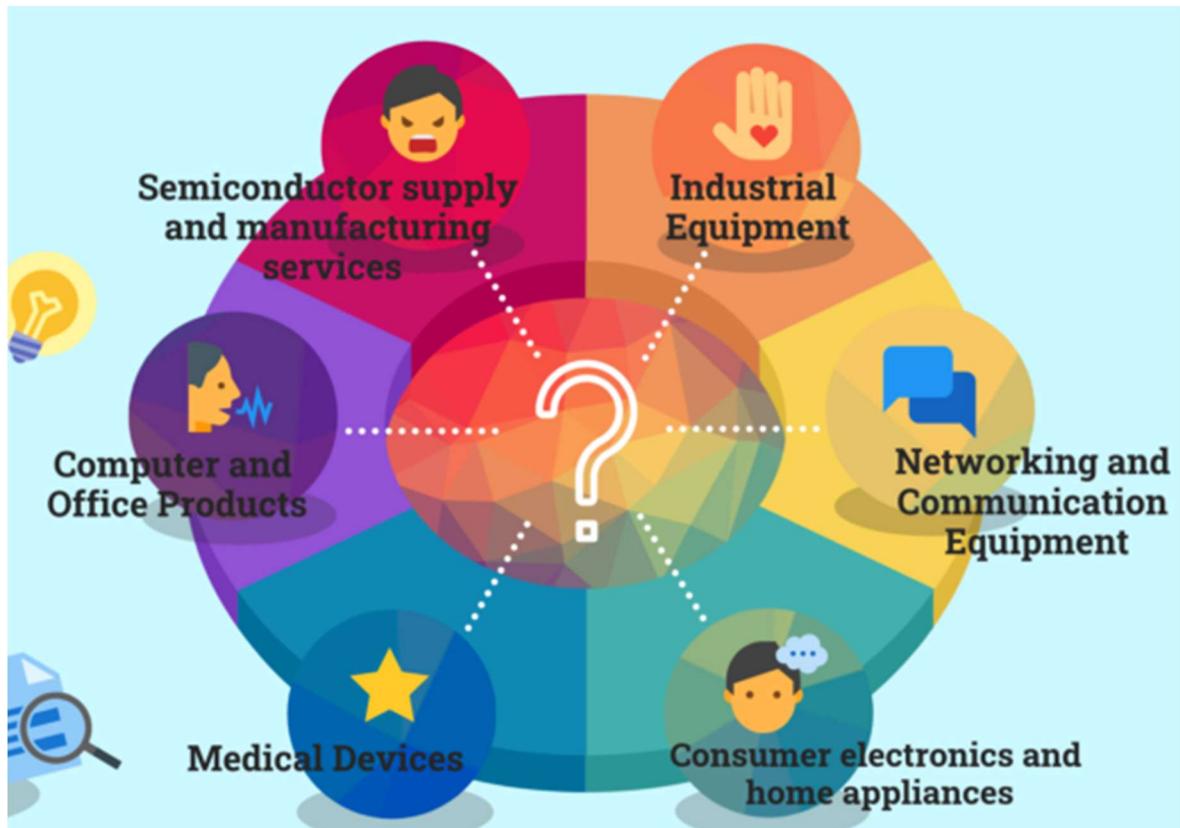


Role of Semiconductors in Electronics industry

The electronics industry is made up of companies that manufacture, design, assemble and service electronic products. Electronic products may range from:

- Components like integrated circuits used in almost all electronic devices
- Consumer electronics such as televisions, smartphones, personal computers and laptops
- Medical equipment such as heart-rate monitors, dialysis machines
- Industrial equipment like artificial intelligence, machines
- Communication and networking equipment like routers and switchboards

Some of the major sectors supported by electronics industry include automobile, aviation, defense, telecommunications, entertainment and healthcare. The electronics industry is driven by innovation and requires substantial capital and skill for research, development, design and manufacture.



Overview of Indian Electronics industry

With per capita disposable income and private consumption having doubled in the past 7 years, India has emerged as one of the largest markets for electronic products globally. The current electronics industry is valued at US\$75 billion compared to US\$10 billion in 2014.

Foreign Direct Investment (FDI) inflows in the sector during April 2000 – September 2022 stood at US\$ 3.71 billion. The global electronics market is estimated to be over US\$2 trillion. India's share therein has grown from 1.3% in 2012 to 3.6% in 2019. Some of the prominent FDI investors in the electronics sector of India are Samsung, Intel, Bosch and Whirlpool.

India's strategy to become a global semiconductor hub

Semiconductors are used in almost all the electronic devices we use today. Being the very foundation of electronic devices, semiconductors play a pivotal role within the electronics industry. Without semiconductors, the technology that we rely on today would not be possible.

It is for the said reason that India's strategy to become a semiconductor hub is closely linked to its ambition of being a major player in the electronics value chain globally.

- India's focus is not limited to manufacture of electronic devices but also manufacture, packaging, design and innovation of semiconductor chips, since these chip components are used in almost all electronic devices
- Developments in semiconductor technology during the past 50 years have made electronic devices smaller, faster, and more reliable. A single semiconductor chip has many transistors. Currently, there are more than 100 billion integrated circuits in daily use around the world
- In 2014, over 92% of the mobile phones were imported in India. However, currently over 97% of the mobile phones are manufactured in India. India has emerged as the 2nd largest mobile phone manufacturer in the world with 126% jump in production from 2021 to 2022
- India had few exports in the electronics manufacture in 2014. At present, India exports electronic equipment worth INR 700 billion, paving the way for manufacture and design of semiconductors in India

The Global Semiconductor industry

United States of America (USA)

Semiconductors were invented in USA it still leads the world in cutting-edge manufacture and design of semiconductors. The semiconductors industry in USA directly employs over 250,000 workers and supports nearly 1.8 million additional jobs within USA.

Semiconductors are amongst the top 5 American export products after airplanes, refined oil and automobiles. Many global companies continue to invest and expand in USA, with the construction of new and expanded state-of-the-art fabrication facilities across the country. Overall, USA based semiconductor companies retain about 50% of global market share in a highly competitive market.

South Korea

Korea's share in global semiconductors market in 2020 was 18.4%, continuing to rank 2nd in the world since 2013. Korean-made semiconductors possess the world's best technology. Korea continues to focus on investment in research and development in order to keep its competitive advantage. In addition, Korea is pushing to expand its semiconductor manufacture market share based on ultra-fine processing technology. Semiconductors are one of Korea's principal export items accounting for 19.3% of total exports as of 2020. The Government of Korea has strong willingness to nurture the growth of semiconductors and foster Korea into a global semiconductor powerhouse.

Taiwan

Taiwan's position in the world of manufacture of semiconductors can be compared to gulf countries in matter of export of oil. The manufacture of advanced chips requires complex software, explosive chemicals, ultra-pure silicon and machines costing billions of dollars. For the past half a decade, Taiwan Semiconductor Manufacturing Corporation (TSMC), a Taiwanese chip making

giant company has been the world’s leader in the field of manufacture of semiconductor chips. TSMC’s engineers undertake innovative methods to pattern semiconductor chips with great accuracy on a large scale.

TSMC has 53% market share of the global foundry market (factories contracted to manufacture chips which are designed in other countries). Other Taiwan-based manufacturers claim another 10% of the market share. USA is heavily dependent on TSMC for manufacture of its leading semiconductor chips due to the fact that only TSMC and Samsung (South Korea) are capable of manufacturing the most advanced semiconductors which are approx. 5 nanometers (nm) in size.

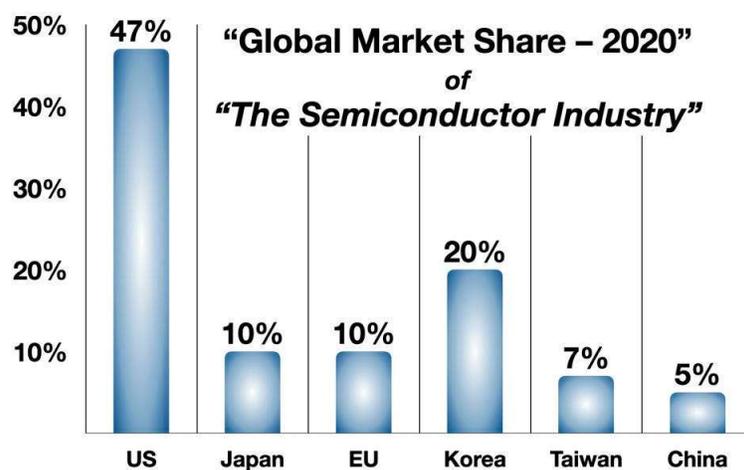
Japan

In the 1980s, Japan was the world’s largest semiconductor producer, accounting for over 50% of global semiconductor production. Currently, Japan accounts for 9% of the global semiconductor production. Although no longer the world’s largest semiconductor market, Japan still retains a high market share and international competitiveness in product groups such as memory and power semiconductors.

Power semiconductors enable the efficient use of electricity and are indispensable devices for electric vehicles (EVs). 5 Japanese companies – Mitsubishi Electric, Fuji Electric, Toshiba, Renesas Electronics and ROHM were ranked among the top 10 power semiconductor companies in terms of sales in 2021. Japanese manufacturers account for approximately 3-6% of the power semiconductor global market.

Europe

The European market accounts for 10% of the entire world semiconductor market. The industrial sector together with high demand for EVs have major impact on the demand for semiconductors in Europe. The Europe industry was ranked as the most research and development intensive industry by the European Commission in 2011 and supports around 200,000 jobs directly and more than 1,000,000 indirect jobs in Europe. The global market size of the semiconductor sector alone was around US\$412 billion in 2019. The impact of micro- and nano-electronics on the whole economy is estimated at 10% of the worldwide Gross Domestic Product (GDP).



Source: Semiconductor Industry Association Factbook, 2021

The Indian Semiconductor industry

The COVID-19 induced lockdowns and restrictions resulted in a shortage of semiconductor chips globally. This was mainly because the semiconductor industry is dominated by few major players. The foundry business, which focuses on the fabrication of semiconductors, is controlled by Taiwanese and South Korean companies, which collectively accounted for over 80% of the global semiconductor market in 2021. As a result, the need to reduce dependence on imported electronics became all the more relevant in 2020, following the outbreak of COVID-19.

India, like the rest of the world, became victim to a semiconductor shortage that disrupted a variety of critical businesses. India's smartphone manufacturing industry, the world's 2nd largest, was hit hard by the unavailability of semiconductor chips. This has fueled India's ambition to become a hub for semiconductors, which are used in a wide range of electronic products.

Accordingly, the Government of India has launched the 'Semicon India Programme' in December 2021 with an outlay of INR 760 billion for the development of semiconductor and display manufacturing ecosystem in India. The Programme aims to provide financial support to companies investing in semiconductors, display manufacturing and design ecosystems.

Mr. Rajeev Chandrasekhar, the Minister of State for Electronics and Information Technology (IT), has highlighted that India is well positioned to emerge as a major player in electronics and semiconductors as part of 'China plus one' diversification strategy. Considering that China has dominated the electronics and semiconductor industry for nearly 2 decades, 'China plus one' is a business strategy to avoid overdependence on China and diversifying businesses into other countries. It started becoming popular in 2018 and gained prominence after the COVID-19 outbreak. The opportunity is huge for India as global electronics and semiconductor industry is currently valued at US\$1.5 trillion.

Factors conducive to making India a Semiconductor hub

- *Huge domestic consumption market*

India, being the world's 2nd largest populated country has a wide consumer base when it comes to electronic products. With the rising per capita disposable income, the consumption of electronic products ranging from mobile phones to laptops to electrical appliances has increased voluminously in India. The Government and corporates are also buying large number of servers for data centers. As a result, demand for semiconductor chips is also increasing simultaneously. India's domestic consumption of semiconductors is expected to cross US\$80 billion by 2026.

- *Availability of skilled talent*

India has large pool of well trained and skilled engineers who are instrumental in undertaking chip design for semiconductors and currently make up 20% of the world's semiconductor design engineers. Almost all of the top 25 semiconductor design companies have their research and development centers in India. The Government of India has recently launched 'Chips to Startups' (C2S) programme that will train 85,000 highly qualified engineers in the area of very large-scale integration (VLSI) and embedded system design over a period of 5 years.

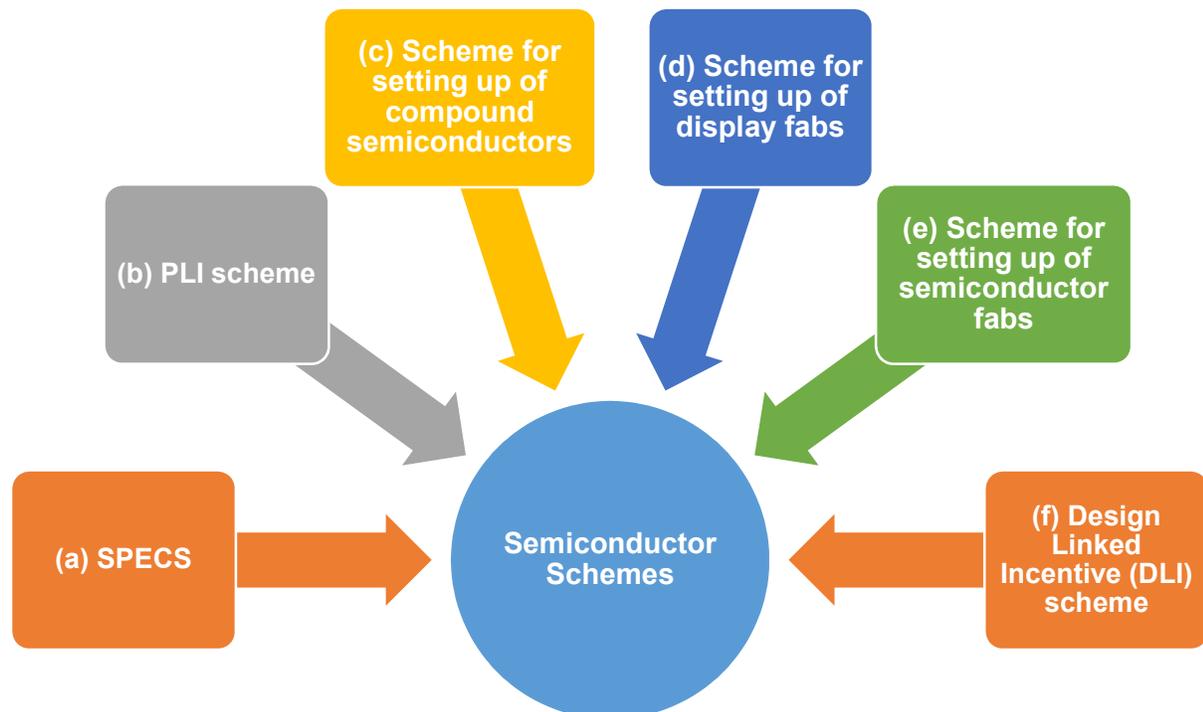
- *Government incentives*

In a bid to make India both self-reliant and a global hub for semiconductors, the Government of India has come up with many incentives such as:

- ✓ Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (SPECES);
- ✓ Production Linked Incentive (PLI) scheme for large scale electronic manufacturing; and
- ✓ Other schemes under the Semicon India Programme

Some of these schemes have been explained below.

Government Schemes to strengthen development of semiconductor ecosystem in India



Scheme	Who can apply	Value of Benefit	Current tenure of the Scheme ¹	Progress so far									
Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (SPECS)	<p>Eligible product-range covers 20 categories of products with minimum investment criteria ranging from INR 5 crore to INR 1,000 crore.</p> <p>The product range includes electronic components, semiconductor / display fabrication units, assembly, testing, marking, and packaging (ATMP) units, specialized sub-assemblies and capital goods for manufacture of electronic goods.</p>	<p>Reimbursement (cash-back) of 25% of Capital Expenditure to units investing in manufacture of electronic components and semiconductors in India</p>	<p>Uptil 31 March 2023</p>	<p>As on 30 November 2022, the Government has approved 32 applications with total project outlay of INR 11,130 crore.</p> <p>The total employment generation potential of the approved applications reportedly is 32,457.</p>									
<p>PLI scheme for large scale electronic manufacturing</p>	<table border="1" data-bbox="334 779 732 1293"> <thead> <tr> <th data-bbox="334 779 492 873">Criteria</th> <th data-bbox="492 779 586 873">Mobile phone</th> <th data-bbox="586 779 732 873">Specified electronic component</th> </tr> </thead> <tbody> <tr> <td data-bbox="334 873 492 1066">Aggregate incremental investment over base year of FY 2019-20, in the next 4 years</td> <td data-bbox="492 873 586 1066">INR 200 crore</td> <td data-bbox="586 873 732 1066">INR 100 crore</td> </tr> <tr> <td data-bbox="334 1066 492 1293">Aggregate incremental sales of manufactured goods over base year of FY 2019-20, in the next 5 years</td> <td data-bbox="492 1066 586 1293">INR 5,000 crore</td> <td data-bbox="586 1066 732 1293">INR 600 crore</td> </tr> </tbody> </table>	Criteria	Mobile phone	Specified electronic component	Aggregate incremental investment over base year of FY 2019-20, in the next 4 years	INR 200 crore	INR 100 crore	Aggregate incremental sales of manufactured goods over base year of FY 2019-20, in the next 5 years	INR 5,000 crore	INR 600 crore	<ul style="list-style-type: none"> Under 1st round of PLI scheme <p>Incentive of 4% to 6% on incremental sales (over base year of FY 2019-20) for goods manufactured in India and covered under target segments</p> Under 2nd round of PLI scheme <p>Incentive of 3% to 5% on incremental sales (over base year of FY 2019-20) for goods manufactured in India and covered under target segments</p> 	<p>Currently closed, 3rd round may open in future</p>	<p>As on September 2022, the Government has approved 32 applications under the PLI scheme with a committed investment of INR 4,784 crore and total production of INR 203,952 crore.</p> <p>The scheme has generated employment for 40,916 people.</p> <p>The PLI scheme has attracted global players such as Foxconn, Samsung, Pegatron and Wistron.</p>
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¹ May be extended

Scheme	Who can apply	Value of Benefit	Current tenure of the Scheme ²	Progress so far
Scheme for setting up compound semiconductors, ATMP units and outsourced semiconductor assembly and testing (OSAT) facilities in India	<p>Companies manufacturing high frequency / high power / optoelectronics devices on minimum capital investment of INR 100 crore</p> <p>and</p> <p>Companies setting up ATMP / OSAT facilities on minimum capital investment of INR 50 crore</p>	50% of capital expenditure	Uptil 31 December 2024	<p>4 companies namely, SPEL Semiconductor, HCL, Syrma Technology and Valenkani Electronics have registered under the scheme for semiconductor packaging.</p> <p>Ruttonsha International Rectifier has registered under the scheme for compound semiconductors.</p>
Scheme for setting up of display fabs in India	Companies / consortia / joint ventures proposing to set up a display fabrication unit (fab) in India for manufacturing TFT LCD or AMOLED based display panels on minimum capital investment of INR 10,000 crore and having minimum revenue of INR 7,500 crore (includes group companies) in any of the 3 preceding FYs	Upto 50% of project cost	6 years (from October 2022)	<p>2 companies namely, Vedanta and Elest have proposed to set up a display manufacturing unit with a projected investment of US\$6.7 billion.</p> <p>Fiscal support from the Government of India is being sought under the scheme for nearly US\$2.7 billion.</p>

² May be extended

Scheme	Who can apply	Value of Benefit	Current tenure of the Scheme ³	Progress so far
Scheme for setting up semiconductor fabs in India	Companies / consortia / joint ventures proposing to set up a silicon CMOS based semiconductors fab in India for manufacturing logic / memory / digital ICs/ analog ICs / mixed signals ICs / system on chips (SoCs) on minimum capital investment of INR 20,000 crore and having minimum revenue of INR 7,500 crore (includes group companies) in Electronics System Design and Manufacturing (ESDM) in any of the 3 preceding FYs	Upto 50% of project cost depending on node size	6 years (from October 2022)	<p>3 companies namely Vedanta in joint venture with Foxconn; IGSS ventures PTE Singapore and ISMC have proposed to set up 28 nm to 65 nm semiconductor fabs with the projected investment of US\$13.6 billion.</p> <p>Fiscal support from the Government of India is being sought under the scheme for nearly US\$ 5.6 billion.</p>
Design Linked Incentive (DLI) Scheme	Domestic companies, start-ups and micro, small and medium enterprises (MSMEs) engaged in semiconductor design for integrated circuits, chipsets, SoCs, system and IP cores linked design under the DLI scheme	<p>Reimbursement of 50% of the eligible expenditure subject to a ceiling of INR 15 crore incentive per application,</p> <p>and</p> <p>Reimbursement of 4% to 6% of net sales over 5 years subject to a ceiling of INR 30 crore incentive per application</p>	Uptil January 2025	3 companies namely, Terminus Circuits, Trispace Technologies and Curie Microelectronics have registered under the scheme.

³ May be extended

Key transactions within the Semiconductor industry

Global

- American semiconductor giant AMD acquired Silicon Valley adaptable computing powerhouse, Xilinx for US\$ 49 billion (approx.), making it the largest M&A deal within semiconductor industry
- America's Intel Corporation acquired Israel's leading chip company Tower Semiconductors for US\$ 5.4 billion approx. This acquisition is a part of Intel's strategy to enter into the silicon foundry segment of the semiconductor business

Indian

India has received investment proposals worth US\$ 20.5 billion from 5 global semiconductor giants to set up semiconductor fab and display fab locally in India. Some of them are:

- Vedanta and Elest have proposed to manufacture display fabs in India with projected investment of US\$ 6.7 billion
- Vedanta in joint venture with Foxconn; IGSS ventures PTE Singapore and ISMC have proposed to manufacture semiconductor fabs in India which are used in a wide range of products ranging from 5G devices to electric cars, with the projected investment of US\$ 13.6 billion
- One of the world's largest semiconductor manufacturer, Applied Materials has proposed to invest INR 18 billion in India over the next few years. Applied Materials India recently invested US\$ 50 million to purchase land in Bangalore, where the company plans to expand its engineering infrastructure

Road Ahead

In today's technologically driven world, semiconductors are an essential part of the new age gadgets, such as smartphones, laptops, cars, electrical appliances etc. Alarmed by the disrupted supply chain of electronics during the COVID-19 phase, India today is aiming not just to be at the top of the electronics industry but also to be a semiconductor hub in the near future.

Due to many factors such as huge demand for electronics, skilled talent and support from the Government incentive schemes, many global companies are looking at India as a viable investment destination for semiconductors.

Going forward, India's semiconductor market is likely to reach US\$ 300 billion by 2026, as 'Make in India' and PLI schemes are likely to boost local manufacturing of semiconductor components in the coming years.

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