India Deep Tech Alliance

KPMG

# India's Semiconductor Opportunity

**Building a globally competitive ecosystem**

Nishith Desai Associates

LEGAL AND TAX COUNSELING WORLDWIDE

India Deep
Tech Alliance

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**Building a globally competitive ecosystem**

Released at

SEMICON® India

SEMICON India 2026

September 17, 2026

New Delhi

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# Foreword by IDTA

Semiconductors have become the foundation of economic competitiveness, technological leadership and national security. They power virtually every element of the modern economy. As countries contemplate the importance of technology sovereignty, semiconductor technologies rank among the top priorities. For India, therefore, the semiconductor opportunity is about building the technological capabilities, intellectual property, talent and supply-chain resilience required to secure and shape the country's economic future

This report comes at an important moment in India's semiconductor journey. India's semiconductor demand is projected to grow from approximately USD 44 billion in 2025–26 to around USD 90 billion by 2029–30. This expansion will be propelled by electronics manufacturing, digital infrastructure, electric and increasingly software-defined vehicles, industrial systems, telecommunications, defence and the rapid adoption of artificial intelligence. AI, in particular, is driving an exponential increase in demand for compute, memory, networking, connectivity and power-management technologies.

Demand alone, however, does not automatically translate into domestic value creation. India continues to import most of the semiconductors it consumes. The strategic task, therefore is to convert the scale of its market into a durable ecosystem of Indian and global companies undertaking design, research, manufacturing, packaging and product development in India.

Against this backdrop, the India Deep Tech Alliance (IDTA) believes that India has an opportunity to become an important and trusted node in the global semiconductor value chain. India brings several significant strengths: a large base of semiconductor design talent; world-class engineering institutions; a growing electronics manufacturing sector; an entrepreneurial technology ecosystem; and expanding domestic demand. It also enjoys strong relationships with the world's leading semiconductor economies and companies.

This opportunity is being supported by an increasingly coherent policy framework. The Government of India's India Semiconductor Mission (ISM) has provided the essential strategic foundation for this effort. Through the Mission, the Design Linked Incentive Scheme, the Chips to Startup program and support for fabrication, compound-semiconductor, assembly, testing and packaging facilities, the Government has credibly signaled its long-term commitment to building a domestic semiconductor ecosystem. The comprehensive approach of India Semiconductor Mission 2.0, covering design, equipment, materials, fabrication, advanced packaging, research and talent, recognizes that semiconductor capability requires an integrated ecosystem and sustained policy support.

The findings of this report point to a pragmatic, phased pathway. India should scale immediately where it already possesses clear advantages. Semiconductor design, fabless product development, mature-node and compound semiconductor manufacturing, connectivity and power integrated circuits, and advanced packaging offer credible near-term pathways to value creation. The report's identification of 28/40 nanometer logic manufacturing as an important opportunity is particularly relevant, given the continuing importance of mature nodes in automotive, industrial, telecommunications, consumer and strategic applications.

At the same time, India must develop capabilities in materials, specialty chemicals, gases, equipment, testing and qualification. These less visible layers will ultimately determine the resilience and competitiveness of the ecosystem. Over the longer term, sustained investment in advanced-node research, chiplets, next-generation packaging, AI accelerators and high-performance computing can enable India to participate in the emerging frontiers of semiconductor innovation.

Capital will be central to this journey. Semiconductor and other deep-technology businesses require long investment horizons, significant technical diligence, and informed capital with the willingness to fund companies through multiple states of development. When IDTA was launched last year, its venture capital members committed to invest USD 1 billion in Indian deep-tech ventures over five-ten years. It is encouraging to see this commitment beginning to translate into action and total commitments increasing to approximately USD 3 billion. This early traction reflects both the growing quality of India's deep-tech companies and the conviction of investors in the opportunity ahead.

IDTA's work extends beyond capital. We engage with policymakers on the environment for deep-tech investment; connect investors and founders around critical technology opportunities; encourage corporations to participate as investors, technical partners and customers; and promote collaboration between Indian companies and international semiconductor ecosystems. Through research, consultations, founder forums and other ecosystem-building initiatives, we seek to close the gaps that prevent promising technologies from progressing from laboratory innovation to commercial scale.

The semiconductor alignment between India and the United States is compelling because the two countries possess complementary strengths. The United States brings leadership in semiconductor architecture, design tools, equipment, advanced research, computing and venture capital. India contributes exceptional engineering talent, an expanding design and manufacturing ecosystem, a large domestic market

# Foreword by IDTA

and a growing capacity to build globally relevant deep-technology companies.

Government-to-government alignment, however, must be converted into private-sector activity. Indian and American companies must jointly undertake research, develop suppliers, train talent, invest across borders and create commercial pathways for start-ups. Large companies can provide design partnerships, manufacturing expertise, qualification support and early customer relationships. Investors must supply patient capital and global networks. Universities and laboratories can support research and talent mobility. The India Semiconductor Mission, TRUST, Pax Silica and the work of IDTA should function as mutually reinforcing parts of this broader public-private architecture.

The objective is a secure and resilient network of trusted partners in which India participates strongly with the depth of Indian IP, the strength of domestic suppliers, the quality of talent developed, and the globally competitive companies created.

Our profound thanks to KPMG in India and Nishith Desai Associates (NDA) for their knowledge partnership in creating this report.

This document provides a thoughtful roadmap for India's journey in semiconductors. IDTA remains committed to mobilizing capital, convening the ecosystem and working with the Government of India, industry, investors and academic partners in India and the United States to translate India's semiconductor promise into enduring technological and economic leadership.

Arun Kumar

**Chair, India Deep Tech Alliance**

Managing Partner, Celesta Capital

# Foreword by KPMG

Few industries today sit at the intersection of technological progress, economic competitiveness and national resilience as profoundly as semiconductors. As artificial intelligence reshapes industries, digitalisation accelerates and technology becomes increasingly central to economic growth and strategic autonomy, semiconductor capabilities have emerged as a defining factor in shaping the future trajectory of nations. For India, semiconductors represent not only a significant economic opportunity but also a strategic imperative to strengthen technological self-reliance, build resilient supply chains and support its vision of Viksit Bharat @2047.

As a strategic enabler of technological self-reliance, industrial competitiveness and domestic value creation, semiconductors represent more than just a market opportunity for India. Semiconductor capabilities can support India's aspirations for technological sovereignty, secure supply chains and sustained economic growth, together forming a critical pillar of its journey towards Viksit Bharat @2047.

India enters this opportunity from a position of considerable strength. The country is home to one of the world's largest pools of semiconductor design talent, a robust STEM ecosystem and a rapidly expanding electronics manufacturing base. As demand continues to grow and policy support remains sustained, India is increasingly well-positioned to deepen capabilities across the semiconductor value chain and emerge as a trusted participant in the global semiconductor ecosystem.

Recognising the strategic importance of the sector, the Government of India unveiled initiatives such as Semicon 1.0, which have helped catalyse investments and lay the foundations of a domestic semiconductor ecosystem spanning design, manufacturing, packaging, talent development and innovation. Semicon 2.0 takes this vision forward by broadening support across critical value-chain segments. As the ecosystem develops, it becomes important to build capabilities in areas that can strengthen India's long-term competitiveness across the semiconductor value chain.

This report examines India's semiconductor demand landscape and identifies opportunities aligned with the country's evolving needs and existing strengths. Semiconductor design and advanced packaging offer attractive near-term opportunities, while the development of a mature-node semiconductor ecosystem can provide a commercially viable pathway to strengthen manufacturing capabilities. Together, these opportunities can help India deepen value addition, build ecosystem capabilities and progressively expand its presence across the semiconductor value chain.

A key theme emerging from this report is that India's semiconductor ambitions are best pursued through a focused strategy aligned with its demand profile and existing strengths. A substantial share of India's semiconductor demand is expected to be driven by applications that predominantly rely on mature-node technologies, creating a compelling case for strengthening domestic manufacturing capabilities in these segments. The report also highlights opportunities in compound semiconductors, which are becoming increasingly important for electric mobility, renewable energy and advanced communications. Together with India's established strengths in semiconductor design and advanced packaging, these segments provide a strong foundation for deepening domestic value creation and strengthening India's role in the global semiconductor ecosystem.

At the same time, building a globally competitive semiconductor ecosystem will require India to deepen capabilities beyond its immediate areas of strength. Developing a robust ecosystem for semiconductor materials, specialty chemicals, equipment, testing and qualification will be critical to improving local value capture and reducing external dependencies. Building capabilities in these areas can enhance supply chain resilience and create the foundations for broader participation across the semiconductor value chain.

Ultimately, India's semiconductor aspirations will depend on its ability to build a robust and globally competitive ecosystem that capitalises on its strengths while developing capabilities across critical segments of the semiconductor value chain. Realising this imperative will require focused action across five strategic enablers: Deepening domestic supply chains, building a future-ready talent base, strengthening R&D and innovation, fostering strategic global partnerships and enhancing infrastructure and business enablement.

These five strategic enablers can help transform India's semiconductor opportunity into a sustainable competitive advantage, enabling the country to strengthen its position across the global semiconductor value chain and advance its Viksit Bharat @2047 aspirations.

Akhilesh Tuteja

Partner, Head of Clients and Markets

KPMG in India

# Foreword by NDA

Every major technological transformation reshapes the architecture of economic power, and semiconductors occupy a unique place in it. They are not merely components embedded in electronic products; they are the foundational infrastructure on which artificial intelligence, communications, mobility, defence, healthcare, space technologies and increasingly the global economy itself depend.

But technological power does not come from manufacturing alone. Much of a chip's value is created long before it reaches a fabrication facility - in architecture and design, software and algorithms, materials and processes, proprietary know-how, standards and, ultimately, intellectual property. Semiconductors are as much an industry of knowledge as of manufacturing - a distinction that is particularly important for India.

India has already established itself as an important centre of semiconductor design and engineering, and a substantial part of the global industry draws upon Indian talent. The opportunity now is to convert that talent into something more enduring: technologies conceived in India, intellectual property owned in India, research commercialised from India and companies capable of competing globally on their own innovation.

The findings in this report make that opportunity tangible. India's semiconductor patent landscape is already substantial, with 78,188 published applications and 28,257 grants over the period studied. Yet the leading assignees remain predominantly multinational enterprises, and IIT Madras is the only academic institution among the tracked top ten. The issue is not whether sophisticated semiconductor work is taking place in India—it clearly is—but how much of the resulting value is captured, owned and commercialised from India. That is the transition India must now make—from being an important location for technology development to becoming an important source of proprietary technology.

The patent data also points to where the next opportunities may lie. Roughly 92 per cent of India's tracked filings relate to semiconductor accelerators, while advanced packaging, high-bandwidth memory and chiplets account for a much smaller share. These are not simply gaps: they are areas where technological positions are still being established and where focused research and entrepreneurship can create new centres of expertise.

Advanced packaging is a good example: as architectures grow more complex, it is moving to the centre of system performance—and India may build real capability here without the capital intensity of leading-edge fabrication. Chiplets pose a related challenge, as modular architectures make the ability to shape standards and interoperability frameworks decisive in who has a voice in the industry's evolution.

This is where the discussion becomes larger than industrial policy. Innovation requires an institutional architecture around it: researchers who can move ideas from laboratories into companies, start-ups that collaborate with larger enterprises without losing control of their technology, universities with effective technology transfer, and investors with clarity over ownership of intangible assets. Law is not external to this ecosystem; at its best, it is part of the infrastructure that allows innovation to happen.

Semiconductor development has changed considerably. Modern designs rely on reusable IP blocks, design libraries, software, process knowledge and confidential know-how, and a technology's commercial life is often far shorter than the legal right meant to protect it—so our frameworks must evolve with the technologies they support.

Trade secrets may matter even more, since some of a semiconductor business's most valuable assets are never patented. India still lacks a comprehensive dedicated trade secrets statute, and the Law Commission's proposed legislation remains unenacted—a gap that will grow more consequential as India attracts more sophisticated research, design and manufacturing.

A globally competitive semiconductor industry cannot be reduced to attracting investment or building capacity. The harder task is an environment in which knowledge moves efficiently across universities, laboratories, start-ups and industry, and companies retain and build upon the IP they create.

The report's recommendations on collaborative research, pilot facilities, commercialisation and closer academia–industry links are therefore important. Durable ecosystems emerge over long periods from institutions, accumulated knowledge and networks of companies, researchers, investors and universities as Taiwan's and South Korea's pairing of industry with public research, remind us.

India should learn from these experiences without reproducing them building a model around its own strengths: engineering talent, entrepreneurial culture, scientific institutions, a large domestic market and the ability to work across global technology ecosystems.

Ultimately, India's semiconductor success will be measured not by fabrication facilities built or patents filed, but by its capacity to convert knowledge into technology, technology into intellectual property, and intellectual property into globally competitive businesses. India has shown its people can play a central role in the world's technology industry; the next chapter is about ensuring more of the technology itself is created, owned and commercialised from India. If we make that transition, the significance will extend well beyond semiconductors: we will have created a template for building the deep-technology industries that will define the coming decades.

Nishith Desai

Founder, Nishith Desai Associates

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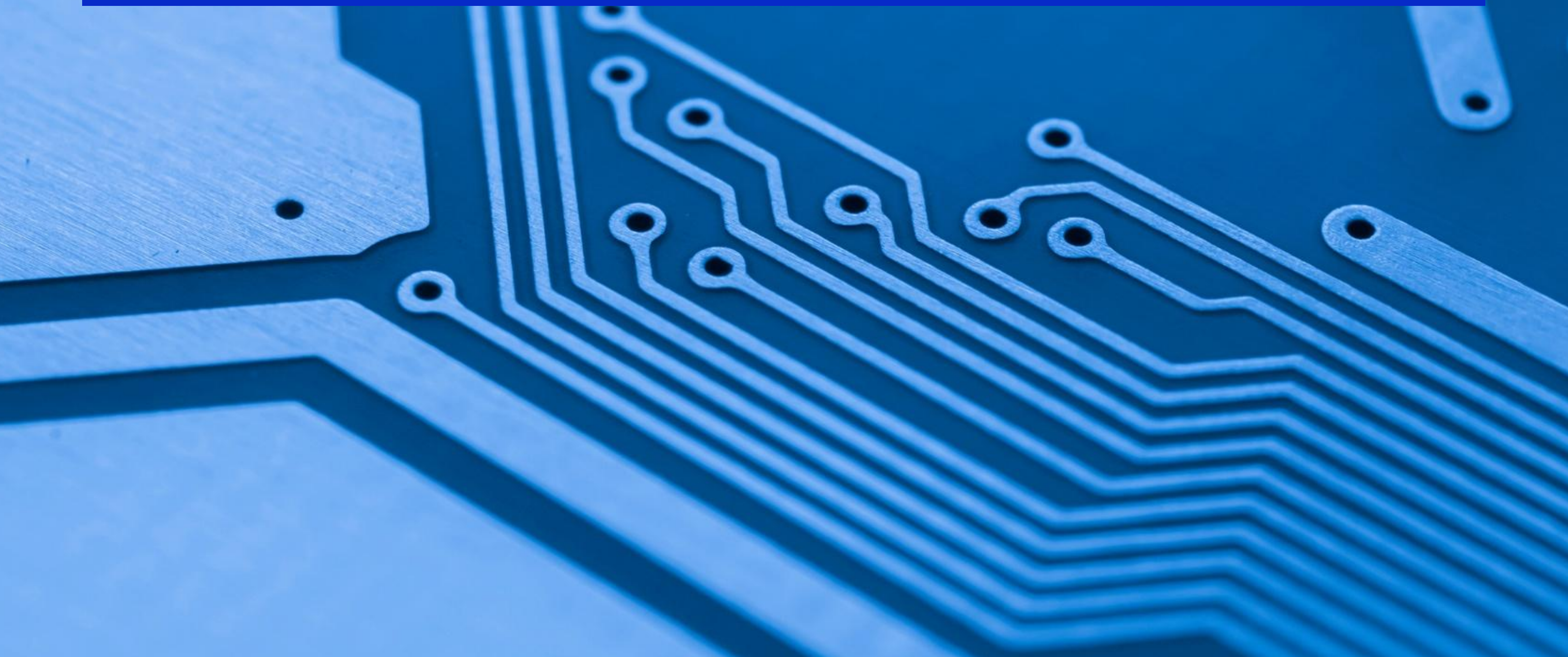


# Executive summary

Semiconductors have emerged as a strategic imperative for India, underpinning economic competitiveness, technological advancement and national security. Driven by rapid growth in electronics manufacturing, expanding digital infrastructure, increasing semiconductor intensity across automobiles and industrial systems and rising adoption of AI, India's semiconductor demand is projected to reach approximately USD90 billion by 2029-30, up from around USD44 billion[1] in 2025-26.

## Policy initiatives are laying the foundation for ecosystem development

To translate growing semiconductor demand into domestic value creation, the Government of India is fostering a policy-led ecosystem development approach. Initiatives such as Semicon 1.0 and Semicon 2.0 , DLI Scheme, Chips to Startup programme and strategic technology partnerships are helping build capabilities across manufacturing, design, talent and innovation, creating a stronger foundation for India's semiconductor ambitions.

**~USD90 Bn[1]**

India's semiconductor demand by 2030

## Electronics, digital infrastructure and AI are emerging as key demand drivers

Mobile and wearables, digital infrastructure, telecom, automotive electronics, industrial automation and strategic sectors are creating sustained semiconductor demand across the economy. At the same time, rising AI adoption is accelerating demand for advanced compute, memory and networking semiconductors.

### Segment-wise semiconductor demand by 2029-30, USD billion[2]

| Segments | 2029-30 Demand | Relative opportunity |
|---|---|---|
| **Mobile & wearables** (Logic, memory, connectivity, power management) | **USD42.13 bn** | Largest opportunity |
| **Telecom** (Processors, RF, networking, power) | **USD13.22 bn** | |
| **Information technology** (Processors, memory, connectivity, power) | **USD11.31 bn** | AI and cloud adoption are increasing demand for compute, memory and networking chips |
| **Industrial** (MCUs, sensors, connectivity, power devices) | **USD7.95 bn** | |
| **Consumer electronics** (Logic, memory, connectivity, power management) | **USD5.55 bn** | |
| **Automotive** (MCUs, sensors, power devices, connectivity) | **USD4.52 bn** | |
| **Strategic sectors** (Processors/FPGAs, RF, sensors, rad-hard memory) | **USD2.19 bn** | |

India's demand profile, characterised by strong demand for logic, connectivity and power semiconductors (as shown above), together with its strengths in design talent, STEM capabilities and electronics manufacturing, creates distinct opportunities across the semiconductor value chain. While design and packaging provide the most immediate pathway to value creation, India can progressively build capabilities in manufacturing (fabs), materials and equipment.

**Opportunities:**

- ✓ Logic semiconductors represent one of the largest manufacturing opportunities
- ✓ 300 mm wafers are expected to account for ~75 per cent[3] of logic demand by 2030
- ✓ 28/40 nm[3] emerges as a key logic manufacturing opportunity by 2030
- ✓ Most end-use sectors rely predominantly on mature-node technologies

**28/40 nm[3]**

Key logic manufacturing opportunity

1) Future of India's Semiconductor Industry, NITI Frontier Tech Hub, NITI Aayog, May 2026 For exchange rate conversion, USD/INR rate of 95.5 was used
2) KPMG in India Analysis basis the market size estimate from Future of India's Semiconductor Industry, NITI Frontier Tech Hub, NITI Aayog, May 2026
3) KPMG in India analysis

# Opportunities across the value chain

India's semiconductor demand profile and existing strengths indicate distinct opportunities across the value chain. While design and packaging provide the most immediate pathway to value capture, strong domestic demand for mature-node technologies creates a commercially viable case for manufacturing expansion. At the same time, India can build long-term competitiveness through investments in materials, equipment, compound semiconductors and advanced technologies linked to AI and high-performance computing.

### A phased pathway to strengthen India's semiconductor competitiveness

| Scale now | Build capabilities | Strategic frontier |
|---|---|---|
| Strong alignment with India's strengths and faster pathway to value creation | Areas that require phased ecosystem development and technology investments | Longer-term play requiring sustained investments and ecosystem maturation |
| **Semiconductor design** | **R&D and innovation ecosystem** | **Advanced node R&D** |
| **Fabless IP development** | **Tech commercialisation ecosystem** | **Advanced memory technologies** |
| **AI accelerator and ASIC design** | **Semiconductor materials** | **AI infrastructure chips** |
| **Mature-node and compound fabs** | **Specialty chemicals and gases** | **Next-gen packaging tech** |
| **Advanced packaging (ATMP/OSAT)** | **Testing and qualification ecosystem** | **High performance compute chips** |
| **Connectivity and power ICs** | **Equipment ecosystem** | **Emerging semiconductor techs** |
| *India's strong design talent base and established semiconductor design ecosystem make design and packaging among the most attractive near-term opportunities.* | *Growing domestic demand and existing industrial strengths support phased capability building in mature-node manufacturing and adjacent ecosystem segments.* | *AI adoption and advanced computing are expected to create future opportunities in advanced semiconductor technologies, requiring sustained investments in R&D, innovation and talent.* |

# Enabling India's semiconductor ambitions

Coordinated ecosystem development across talent, innovation, suppliers, manufacturing infrastructure and strategic partnerships will be critical to translating semiconductor demand into domestic value creation. These enablers can accelerate capability development, strengthen supply-chain resilience and support India's emergence as a globally competitive semiconductor hub. These strategies should be centred on five focus areas.

### Strategic enablers for semiconductor ecosystem development

- Deepening domestic supply chain
- Nurturing future ready talent ecosystem
- Strengthening R&D, innovation and IP creation
- Fostering strategic global partnerships
- Infrastructure and business enablement

1

# Overview

*Semiconductors: A strategic imperative for India*

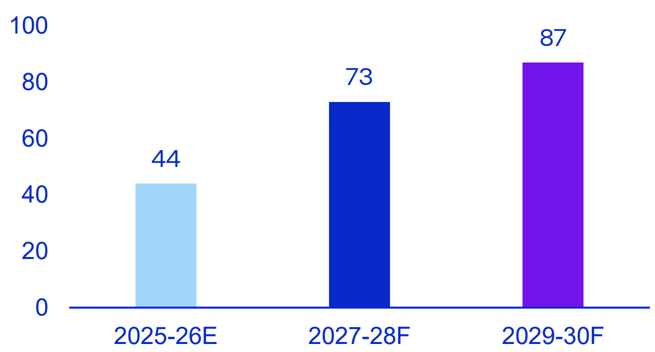
# 1. Overview

Semiconductors are no longer just a technology component. They are the foundation of economic competitiveness, technological leadership and national security. Every critical industry, from AI and telecommunications to defense, automotive, healthcare and consumer electronics, runs on chips. Nations that lead in semiconductors will shape the future of innovation, productivity and geopolitical influence. As India accelerates its digital and sovereignty ambitions, strengthening domestic semiconductor capabilities has become a strategic priority.

## Strong demand growth, high import reliance

India presents a compelling demand-side opportunity, supported by a large domestic market, rising digital adoption and increasing semiconductor intensity across industries. Domestic demand is projected to reach around USD90 billion[1] by 2029-30, growing at a CAGR of 19 per cent. However, currently, the domestic ecosystem is not ready to absorb the bulk of the demand, leaving India to significantly rely on imports.

**India's semiconductor market size, USD Bn[1]**




| Key semiconductor products | Imports, 2025-26 (USD bn)[1] | Top three import sources |
|---|---|---|
| Integrated circuits (HS code: 8542) | **30.3** | China (29.5 per cent) Hong Kong (17.6 per cent) South Korea (11.3 per cent) |
| Semiconductor devices (HS Code: 8541) | **6.2** | China (48.9 per cent) Singapore (8.4 per cent) Indonesia (7.5 per cent) |

## Semiconductors: A strategic imperative for India

| | | |
|---|---|---|
| **Strategic resilience** | **Higher imports** | India meets **90-95 per cent[2]** of its semiconductor requirements through imports |
| | **National security risk** | Reliance on foreign players for chips used in defence systems increases national security risk |
| | **Geopolitics** | Potential weaponisation of semiconductor supply chains by countries controlling key technologies |
| **Economic opportunity** | **Affordability** | Chips form the foundation for democratisation of technology and its associated benefits |
| | **Foundation for future technologies** | Semiconductors are key to powering emerging technologies such as AI, quantum computing, 6G and advanced robotics |
| | **High quality job multiplier** | The semiconductor sector creates high-value jobs while generating significant employment across the broader value chain |

In view of semiconductors' strategic imperative, advanced nations such as the U.S., Europe and Japan are allocating significant sums to build local ecosystems. This could lead to a fragmentation of the semiconductor supply chain which has traditionally been centred on few countries. In this context, it is imperative for India to develop an indigenous ecosystem to underpin its strategic autonomy and enhance resilience—both are crucial to realise the vision of Viksit Bharat@2047.

1. Trade Statistics, Ministry of Commerce and Industry For exchange rate conversion, USD/INR rate of 95.5 was used
2. Future of India's Semiconductor Industry, NITI Aayog Frontier Tech Hub, May 2026

## Building India's domestic semiconductor ecosystem

Coordinated policy support, capability development and effective ecosystem execution are key to ensuring that this demand translates into domestic value creation, supply chain resilience and long-term technological self-reliance. This recognition is evident in the Government of India's targeted initiatives, which aim to address critical requirements across the ecosystem.

### Translating semiconductor demand into domestic value creation

- Demand from electronics and mobile devices is expanding rapidly
- Vehicle electrification and adoption of ADAS features fuel chip consumption
- Data centres, cloud computing and AI adoption are driving demand for chips
- Industrial automation, telecom infrastructure, IoT and defence applications are creating sustained demand

**Policy-to-value bridge**

- Policy-led ecosystem development
- Capability-led competitive edge
- Execution-led value creation

**Value capture, resilience and self-reliance**

- Maximising domestic value capture by building on strengths in design, advanced packaging and compound semiconductors
- Strengthening supply chain resilience and reducing dependence on imported chips
- Enhancing technological sovereignty while generating high-value employment and investment

**ADAS** - Advanced driver assistance systems

## Government initiatives usher in transformative changes in India's semiconductor landscape

### Existing schemes[3]

Semicon 1.0 with an outlay of USD8 billion was launched to build an indigenous ecosystem, with a primary focus on fabrication, assembly, testing and packing units

**Key achievements:** 12 semiconductor projects with investment commitments of USD17 billion have been approved across six states and three facilities have begun commercial production

Under Chips to Startup programme**, 320 academic institutions** gained access to Electronic Design Automation (EDA) tools, while more than **68,000 students** were trained in advanced chip-design capabilities

DLI scheme approved **24 semiconductor design** projects while providing EDA tool support for **105 startups/MSMEs**

3. Semiconductor and AI Revolution, Press Information Bureau, 13 August 2026 For exchange rate conversion, USD/INR rate of 95.5 was used

## Semicon 2.0

Building on its earlier efforts to nurture foundational chip manufacturing capability, the Government of India adopted a more comprehensive approach to support the semiconductor sector. The new scheme, Semicon 2.0, has a total budget outlay of USD13.4 billion[4], focusing on developing the ecosystem across six pillars.

### A six-pillar approach to semiconductor ecosystem development[5]

**Design: Deepening the design ecosystem by developing IPs and designs of chips and systems**

USD16 million milestone-linked seed funding for startups and equity co-investment beyond that

**Machines and materials: Incentivising companies engaged in manufacturing and R&D of equipment and manufacturing of materials, chemicals and gases**

(2-10 per cent incremental PLI on domestically sourced bill of materials for five years from 2028-29 (equipment ecosystem))

**Setting up more fabs: Attracting investments in silicon fabs, compound semiconductor fabs, discrete component fabs, display fabs, etc.**

(40 per cent fiscal support of eligible capex for silicon fabs and 35 per cent for compound semiconductor, photonics, sensor/MEMS and display fabs)

**Further strengthening the ATMP/OSAT industry: Focusing on attracting most advanced packaging technologies to India**

(35 per cent fiscal support of eligible capital expenditure for advanced packaging and 25 per cent for legacy packaging)

**Research and development: Partnering with leading domestic and international R&D centres to develop more advanced nodes and other advanced technologies**

(Funding of up to 75 per cent of project cost (advanced semiconductor R&D))

**Talent development: Deepening student training while engaging industry to strengthen clean room, fab construction and other ecosystem training**

(Funding of up to 75 per cent of project cost for education and workforce-development initiatives)

ISM 2.0 is a transformative and timely initiative to enable India's semiconductor ecosystem to advance at a time when the evolving geopolitical order has increased uncertainty around technology supply chains. Its holistic approach, covering all crucial segments of the semiconductor value chain, along with a stronger focus on R&D and talent development, is something that can lay a stronger foundation for a local semiconductor ecosystem, which can boost domestic value addition while reducing reliance on the interdependent global ecosystem.

## Strategic alliances with high relevance to India's semiconductor ambitions

### TRUST Initiative: Deepening AI, semiconductor and critical mineral partnerships

In February 2025, India and the U.S. launched Transforming the Relationship Utilizing Strategic Technology (TRUST) initiative, following the initiative on Critical and Emerging Technology (iCET), which was announced in 2022. iCET created a framework for cooperation in critical and emerging technologies. Building on the foundation laid by iCET, TRUST broadens the collaboration across strategic sectors, including artificial intelligence, semiconductors, quantum technologies, biotechnology, critical minerals, pharmaceuticals, space, and advanced manufacturing. It places greater emphasis on cooperation between governments, businesses, research institutions and

### Pax Silica: Strengthening India's position in the future technology landscape

Marking a significant milestone in enhancing strategic and technological cooperation between India and the U.S., India joined the Pax Silica, a strategic coalition of trusted nations focused on strengthening cooperation across the technology stack, spanning critical minerals, semiconductor fabrication, advanced AI systems and deployment infrastructure. Other objectives include supporting hardware ecosystems and collaborating on advanced technologies. This initiative also emphasises the diversification of chip manufacturing locations and the strengthening of long-term global semiconductor supply chain resilience.

### India-Netherlands semiconductor partnership expands across manufacturing, innovation and talent development

India and Netherlands deepened their semiconductor partnership. This collaboration aims to deepen cooperation in advanced lithography technologies that could support the development of India's commercial 300 mm fabrication capabilities. Simultaneously, the Dutch Semicon Competence Centre and the India Semiconductor Mission will work together to support startups, scale-ups, SMEs and their suppliers through technology collaboration capability building and talent development initiatives. The partnership also includes cooperation in critical minerals exploration, research and innovation,

4. Cabinet approves Semicon 2.0, Press Information Bureau, 15 July 2026
5. India Semiconductor Mission. For exchange rate conversion, USD/INR rate of 95.5 was used

technology ecosystems in both countries.

One of the crucial components of the TRUST is U.S.–India Roadmap on Accelerating AI Infrastructure, which aims to promote security, trust, responsible deployment, investment and partnerships in data centres, advanced computing, reliable energy infrastructure and digital connectivity.

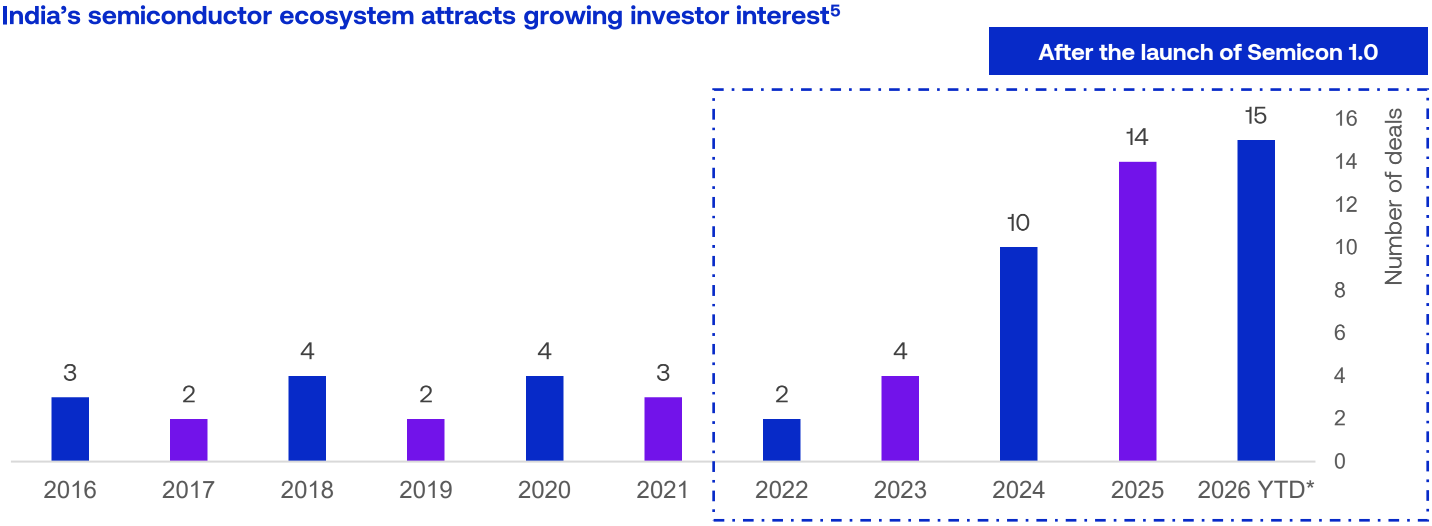
For India, this is a strategic move, as a deep collaboration with trusted partners will bolster its position in the future global tech landscape. Access to secure and resilient supply chains, along with innovations across critical segments of the supply chain, can help advance India's AI ambitions and strength indigenous semiconductor capabilities.

which are essential for securing semiconductor supply chains. Additionally, two universities in the Netherlands and six leading Indian technical institutes will deepen their collaboration to create a semiconductor brain bridge with active industry participation, fostering knowledge exchange, research and talent development. These collaborations will not only help India bolster its domestic semiconductor manufacturing capabilities but also enhance access to advanced technologies and critical raw materials.

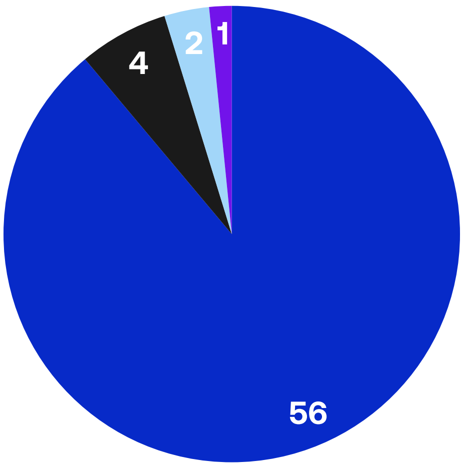
## Government initiatives are catalysing investment activity

Government initiatives such as Semicon 1.0 have significantly strengthened the growth outlook for India's semiconductor industry, fuelling a notable increase in investment activity. The sector attracted PE-VC funding of USD687 million[5] from 2016 to 2026 YTD. Almost 75 per cent of this funding occurred after 2021, the year when Semicon 1.0 was approved. Providing further support to investment momentum and capability development are ongoing collaborations between ecosystem players and global semiconductor companies. Within the value chain segments, fabless design saw the highest number of deals, driven by India's strong semiconductor design pool. In addition, the Government of India's Research, Development and Innovation (RDI) Fund provides long-term capital support for high-impact deep-tech projects nearing commercialisation, thereby fostering innovation in strategic sectors, including semiconductors.

**India's semiconductor ecosystem attracts growing investor interest[5]**




**Number of deals (segment-wise)[5]**




Funding momentum in fabless design is being driven primarily by the country's strengths in semiconductor design

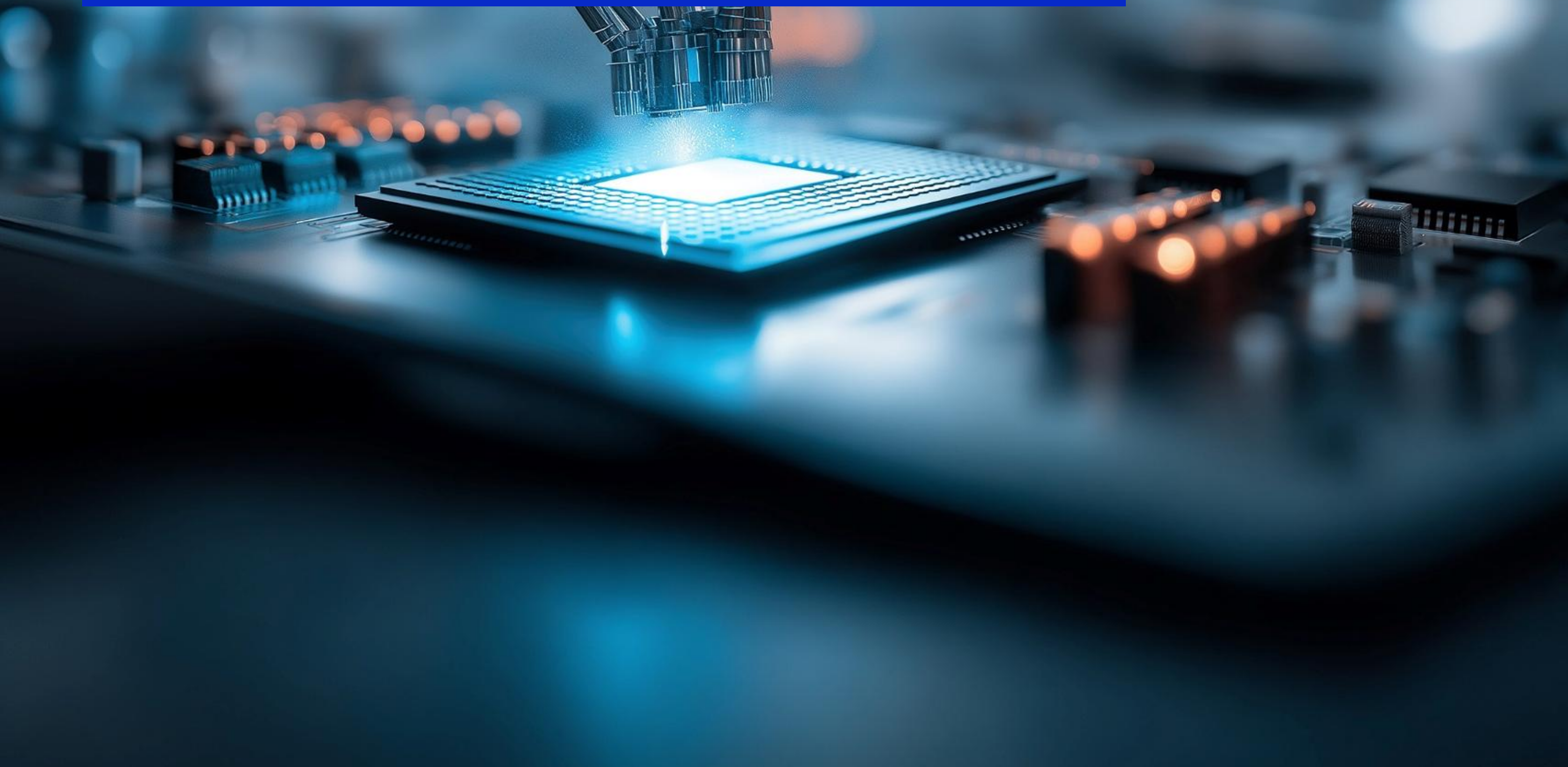
- Fabless Design
- Equipment and Materials
- Integrated Device Manufacturers (IDMs)
- Pure-Play Foundries & OSAT

5. Venture Intelligence

2

# Demand assessment of end-use applications

*Understanding India's semiconductor demand landscape*



# 2. Demand assessment of end-use applications

The electronics sector represents the largest source of semiconductor demand in India. Demand is being driven by mobile phones, wearables, consumer electronics, IT hardware and industrial electronics. Rising semiconductor intensity across these product categories is increasing demand for logic, memory, power and connectivity semiconductors.

## 2.1 Expanding electronics sector driving semiconductor demand

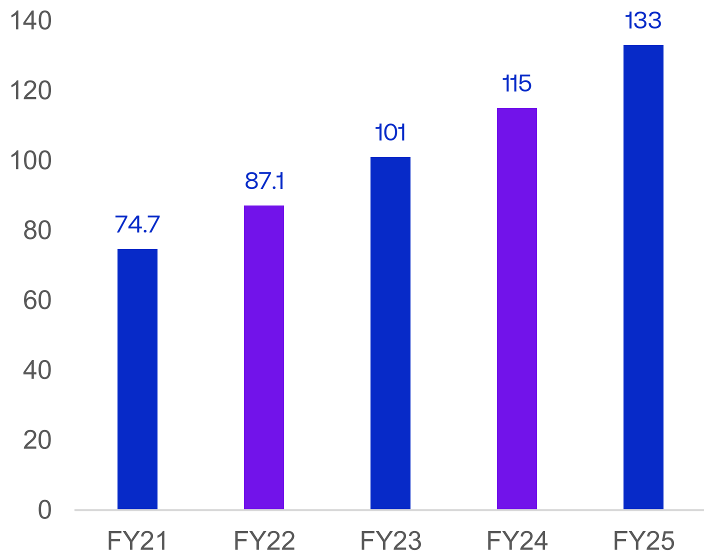
India's electronics manufacturing is on a strong growth trajectory—production almost doubled to USD133 billion in 2024-25 from 74.7 billion[1] in 2020-21. Growth in exports was even stronger, registering an eight-fold jump from 2014-15 to 2024-25[2]. This growth can largely be attributed to strategic government initiatives such as electronics components manufacturing scheme and production-linked incentives for IT hardware and large-scale electronics manufacturing, among others.

### Electronics manufacturing growth is on strong footing

**Government initiatives building a strong foundation**

| | |
|---|---|
| **ECMS** | USD4.2 billion[2] scheme to build a self-sustaining ecosystem for electronics component manufacturing |
| **PLI** (IT hardware) | Cumulative production of USD2 billion[2] and a cumulative investment of USD0.09 billion[3] |
| **PLI** (Large-scale electronics manufacturing) | Achieved investment of USD1.8 billion and production of USD11.5 billion[3] |

**Trend in electronics manufacturing, (USD Bn)[1]**




ECMS – Electronic Component Manufacturing Scheme and PLI – Production-Linked Incentives

Growth in electronics manufacturing is strengthening India's position as a major consumer of semiconductors. Semiconductor consumption per device is expected to increase as electronic devices become more connected, intelligent and feature-rich. This, in turn, will reinforce electronics as one of the key sources of semiconductor demand.

### Key segments driving semiconductor demand from the electronics sector

#### Mobile phone manufacturing momentum

India's mobile phone production grew at ~21 per cent[1] CAGR between FY21 and FY25, supported by initiatives such as Phased Manufacturing Programme (PMP) and the Production Linked Incentive (PLI) scheme. This growth, together with rising smartphone adoption, device premiumisation and 5G rollout, is fueling demand for semiconductor content across logic, memory and connectivity chips.

1. Annual reports, Ministry of Electronics and Information Technology
2. Union Budget 2026–27 Raises Scheme Outlay to ₹40,000 Crore, Press Information Bureau, 3 February 2026
3. Domestic value addition in electronics manufacturing has improved, Press Information Bureau, 1 April 2026

For exchange rate conversion, USD/INR rate 95.5 is used

### Mobile phone-driven chip demand

| Logic/compute | Memory/storage | Connectivity |
|---|---|---|
| ▪ Application processors (AP/SoC)<br>▪ AI/NPU accelerators<br>▪ GPUs<br>▪ Image signal processors (ISP) | ▪ LPDDR DRAM<br>▪ NAND Flash, with increasing content driven by AI-enabled devices | ▪ 5G modems<br>▪ RF front-end<br>▪ Wi-Fi<br>▪ Bluetooth<br>▪ NFC<br>▪ UWB chips |

Node range:
3-180 nm*

Mobile phones are expected to drive the largest share of semiconductor demand with requirements spanning logic, memory, connectivity and power management chips.

Growing adoption of smartwatches, hearables and fitness bands, coupled with increasing health-monitoring and AI-enabled functionalities, is driving demand for semiconductor content across low-power compute, memory, sensing, connectivity and power-management chips.

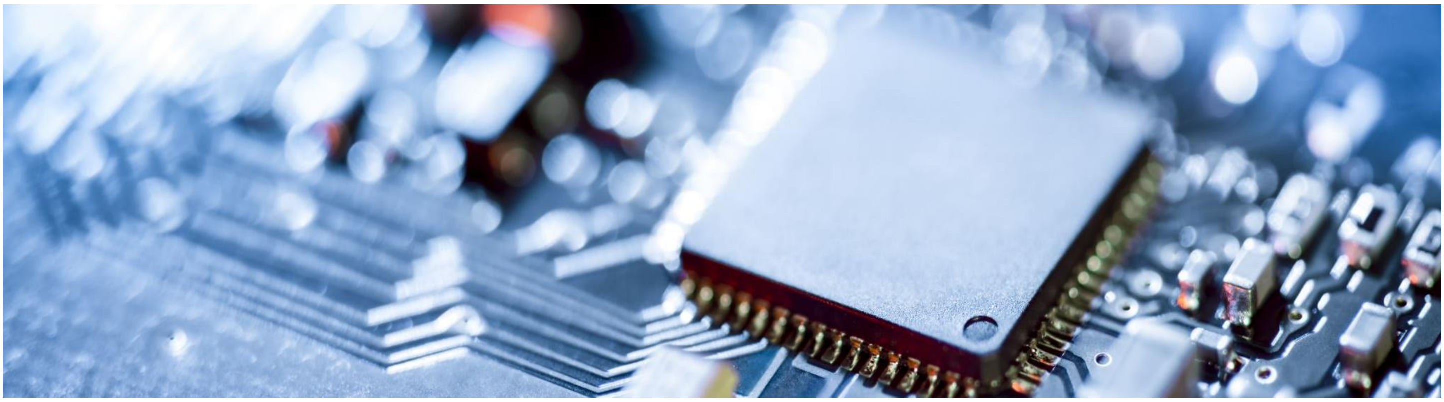
### Consumer electronics growth underpins semiconductor demand

Demand for consumer electronic products that enhance convenience, energy efficiency and in-home entertainment is expected to remain strong, underpinned by rising affordability.

### Home appliances drive mature-node demand within the consumer electronics ecosystem

| | | |
|---|---|---|
| **Television** | • Demand led by TV SoCs, video processors, memory and connectivity chipsets | ~5-180 nm* |
| **Audio systems** | • Demand led by audio DSPs, audio codecs, wireless connectivity, memory and power management chips | ~12-180 nm* |
| **Home appliances** (Air conditioners, refrigerators, washing machines, etc.) | • Power, logic and other ICs account for most semiconductor value | ~28-350 nm* |

Consumer electronics demand spans both advanced and mature nodes, with televisions and smart entertainment devices driving demand for high-performance compute chips, while home appliances rely on mature-node controllers, power devices and connectivity ICs.

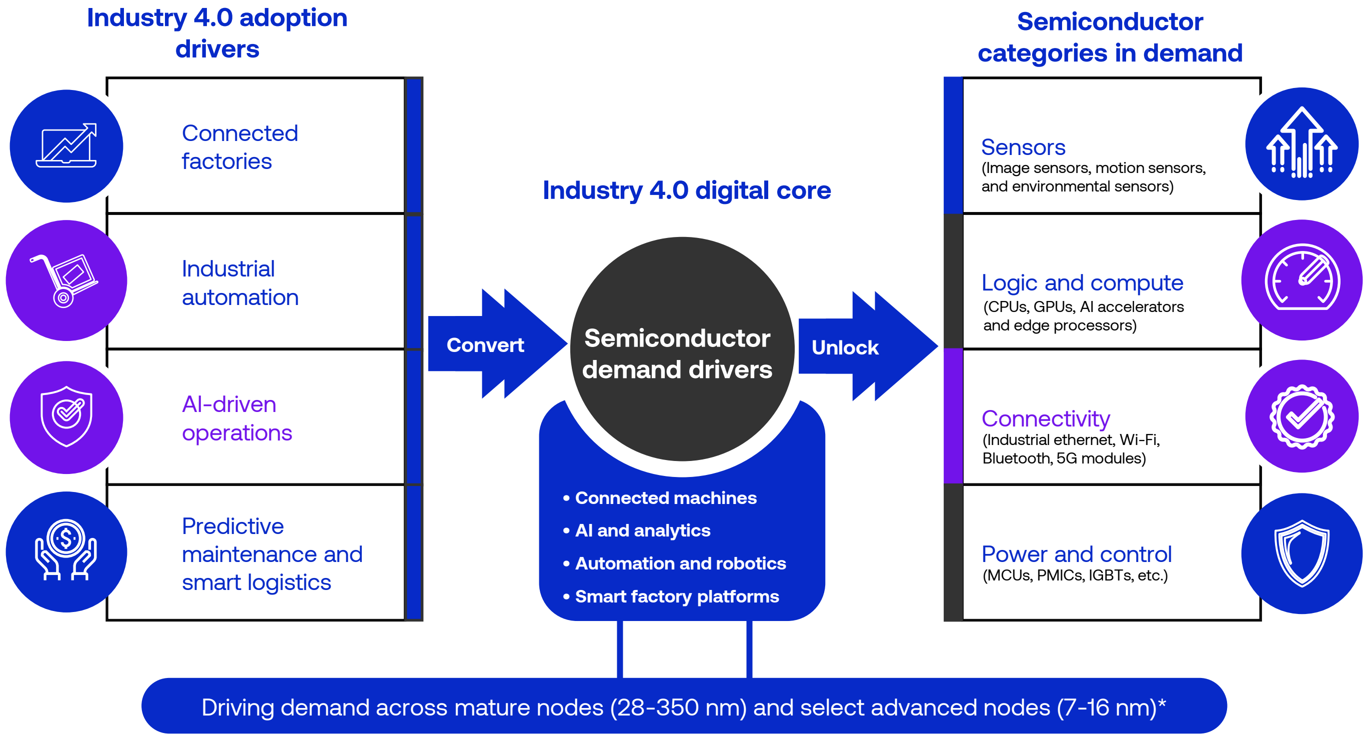


*Indicative node ranges based on typical industry applications; actual values may vary by product architecture, specifications and semiconductor content

## Industrial electronics

Industry 4.0 requires chips for automation, intelligence and connectivity across a range of process nodes. While advanced nodes enable next-generation capabilities, mature nodes account for a significant share of volumes, creating opportunities across the semiconductor value chain.

### Industry 4.0 technologies create demand for a broad range of semiconductor applications




While mature nodes underpin industrial control, sensing, connectivity and power functions, advanced nodes support compute-intensive AI, analytics and edge-processing applications. This creates demand across a broad spectrum of semiconductor technologies, ranging from MCUs and sensors to AI accelerators and edge processors.

## Automotive electronics

Growing popularity of ADAS-equipped vehicles among consumers due to enhanced safety and convenience features has prompted Indian automakers to use their investment in ADAS systems as a market differentiation strategy. Mainstream models are now equipped with the ADAS systems, which were earlier confined to luxury models. Electric vehicles are consuming more chips than traditional ones and, with the country seeking to accelerate EV adoption, demand for semiconductors is likely to increase substantially.

| Category | Representative chips |
|---|---|
| Logic and Compute | ADAS SoCs, ISPs, MCUs |
| Memory and Storage | DRAM, NAND Flash |
| Connectivity | V2X, Automotive Ethernet, Wi-Fi/Bluetooth, Telematics ICs |
| Sensors | Radar, LiDAR, Image and Ultrasonic Sensors |
| Power and control | IGBTs, Battery Management ICs, Voltage Regulators |

**Node range: 16-180 nm***

- Reliability, safety and longevity requirements make mature-node semiconductors the backbone of automotive electronics
- MCUs, PMICs, connectivity and sensing chips account for the majority of automotive semiconductor demand.
- Advanced-node adoption is concentrated in ADAS, autonomous driving and in-vehicle AI compute applications.

*Indicative node ranges based on typical industry applications; actual values may vary by product architecture, specifications and semiconductor content

## Strategic sectors: Defence and spacetech

Defence and space applications rely on a broad range of semiconductors, including processors, sensors, RF components, memory and power devices to support mission-critical capabilities. Expanding defence modernisation and commercialisation of the space sector are expected to strengthen demand for mission-critical semiconductors.

### Key chip categories

| Category | Representative chips |
|---|---|
| Logic and compute | Satellite processors, Payload processors, FPGAs |
| Memory and storage | Radiation-hardened DRAM, Flash memory |
| Connectivity and RF | RF communication ICs, Satellite transceivers, GNSS chips |
| Sensors and Power | Image sensors, Star trackers, GaN power amplifiers, PMICs |

**Node range: 28-180 nm***

- Mature nodes dominate RF, power management, microcontrollers and radiation-hardened semiconductor applications
- Mission-critical requirements prioritise reliability, radiation tolerance and long product lifecycles over leading-edge miniaturisation.

Mission-critical applications require a diverse semiconductor portfolio, spanning radiation-hardened processors, RF communications, sensing and power-management devices.

## IT hardware and telecom

Personal devices, enterprise IT infrastructure and telecom networks are becoming increasingly semiconductor-intensive, driving demand for compute, memory, connectivity, RF and power devices. The diverse chip requirements of these segments span both advanced and mature nodes.

### Key Semiconductor Applications in IT Hardware and Telecom

| Segment | Applications | Node range |
|---|---|---|
| IT hardware | ▪ PCs, laptops and workstations drive demand for processors, memory and connectivity chips<br>▪ Cloud infrastructure, servers and storage systems require compute, networking and power semiconductors (Section 2.2) | ~3 nm to 180 nm* |
| Telecom | ▪ 5G rollout and network expansion increase semiconductor consumption<br>▪ Processors, memory, RF, networking and power semiconductors underpin telecom infrastructure. | ~5 nm to 180 nm* |

*Node ranges are indicative and may vary by chip function, product design and performance requirements.

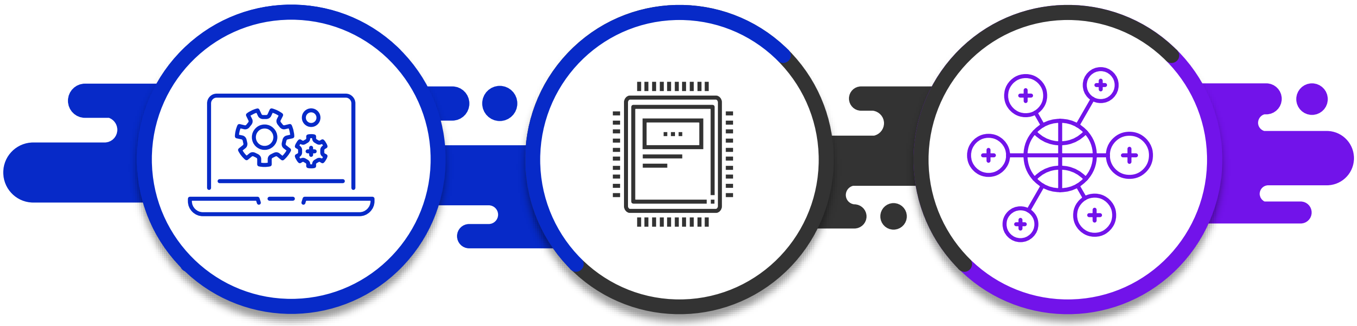
IT hardware and telecom drive demand for compute, networking, memory and RF semiconductors, supporting both advanced and mature-node technologies.

*Indicative node ranges based on typical industry applications; actual values may vary by product architecture, specifications and semiconductor content

## 2.2. Data centres

Data centres are rapidly expanding in India, with total capacity increasing from around 375 MW in 2020 to 1,500 MW[4] in 2025 and it is expected to reach 6,000 MW by 2030. This expansion is being driven by multiple structural demand drivers, including cloud adoption, data localisation mandates, AI workloads, BFSI digitisation and 5G-led edge computing.

### Types of chips required by data centres



**Compute and AI acceleration** (CPUs, GPUs, ASICs and FPGAs)

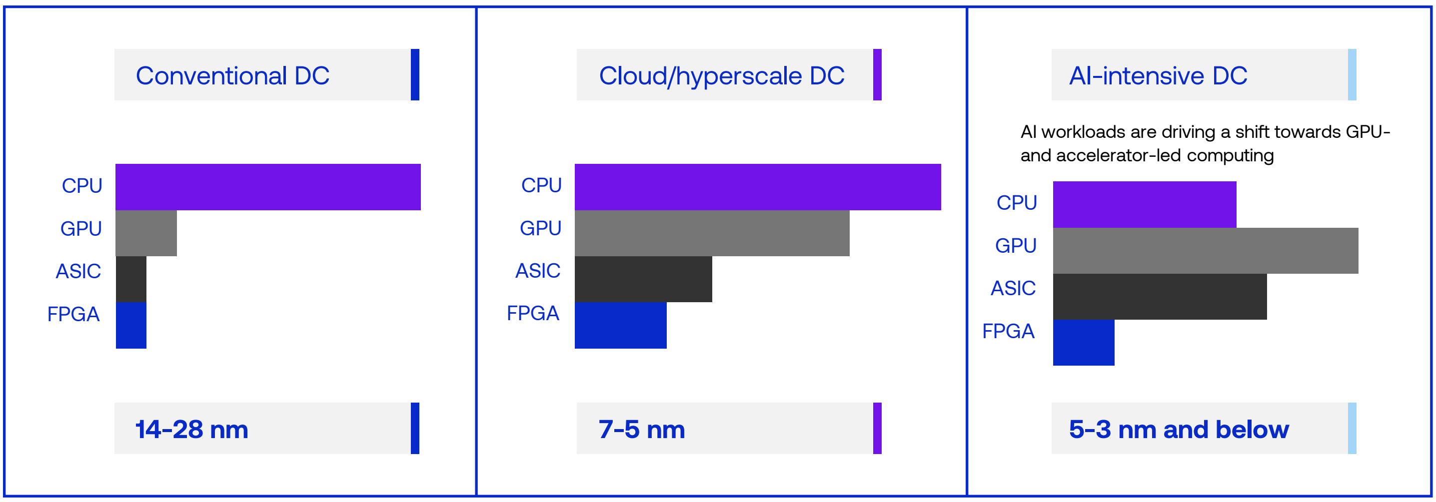
**Memory and storage** (DRAM/HBM and NAND Flash)

**Networking** (Ethernet switch ASICs, DPUs/SmartNICs and optical interconnect components)

Central processing Units (CPUs), Graphics Processing Units (GPUs), Application-Specific Integrated Circuits (ASICs) and Field-Programmable Gate Arrays (FPGAs)

Rising AI adoption will usher in a transition from conventional CPU-led architectures towards GPU- and accelerator-intensive environments, which will, in turn, increase compute intensity and drive demand for advanced semiconductor nodes.

### Evolution of chip demand across data centre architecture




DC – Data centres

**Node size decreases as computing improves**

AI infrastructure build-out is increasing demand for advanced compute and memory semiconductors. Recent increases in DRAM and HBM prices reflect strong AI-driven demand and underscore the strategic importance of advanced memory technologies.

4. Data centre capacity in the country, Press Information Bureau, 13 March 2026

## Key drivers of data centres

### Accelerating AI adoption: A catalyst for driving AI-enabled data centres

AI adoption is accelerating across sectors including healthcare, agriculture, manufacturing and education—around 89 per cent[5] of startups in India are using AI in their products or services. As India's AI agenda is centred on making AI affordable and open to all, its adoption rate is poised for rapid growth. Rising AI adoption, in turn, will fuel demand for GPUs, AI accelerators and high-performance memory, key components underpinning AI-enabled data centres.

### Key enablers of AI adoption

**IndiaAI Mission**

- Allocation of USD1.1 billion[6] for five years

**Centres of Excellence for AI**

- Three centres of excellence with a budget outlay of USD104 million[7], covering agriculture, healthcare and sustainable cities

**Expansion of DPIs**

- Large-scale digital ecosystems for AI applications generated by Aadhaar, UPI, DigiLocker and ONDC

**AI skilling and talent developmen t**

- 8,000 undergraduate students, 5,000 post graduate students and 500 PhD students supported in AI-related work[5]

DPI-digital public infrastructure

### Indigenous LLM development strengthens India's AI Ecosystem

India's indigenous AI model ecosystem is transitioning towards the development and deployment of foundation-models. This shift is being primarily driven by government initiatives such as the IndiaAI Mission, supported by the country's deep talent pool and strong entrepreneurial ecosystem. 12 organisations[6] and consortia were chosen to develop indigenous foundation-models under the IndiaAI Mission. The country has already witnessed the launch of India-focused sovereign models broadly focused on building sovereign AI capabilities through training on Indian datasets and languages. These models are expected to contribute to the creation of an open-source ecosystem, which can easily be leveraged by government organisations, startups and researchers.

**45,000[7] GPUs onboarded to train models**
(as of June 2026)

**USD223 million[6] financial assistance**
(as of February 2026)

**30 applications approved[6] for developing India-specific AI applications**

Growing deployment of indigenous AI models is expected to increase training and inference workloads, driving demand for AI-intensive data centres and higher semiconductor consumption across GPUs, processors, memory chips and networking equipment.

5. India's Emerging Technology Ecosystem, Press Information Bureau, 22 June 2026
6.. India AI Mission, Press Information Bureau, 13 February 2026
7. Centres of Excellence in Artificial Intelligence, Press Information Bureau, 5 August 2026

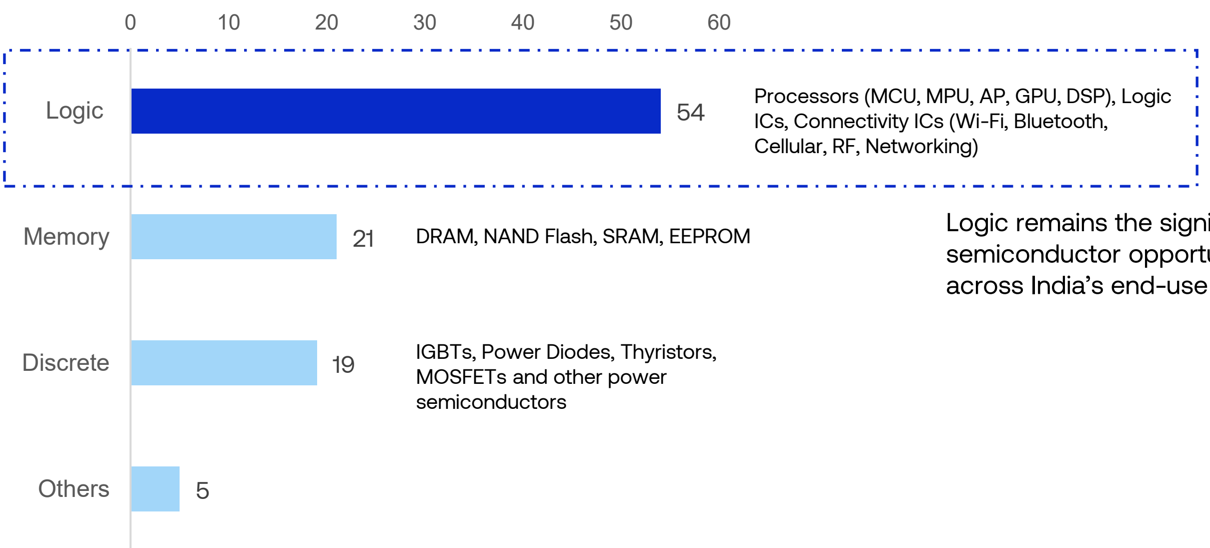
For exchange rate conversion, USD/INR rate 95.5 is used

# Mature logic nodes to remain central to India's semiconductor demand

India's semiconductor demand growth is likely to be driven by compute- and connectivity-intensive applications across mobile, telecom and digital infrastructure. At the same time, widespread adoption of electronics across automotive, industrial automation and consumer devices will sustain strong demand for mature-node semiconductors.

| Segments | 2029-30, USD Bn[8] | Drivers |
|---|---|---|
| Mobile and wearables | 42.13 | Government push through PLIs, rising need for connectivity and higher penetration of smartphones |
| Telecom | 13.22 | 5G rollouts and government push through PLI schemes |
| Information technology | 11.31 | Increased emphasis on data localisation and increased adoption of cloud usage |
| Industrial | 7.95 | Technology modernisation and proliferation of AI, digital and connected technologies |
| Consumer electronics | 5.55 | Increased disposable income with middle-class |
| Automotive | 4.52 | Further expansion in ADAS and EV penetration |
| Strategic sectors | 2.19 | Defence modernisation and localisation initiatives to fuel demand |

**Component-wise demand by 2029-30, per cent[8]**




Logic remains the significant semiconductor opportunity across India's end-use sectors

**28/40nm emerges as a key logic node**

- 300 mm wafers are expected to account for approximately 75 per cent[9] of India's logic demand by 2030, reflecting the concentration of high-volume digital and mixed-signal applications
- Within this segment, 28/40 nm is likely to contribute around 35 per cent[9] of demand in 2030, making it one of the largest node opportunities in the market. India's first fabrication plant, in Dholera, is geared for 28 nm and more matured nodes
- India's demand profile thus positions 300 mm and 28/40 nm technologies as attractive manufacturing opportunities
- Most end-use sectors analysed in this chapter rely predominantly on mature-node technologies, reinforcing the attractiveness of 28/40 nm manufacturing.

8) KPMG in India Analaysis basis the market size estimate from Future of India's Semiconductor Industry, NITI Frontier Tech Hub, NITI Aayog, May 2026
9) KPMG in India

3

# India's strategic play across the semiconductor value chain

*Prioritising opportunities aligned with India's strengths*

# 3. India's strategic play across the semiconductor value chain

## An interconnected semiconductor value chain

The semiconductor industry broadly comprises six core activities: EDA, chip design, equipment, materials, wafer fabrication and testing and packaging. Each activity is concentrated in specific regions and countries, collectively forming a deeply interconnected global ecosystem. Design and equipment are areas where the level of concentration is very high. While concentration is relatively lower in materials and testing and packaging, the dominance of these segments by a handful of countries underscores the potential risk of supply chain disruption should any of these geographies be affected by adverse events.

### Semiconductor value chain: Dominant regions and concentration level[1]

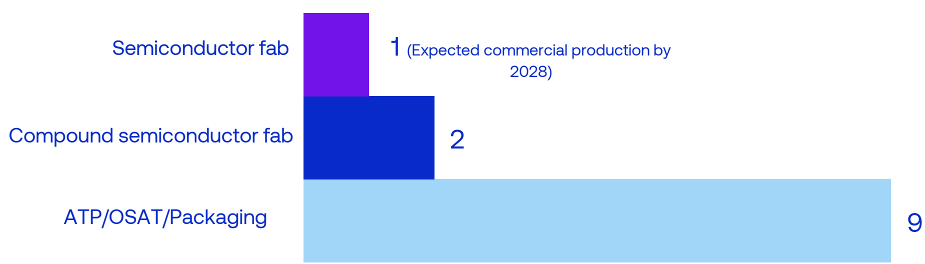
| Value chain segments | EDA | Design | Equipment | Materials | Fabs | ATP |
|---|---|---|---|---|---|---|
| Level of concentration | High | High | High | High | Moderate-high | Moderate-high |
| Dominant regions | The U.S. maintains a leading position in the EDA segment | The U.S.is a major hub for fabless design firms and IP providers | Equipment manufacturing is concentrated in the U.S., Japan and the Netherlands | Materials supply is concentrated in Japan, South Korea and Taiwan | Fabrication capacity is concentrated across Taiwan, South Korea, China and Japan | China and Taiwan dominate testing and packaging activities |

ATP: Assembly, testing and packaging

## Distribution of approved ISM projects across the semiconductor value chain

Investments in India's semiconductor sector to date have been spread across the value chain. The country's first fabrication plant is on track to begin commercial production by 2028, while investments into packaging projects help establish a strong manufacturing base. India also secured projects in advanced packaging and compound semiconductors, establishing an early foothold in these high-growth segments.

**Figure: Semiconductor value chain: Dominant regions and concentration level[2]**




ATP: Assembly, testing and packaging and OSAT: Outsourced Semiconductor Assembly and Test

**Drivers of next phase of growth**

**Concentration risks**
(EDA, design and equipment dominated by a few geographies)

**Strong manufacturing momentum**
(Progress in mature-node and packaging ecosystems)

**Semicon 2.0 opportunity**
(Expanding capabilities in design, equipment, materials and advanced packaging)

While India has established an initial presence across manufacturing-focused segments, the next phase should focus on areas where supply chain disruption risks are high and where India's inherent strengths can be leveraged to build capabilities, mitigate such risks and reduce import dependency.

1. Industry interactions and KPMG in India analysis
2. Government's Semicon India Programme, Press Information Bureau, 15 July 2026

## Strength mapping

India's strong design talent base, large STEM workforce, abundant labor pool and capabilities in materials engineering and specialty chemicals give it a unique advantage, which should be leveraged to build capabilities in strategic areas of the semiconductor ecosystem. An attempt has been made to compare these advantages with value chain segments, as shown in the figure below.

### Mapping India's core strengths across the semiconductor value chain*

● Strong linkage

| Value Chain Segment | Design | Equipment | Materials | Fabs | ATP |
|---|---|---|---|---|---|
| **Design talent** (20 per cent[2] of world's chip design engineers) | ● | | | | ● (AP) |
| **STEM pipeline** (10 million STEM[3] enrollment) | ● | ● | ● | ● | ● (AP) |
| **Workforce scale** (~1000 million working-age population[4]) | | | | | ● (LP) |
| **Material science** (Materials engineering, metallurgy, precision manufacturing) | | | ● | | |
| **Chemicals ecosystem** (Specialty chemicals and industrial gases) | | | ● | | |
| **Manufacturing capability** (Large-scale electronics manufacturing ecosystem and operational expertise) | | ● | ● | ● Compound & mature | |

ATP: Assembly, testing and packaging, AP: Advanced packaging and LP: Legacy packaging

Supported by its skilled talent pool, including large STEM pipeline, India is naturally aligned with talent-intensive segments such as design and advanced packaging. Among manufacturing-linked segments, materials exhibit a relatively strong alignment with India's existing industrial capabilities, making it a natural area for capability expansion and import substitution. While India's STEM talent base and manufacturing capability create a foundation for participation in equipment manufacturing, substantial technology development and sustained R&D investments are inevitable to build a meaningful presence.

### Capability complexity heatmap*

**Heat scale :** Low | Moderate | High | Very High

| Value chain segment | Investment required | Skill intensity | Time required | R&D intensity |
|---|---|---|---|---|
| **Design** Scale now | Moderate | High | Moderate | High |
| **Equipment** Build | Moderate | High | Moderate | High |
| **Materials** Build | High | High | Long | High |
| **Fabs** (mature nodes) Scale now | Very high | High | Very long | High |
| **ATP** Scale now | Moderate | Moderate | Short to Moderate | Moderate |

Scale now: Aligned with India's current strengths, policy priorities and ongoing investments and Build: Requiring capability development to unlock long-term competitiveness.

**Investment priorities**

- Design emerges as attractive opportunities given relatively lower investment and availability of skilled resources. While assembly, testing and packaging offers the fastest path to scale, equipment and materials require phased capability building.
- Mature-node fabs offer India a commercially viable pathway to build manufacturing scale and support a large domestic market. Building multiple fabs and supporting supply chains could create ecosystem synergies, laying the foundation for a future transition to advanced-node technologies.

2. India has emerged as a global hub for semiconductor design, Press Information Bureau, 13 March 2026
3. 14th Edition of All India Survey on Higher Education (AISHE), 2023-24, Ministry of Education, Government of India
4. United Nations, Population Division, people aged 15-64 considered working age population

*Note:
1) Strength mapping is indicative and based on a qualitative assessment of India's current capabilities and their applicability across semiconductor value-chain segments
2) Complexity heat map is based on typical capability requirements across value-chain segments. Complexity may vary by specific technologies, products and use cases. Equipment manufacturing assessment primarily reflects selected equipment categories, subsystems and components.

*Assessment is directional and based on typical capability requirements across value-chain segments; complexity may vary for specific technologies, products and use cases.

4

# Global best practices

*Lessons from leading semiconductor ecosystems*

# 4. Global best practices

**Taiwan: Key factors underpinned Taiwan's foundry-led semiconductor industry**

Taiwan adopted a foundry-led semiconductor development strategy, underpinned by strong government support and the establishment of one of the leading chip fabrication companies in 1987, which was a pivotal phase in Taiwan's semiconductor development[1]. Through successive industrial plans, sustained public investment, technology transfer initiatives and stable policy support over several decades, the government maintained a long-term commitment to building a globally competitive semiconductor industry. This commitment continues today through initiatives such as the Chip-based Industrial Innovation Program (2024-2033), backed by a budget of approximately USD9.3 billion[2] to support the development of innovative industrial solutions, strengthen design capabilities, improve domestic talent cultivation and attract global R&D professionals, international startups and investment.

Established in 1980, Hsinchu Science Park was created as Taiwan's first science park to support the country's transition towards technology-driven industrial development. The park brought together semiconductor companies, research institutions and leading universities. The park has served as an important hub for industry-academia collaboration, talent development and high-technology innovation[3].

Founded in 1973, ITRI played a key role in applied R&D, technology transfer and the incubation of semiconductor ventures[4]. Overseas training, talent repatriation and the recruitment of experienced industry leaders further strengthened Taiwan's technical capabilities and global industry linkages[1].

**Key lessons**

- Foundry-led industrial development
- Specialised SME supplier ecosystem
- Cluster-based ecosystem development
- Long-term policy commitment and talent development

**South Korea: Building semiconductor leadership through national champions and technology development**

South Korea's semiconductor industry has been driven by large conglomerates, whose multi-decade investments in manufacturing capacity, technology development, R&D and talent created the capabilities required for global competitiveness[5]. In parallel, the concentration of semiconductor activities across Giheung, Hwaseong, Pyeongtaek, Icheon and Yongin fostered deep ecosystem integration, specialised infrastructure and strong supplier collaboration[5]. Government support complemented private-sector investment through industrial policy, technology acquisition and public R&D institutions such as ETRI, which helped localise semiconductor design, manufacturing processes and production technologies.

Reflecting its continued commitment to the semiconductor sector, South Korea expanded its semiconductor support package to USD23.25 billion in 2025, up from USD18 billion in 2024[7]. Government support is broadly focused on R&D activities, investment in high-tech manufacturing equipment and the development of industrial infrastructure. This builds on South Korea's long-term ambition to establish one of the world's largest semiconductor clusters by 2047, spanning Pyeongtaek, Hwaseong, Yongin, Icheon, Anseong, Seongnam (including Pangyo New Town) and Suwon, which host semiconductor companies and institutions[5].

**Key lessons**

- National champion-led industrial development
- Cluster-based ecosystem development
- Public R&D-led capability building
- Technology acquisition and localisation

1. History of Taiwan's Semiconductor Industry, Center for Semiconudctor Processing and Systems Research
2. Taiwan Chip-based Industrial Innovation Program, Executive Taiwan, 13 November 2023
3. Hsinchu Science Park, International Development Program for Intelligent Computing (IDIPC)
4. Nation to build world's biggest semiconductor cluster by 2047, Korea.net (Republic of Korea Government), 16 January 2024
5. ETRI Semiconductor Laboratory, Electronics and Telecommunications Research Institute (ETRI)
6. Future of India's Semiconductor Industry, NITI Frontier Tech Hub, NITI Aayog

# Global best practices

## China: Key enablers of China's semiconductor development

China has pursued semiconductor self-sufficiency through a range of policy measures aimed at strengthening domestic semiconductor capabilities. Launching of National Integrated Circuit Industry Investment Fund ("Big Fund") was crucial step in the country's semiconductor journey. The first phase of Big Fund was launched in 2014 with a registered capital of USD21 billion[7]. This was followed by two subsequent phases: one with a registered capital of around USD35 billion[7] in 2019 and another one in 2024 with USD47.5 billion, the largest among the three. These funds helped the country build capabilities by investing in domestic semiconductor companies involved in design, equipment, materials and memory. China's semiconductor industry is concentrated in major regional hubs including Shanghai, Beijing, Shenzhen, Wuxi and Wuhan, with local governments supporting semiconductor development through industrial funds, industrial parks and other investment initiatives[8]. To strengthen its talent base, China introduced talent repatriation programmes with the aim to bring back Chinese engineers, researchers and entrepreneurs working overseas[9].

China's position as a major electronics manufacturing hub and one of the world's largest semiconductor markets has contributed to significant domestic demand for semiconductor products. Also supporting the local companies was public policy encouraging the use of domestically produced semiconductor products in strategic industries, thereby creating stable demand.

**Key lessons**

- **Cluster-based ecosystem development**
- **Deployment of patient capital at scale**
- **Competitive federalism to accelerate investment**
- **Public procurement and demand creation policies**

## The U.S.: Building semiconductor leadership through incentives, innovation and talent

The United States is strengthening its domestic semiconductor ecosystem through the CHIPS and Science Act, which provides USD52.7 billion[10] to support semiconductor manufacturing, research and workforce development. The programme includes USD39 billion for manufacturing incentives and USD13.2 billion for R&D and workforce development. The legislation provides incentives to expand domestic fabrication capacity and invest in semiconductor supply-chain capabilities, while also funding key initiatives such as the National Semiconductor Technology Center (NSTC) and the National Advanced Packaging Manufacturing Program (NAPMP).

In parallel, the U.S. is investing in semiconductor R&D, advanced packaging and workforce development programmes to support innovation and build technical capabilities. The strategy is further supported by industry, academic and government collaboration to accelerate technology development, commercialisation and talent creation. Together, these measures seek to enhance domestic semiconductor capabilities, strengthen supply-chain resilience and support long-term competitiveness in the global semiconductor industry.

**Key lessons**

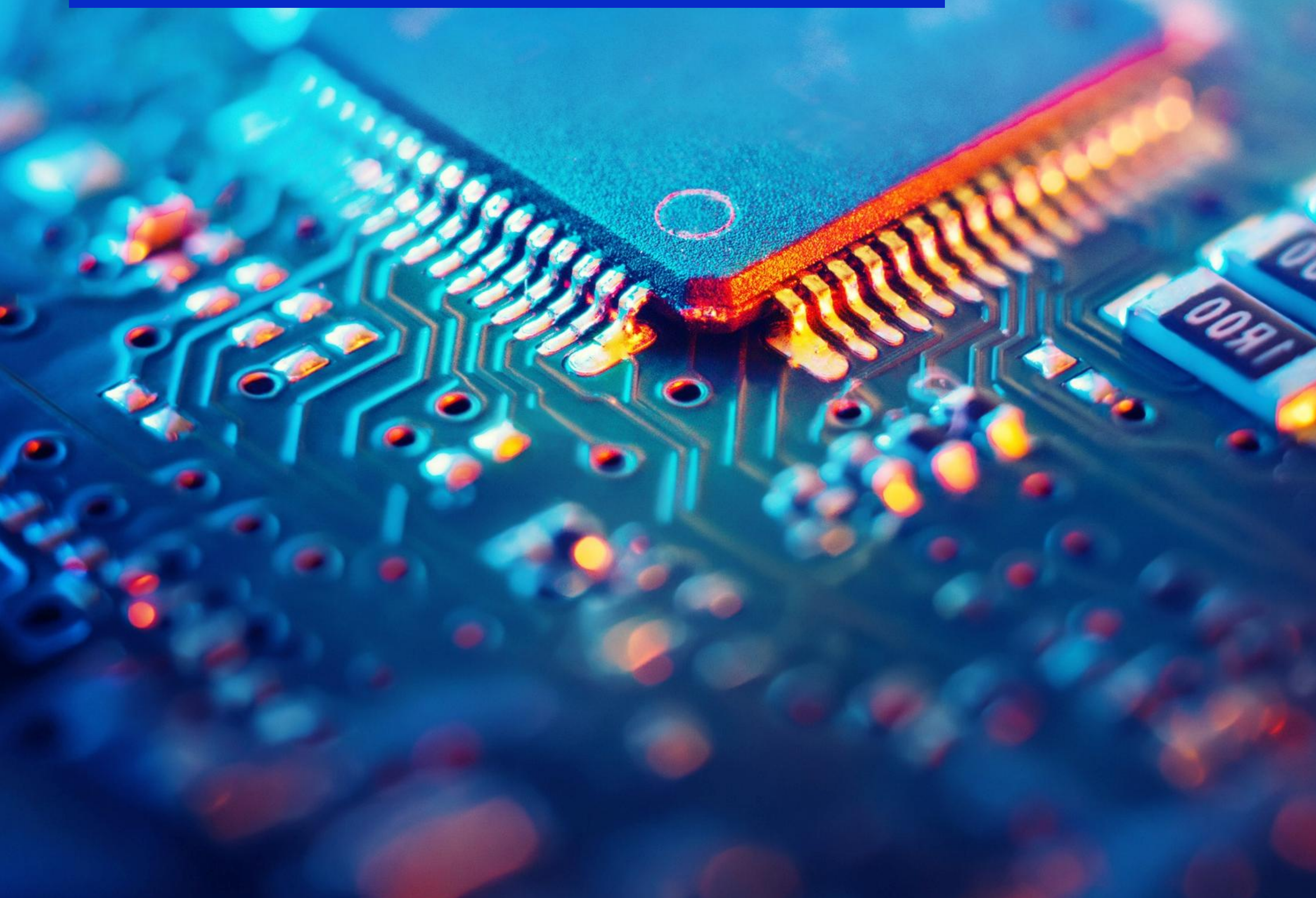
- **Large-scale manufacturing incentives**
- **Innovation-driven R&D ecosystem**
- **Public-private R&D infrastructure**
- **Talent and workforce development**

7. Taking stock of China's semiconductor industry, Semiconductor Industry Association, 13 July 2021
8. China's Semiconductor Sector Attracts Billions in Industrial Investment Funds, TrendForce, 29 July 2026
9. The Chinese Global Brain Turning Back to Home, IJ Reportika, 2026
10. Future of India's Semiconductor Industry, NITI Frontier Tech Hub, NITI Aayog

5

# Semiconductor patent landscape

*Global Patent Trend and India Opportunity*



# 5. Semiconductor Patent Landscape

The present landscape examines patent activity during the period January 1st, 2016, to June 30th, 2026, capturing global activity and identifying patent activity in India. The analysis identifies four major technology sectors: Semiconductor Accelerators, Semiconductor Advanced Packaging, High-Bandwidth Memory (HBM), and Chiplets & Advanced Heterogeneous Integration, which together represent interconnected dimensions of next-generation semiconductor development.

The landscape is structured as a hierarchical semiconductor patent universe, with the broader Semiconductor Industry serving as the parent technology population against which narrower technology-level patent activity can be benchmarked. Within this broader universe, they are further segmented into their respective technology sub-sectors.

**Semiconductor Accelerators**

**Semiconductor Advanced Packaging**

**High-Bandwidth Memory (HBM)**

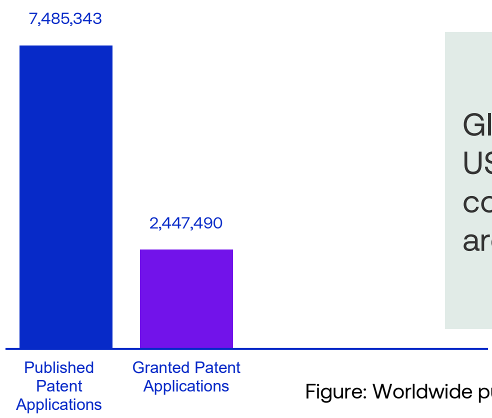
**Chiplets & Advanced Heterogeneous Integration**

*Scope note:* Since the patent databases are not neatly divided into specific and evolving sector definitions, we have painstakingly segregated data based on related keyword searches. In some cases, despite our best efforts, there could be overlap of patents across sub-sectors. Our intent here is to provide a larger picture of the patent landscape to help innovators, entrepreneurs, investors, and regulators to make appropriate decisions.

## 5.1 Global Patent Landscape

### A. Filing activity

The filing: split reflects an active pipeline rather than a bottleneck as major patent offices take two to four years to examine and grant, so a meaningful share of filings between 2023 & 2026 are still in prosecution




Global semiconductor sales are tracking toward roughly USD 1 trillion annualised in 2026 — the filing trend points to continued investment in emerging semiconductor architectures and technologies.

Figure: Worldwide published patent applications vs granted patents

### B. Jurisdictional distribution

| Jurisdiction | Publication | Grants |
|---|---|---|
| China (CN) | 2,112,833 | 586,490 |
| United States (US) | 1,680,142 | 683,967 |
| Japan (JP) | 989,018 | 323,006 |
| South Korea (KR) | 527,304 | 201,182 |
| European Patent Office (EP) | 469,716 | 101,201 |
| Taiwan (TW) | 254,507 | 97,901 |
| Germany (DE) | 89,967 | 19,613 |
| India (IN) | 78,188 | 28,257 |
| Australia (AU) | 51,414 | 16,255 |

China leads on filing volume, consistent with the scale of its domestic electronics and semiconductor ecosystem, while the US leads on grants (683,967), reflecting a mature examination pipeline and deep strength in processor, AI and EDA technologies. Japan, South Korea and Taiwan track their respective strengths in materials and components, memory manufacturing, and foundry operations.

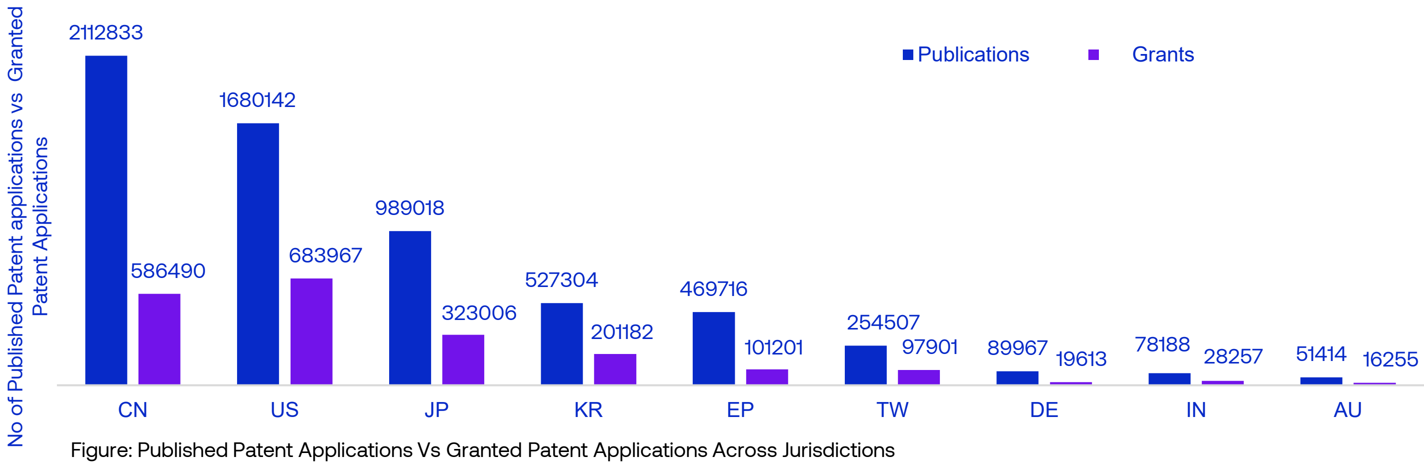


Figure: Published Patent Applications Vs Granted Patent Applications Across Jurisdictions

India, at 78,188 filings, sits below Germany and just above Australia in the tracked set

**China leads on filing volume; the US leads on grants**

## C. Leading global assignees

The top tracked assignees are led by Samsung Group (258,874), Huawei (139,575), TSMC (111,533) and IBM (106,601), followed by Mitsubishi Electric, Intel, Canon and BOE Technology Group. The ranking is dominated by integrated device manufacturers, foundries and diversified electronics conglomerates rather than fabless AI chip designers.

These organisations have built extensive portfolios around core semiconductor architectures, memory technologies, fabrication processes, packaging, processors, connectivity, sensors and other enabling technologies. That distinction matters commercially; for instance, NVIDIA, which holds an estimated 80–85% of data-centre AI accelerator revenue in 2026, relies on TSMC for both fabrication and advanced packaging, so its market dominance is not directly visible in this ownership ranking. Patent volume indicates where semiconductor R&D and manufacturing infrastructure is concentrated, and not necessarily where commercial value may have been captured.

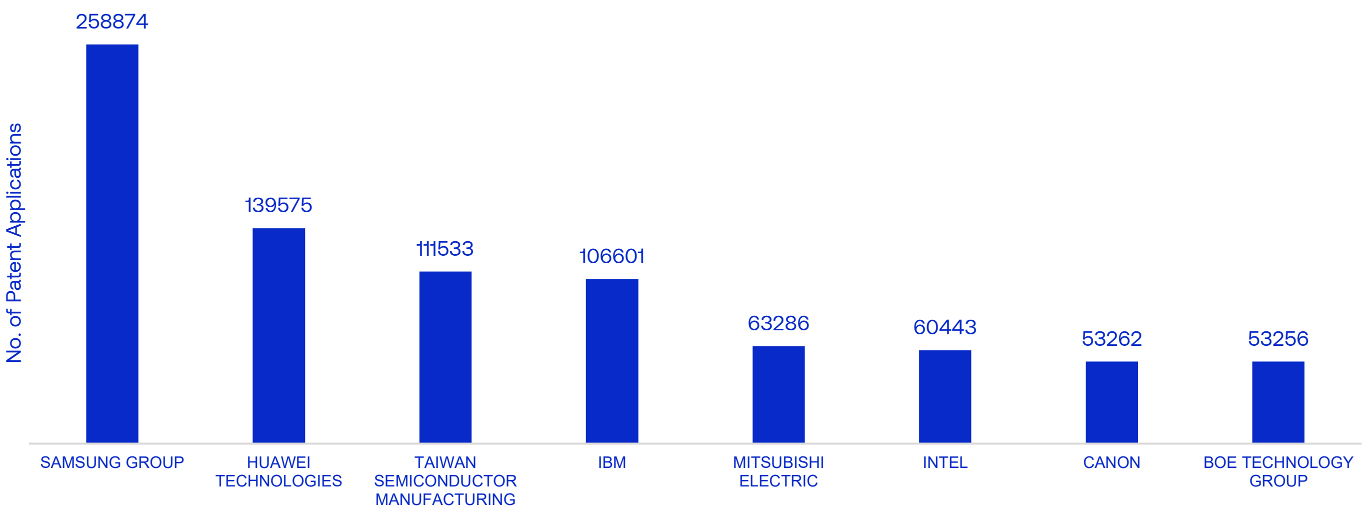


Figure: Leading worldwide patent assignees in semiconductor technologies

That ranking is not simply a measure of the number of patents owned; it reflects different positions within the semiconductor value chain because patent volume, patent ownership, technological significance and commercial semiconductor leadership are related but not identical measures.

Taken together, the jurisdiction and assignee analyses point to a highly competitive but concentrated semiconductor ecosystem. China contributes enormous patenting volume, the US remains a major centre for semiconductor and computing innovation, Japan retains deep technological expertise, and South Korea and Taiwan demonstrate the importance of manufacturing-led innovation. At the organisational level, this competition is concentrated among a relatively small number of global technology leaders. The resulting landscape can therefore be viewed as a race for control over the critical building blocks of next-generation computing that ranges from advanced process nodes and transistor architectures to AI accelerators, HBM, advanced packaging and chiplet integration. This is yet another reason why semiconductor patent portfolios have become increasingly strategic. They do not merely protect individual inventions but can provide companies with technological leverage across entire segments of the semiconductor value chain.

## 5.2 Indian Patent Landscape

### A. Filing activity

India recorded 78,188 published applications and 28,257 grants over the period — a modest base relative to the leading jurisdictions, but one shaped by India's historical strength in chip design, embedded systems and engineering services rather than fabrication.

**78,188**
published applications

**28,257**
granted patents

**~36%**
filing-to-grant conversion

**India's 78,188 filings are a modest base — but the mix is about to shift.**

That balance is shifting. As the India Semiconductor Mission scales and domestic manufacturing and packaging capacity comes online, India's patent footprint is likely to broaden beyond design-led filings into process, packaging and materials IP.

### B. Leading Assignees in India

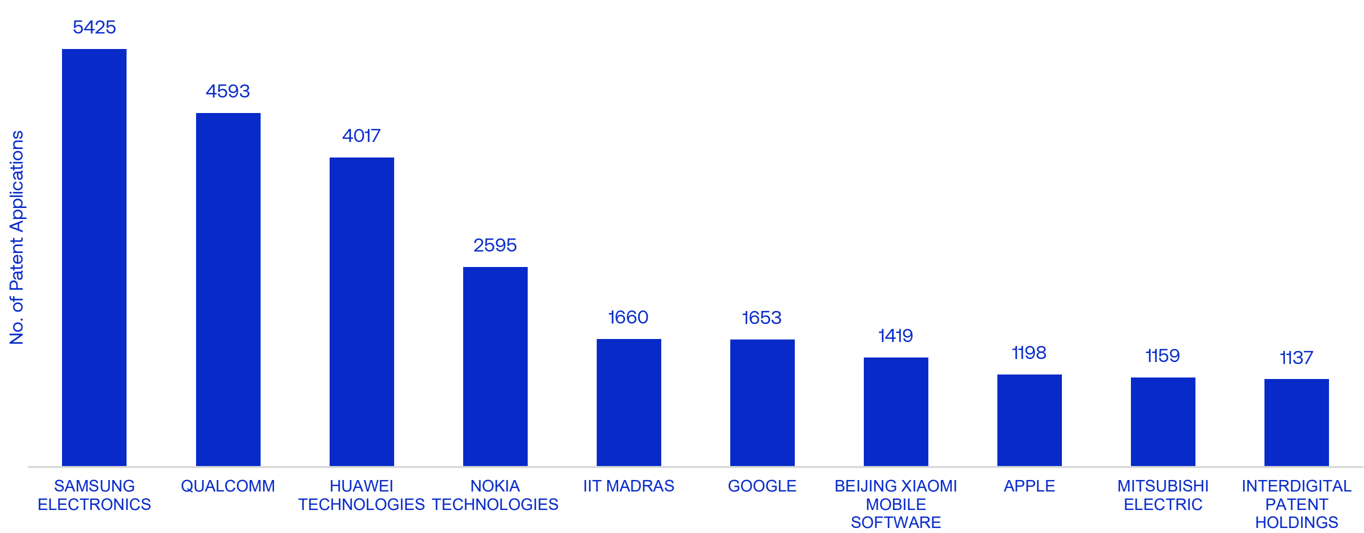



Figure: Leading patent assignees in India

The India-specific assignee list is led by Samsung Electronics (5,425), Qualcomm (4,593), Huawei (4,017) and Nokia (2,595) — multinational R&D and engineering centres rather than domestic manufacturers, consistent with India's design-services-led semiconductor economy.

**IIT Madras (1,660) is the only academic institution in the top ten**

Increasing patent quality, encouraging domestic ownership of semiconductor inventions, improving university–industry collaboration, supporting deep-tech startups and encouraging companies to protect innovations internationally could help India build portfolios that are not merely large in number but strategically important.

### C. Technology Mix

Semiconductor Accelerators account for roughly 92 per cent of India's tracked technology-sector filings (13,091 of 14,259), dwarfing Advanced Packaging, Chiplets and HBM. That concentration tracks the global AI accelerator market and plays to India's existing strength in chip design and software.

| Technology Sector | Publication | Grants |
|---|---|---|
| Semiconductor Accelerators | 13,091 | 2,621 |
| Advanced Semiconductor Packaging | 557 | 120 |
| Chiplets & Heterogeneous Integration | 358 | 49 |
| High-Bandwidth Memory (HBM) | 253 | 66 |

The comparatively thin activity in packaging, HBM and chiplets is notable given that all three are supply-constrained globally. This is a key gap that could narrow as India's OSAT and advanced-packaging capacity expands under ISM 2.0.

**Accelerators dominate India's mix; packaging, chiplets and HBM stay thin**

## 5.3 Technology Sector Deep Dive

### A. Semiconductor Accelerators

**NPU**

Neural Processing Units for efficient AI/ML work load execution

**Tensor/Matrix Processing Unit**

Optimized hardware for tensor and matrix computations in AI workloads

**AI Inference Accelerators**

Hardware optimized for low-latency, high-throughput AI inference

**Neuromorphic AI Hardware**

Brain-inspired computing for ultra-low-power, event-driven AI

Neural Processing Units dominate India's accelerator patenting more than ten times (10X) the next-largest sub-sector by publication count. That concentration mirrors the broader edge-AI hardware trend, with on-device inference now being a $30-billion-plus annual market as smartphones, PCs and automotive systems adopt dedicated NPUs to cut latency and power draw, and India's software and chip-design base is well positioned to capture that demand. Tensor/matrix hardware, AI inference accelerators, memory-centric accelerators and neuromorphic hardware remain comparatively early-stage by patent volume, leaving room for diversification beyond NPU-centric filings.

The grant distribution reinforces this pattern, although at substantially lower absolute numbers. NPU technology accounts for 764 grants, followed by 40 grants for tensor/matrix processing hardware and 13 grants for AI inference accelerators. Memory-centric AI accelerators account for 3 grants, while neuromorphic AI hardware has only 9 grants in the displayed dataset.

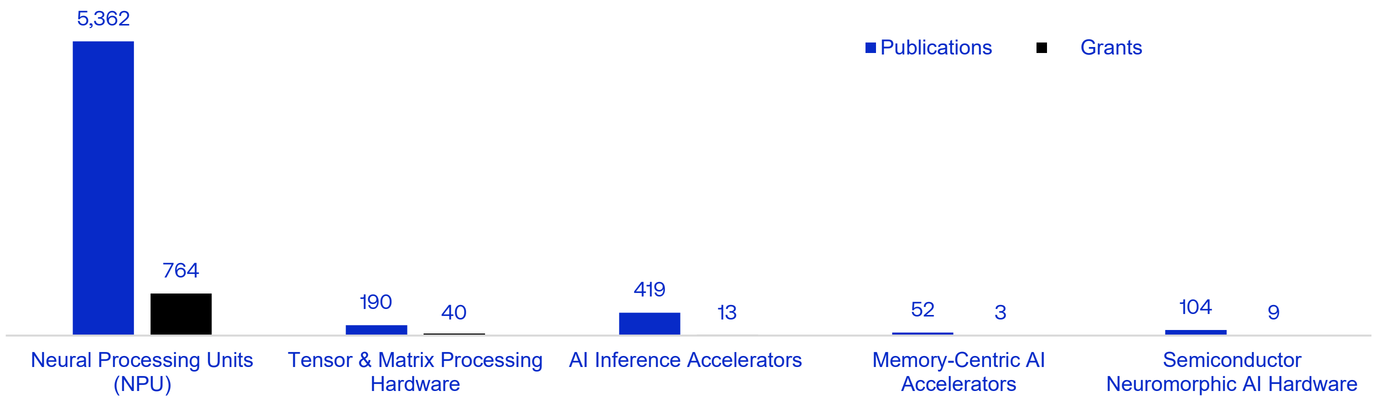



Figure: Published Patent Applications Vs. Granted Patent Applications – Semiconductor Accelerators

The particularly large difference between NPU publications and grants suggests that NPU technology has attracted sustained and extensive patenting over the relevant period, with many applications still progressing through examination. In contrast, the very low neuromorphic grant count indicates that this remains a relatively early-stage and exploratory technology area.

**NPUs dominate India's accelerator patenting by more than 10×**

## B. Advanced Semiconductor Packaging

**Advanced Bonding**

Techniques for joining dies, wafers or components with high precision and fine pitch for high-density integration

**TSV/ Hybrid Bonding/ Interconnect**

Through-silicon vias, hybrid bonding and advanced interconnects for vertical and high-density electrical connections

**Interposer**

Silicon, organic or other interposer structures for high-bandwidth, dense integration of multiple dies or chiplets

**Thermal Management /Power Delivery**

Solutions for heat removal, thermal control and stable power distribution in high-density packages

**162**
Bonding Publications

**129**
Interconnect Publications

**69**
Interposer Publications

**49**
Thermal & power Publications

India's packaging patent activity is fairly balanced across bonding (162 publications), interconnect (129 publications), interposer (69 publications) and thermal/power technologies (49 publications). This is a strategically relevant area as TSMC's CoWoS packaging lines are the industry's primary route for pairing HBM with AI accelerator dies and remained fully booked through 2026 despite roughly doubling capacity in 2025, making advanced packaging one of the tightest bottlenecks in the global AI hardware supply chain. As India's OSAT and ATMP facilities scale up under ISM 2.0, packaging-related patenting is a plausible growth area and is the one requiring comparatively less capital than leading-edge wafer fabrication.

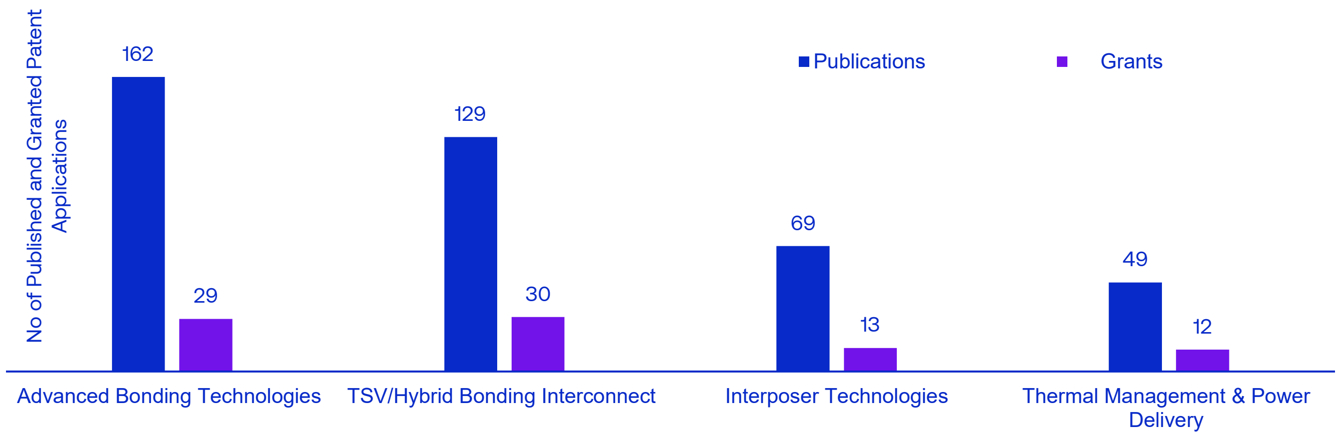



Figure: Published Patent Applications Vs. Granted Patent Applications – Advanced Semiconductor Packaging

Absolute volumes remain modest against the global ecosystem, but packaging is one area where India could build capability without the scale of investment leading-edge wafer fabrication demands. As OSAT and ATMP facilities scale under ISM 2.0, packaging-related patenting is a plausible growth area.

## C. High-Bandwidth Memory (HBM) Architecture

**Bandwidth Scaling**

Increasing memory bandwidth through wider interfaces, higher data rates and parallel channels

**3D-Stacked Memory**

Vertical stacking of multiple memory dies using TSVs to increase capacity and reduce interconnect distance

**Thermal Management**

Managing and dissipating heat in densely stacked HBM structures to ensure performance, reliability and longevity

**Error Management**

Error detection, correction, monitoring and recovery mechanisms to maintain data integrity and system reliability

| Sub-Sector | Publication | Grants |
|---|---|---|
| Bandwidth Scaling in HBM | 140 | 28 |
| 3D-Stacked Memory | 96 | 19 |
| Thermal Management of HBM | 14 | 1 |
| Error Management of HBM | 5 | 0 |

Bandwidth scaling (140 publications, 28 grants) and 3D-stacked memory (96 publications, 19 grants) account for most of India's HBM-related filings. Thermal and error management remain largely unaddressed. HBM-related filings. Thermal and error management remain largely unaddressed. HBM supply itself is concentrated among three producers, viz., SK hynix, Samsung and Micron, while industry trackers report persistent undersupply through 2026 as HBM4 and 16-high stacks ramp, with easing expected only once capacity expansions are complete later in the year

HBM supply is concentrated among three producers — SK hynix, Samsung and Micron — with industry trackers reporting persistent undersupply through 2026 as HBM4 and 16-high stacks ramp, easing only once capacity expansions complete later in the year.

**India's filings concentrate on core architecture rather than the thermal and reliability challenges that dominate industry discussion of HBM4 — a gap that is also clear white space for future patenting.**

## D. Chiplets and Advanced Heterogeneous Integration

**3D Chiplet Integration**

Vertical stacking of chiplets using TSVs, micro-bumps or hybrid bonding for high-density integration

**Heterogeneous Chiplet Integration**

Integration of diverse chiplets (compute, memory, analog, RF, etc.) for optimal system performance and functionality

**Multi-Material /Specialized Integration**

Use of advanced materials (e.g., SiC, GaN, InP, BN) and specialized processes for enhanced performance

**Universal Chiplet Interconnect**

Standardized, scalable interconnect architectures (e.g., UCIe, BoW, AIB) for seamless chiplet connectivity

**Photonic / Optical Integration**

Integration of photonic components and optical interconnects for high-bandwidth, low-power data transmission

3D Chiplet Integration leads India's chiplet-related filings, followed by Heterogeneous Chiplet Integration, though the latter's grant count (2) lags well behind its filing volume, suggesting most of its applications remain in examination.

This activity sits against a fast-maturing global standards backdrop. The Universal Chiplet Interconnect Express (UCIe) standard, backed by AMD, Arm, Intel, Google, Meta, Microsoft, Qualcomm, Samsung and TSMC, reached its 3.0 specification in 2026, and the broader chiplet interconnect market is projected to grow at roughly 34% CAGR through 2035. India's Universal Chiplet Interconnect sub-sector remains small relative to this momentum, marking it as an area to watch rather than a current strength.

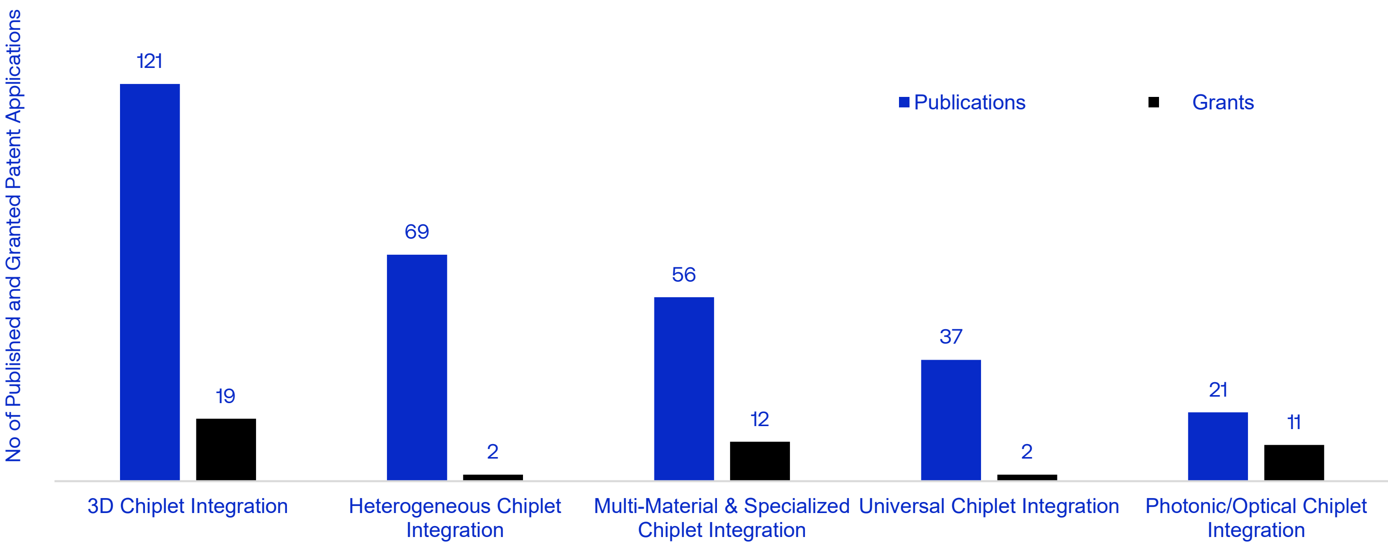



Figure: Published Patent Applications Vs. Granted Patent Applications – 3D Chiplet Integration

# 5.4 The SICLD Act: India's Underused Semiconductor IP Statute

While patent filings only picture a part of India's semiconductor IP story, a separate, purpose-built statute, the Semiconductor Integrated Circuits Layout-Design (SICLD) Act, 2000, was enacted specifically to protect the physical topography of a chip. This Act was in fulfilment of India's obligations under Article 35 of the WTO-TRIPS agreement. Registry data examined below shows that, even as patent filings and India's broader IP system have grown sharply, this dedicated chip-layout statute has remained almost entirely unused, exposing a structural gap between India's design capability and the domestic legal tools meant to protect it.

## A. What the SICLD Act Protects

Unlike a patent, which protects a functional invention, or a copyright, which protects artistic expression, the SICLD Act protects the specific layout design of an integrated circuit — its purpose is to prevent "chip piracy," where a competitor physically strips a chip to copy its layout without doing the underlying R&D.

| Element | What it means |
|---|---|
| **Protection period** | 10 years from the date of filing or first commercial exploitation |
| **Registration criteria** | Layout must be original and inherently distinctive, and not commercially exploited for more than two years |
| **Administering body** | Registry of SICLD, under the CGPDTM (DPIIT) |

Passed in 2000 with the Registry established in 2004, the Act's substantive provisions took effect only on 1 May 2011 — an 11-year gap in which no company could actually register a layout-design in India. Administration then moved from MeitY to DPIIT on 17 March 2016.

**2000**
SICLD Act passed

**2004**
Registry established

**2011**
Provisions in force

**2016**
Moved to DPIIT

The decade-long lag left an entire generation of Indian chip design with no working registration regime — and the habit of not filing has proven hard to reverse even now that the Registry is live.

## B. A Statistical Void: Registry Filing

As of 2026, only thirty-one (31) SICLD applications have been filed for registration since the Registry became operational. Of these, fifteen (15) have been examined, of which seven (07) were registered, and eight (08) were not accepted or were abandoned. Six of those seven registered certificates belong to a single public-sector entity, Bharat Electronics Limited, with one further certificate issued to ISRO. In other words, roughly a quarter-century of activity under India's dedicated chip-IP statute has produced fewer than three dozen filings in total, almost none of them from the private, fabless design sector that India is best known for.

**31**
SICLD applications filed, ever

**7 of 15**
examined filings registered — 6 to one PSU

**~5 / yr**
average filings, no discernible trend

| IP Category | FY 2020-21 | FY 2024-25 | 5-Year Change |
|---|---|---|---|
| **Patents** | 58,503 | 110,375 | +89 per cent |
| **Industrial Designs** | 14,241 | 43,005 | +202 per cent |
| **Geographical Indications** | 58 | 275 | +375 per cent |
| **Copyrights** | 24,451 | 44,095 | +80 per cent |
| **Total IP filings (all categories)** | 528,471 | 749,946 | +42 per cent |
| **SICLD Registrations** | 5 | 6 | ~flat |

## Every other IP category has surged — chip-layout filings have flatlined

The contrast with the rest of India's IP system is stark. Between 2020-21 and 2024-25, patent filings in India rose from 58,503 to 110,375 (+89%), industrial design filings nearly tripled (+202%, from 14,241 to 43,005), geographical indication filings grew nearly 375% (58 to 275), and copyright filings rose about 80% (24,451 to 44,095). Over the identical five years, SICLD Registry filings ran 5, 2, 8, 2, 6, oscillating around a mean of roughly five filings a year, with no discernible trend.

The gap is sharper still against India's own semiconductor patent activity. In 2022-23, the same year SICLD recorded its best-ever total of 8 layout-design filings, semiconductor-related patent applications jumped from 1,488 to 2,178, a 46% single-year surge. Chip designers in India are not filing less IP; rather, they are simply filing almost none of it under the one statute built specifically for the physical layout itself and are overwhelmingly choosing the patent (and trade-secret) route instead. Set against that, the scale of committed investment underscores how disconnected SICLD has become from the ecosystem it was built to serve.

### C. Structural and Legal Roadblocks

The Act's failure to attract commercial filings is not simply a matter of awareness, and it traces to four structural features of the statute itself, now sharpened by the filing data above:

## Four structural flaws leave the SICLD Act unused

**Originality vs. Novelty threshold (Section 7)**
a layout cannot be registered if it is not "original" or is inherently non-distinctive, yet modern VLSI design relies heavily on standard, pre-existing IP blocks and cell libraries, making statutory distinctiveness difficult to establish for an entire layout topography.

**Reverse-engineering carve-out (Section 18)**
third parties may reproduce a registered layout for "scientific research, analysis, or evaluation." In practice, a competitor who analyses a chip and, using independent effort, arrives at a new layout is fully protected, even where the final product performs an identical function, as the Act protects the physical layout only, not the underlying functionality..

**Obsolescence outpaces registration**
A state-of-the-art layout is typically obsolete within 24-36 months, while registration, including processing and potential oppositions, can take long enough to exceed the chip's commercial lifespan, undercutting the value of the nominal 10-year protection term.

**Form over functionality**
The Act protects the geometric arrangement of the mask work, not the underlying logic, code, or electronic architecture. Because that functionality can be replicated with a different physical layout, firms increasingly favour patents (for the inventive concept) or trade secrets (for RTL code and netlists), which offer broader protection.

## D. Global Comparison: Layout-Design Protection Regimes

India, the United States, the European Union, China and Japan all conform to the TRIPS Agreement's baseline standards for layout-design protection, but differ in statutory terminology, regulatory authority and enforcement mechanics. India, China and Japan use dedicated, standalone sui generis statutes; the United States folds chip protection into its Copyright Act as a distinct "mask work" right; and the European Union relies on a harmonising Directive that individual member states implement nationally.

| Feature | India | United States | China | Japan |
|---|---|---|---|---|
| **Governing law** | SICLD Act, 2000 | Semiconductor Chip Protection Act, 1984 | IC Layout-Design Regulations (2001) | Circuit Layout Act (1985) |
| **Legal term used** | Layout-Design | Mask Work | IC Layout-Design | Circuit Layout Right |
| **Registration mandatory** | Yes — required before enforcement | Yes, within 2 years of first use | Yes, within 2 years of first use | Yes, required to establish the right |
| **Duration of protection** | 10 years from filing / first use | 10 years from registration / first use | 10 years (capped at 15 from creation) | 10 years from registration |
| **Reverse engineering allowed** | Yes, for analysis, evaluation or teaching | Yes, for competitive analysis | Yes, for conceptual or academic evaluation | Yes, for evaluation, analysis and research |

## E. A Case for India's Trade Secret Law

### India's real IP gap: no trade-secrets law. A draft bill exists — but remains unenacted

Patents protect inventions and SICLD protects registered chip layouts, but the IP semiconductor companies rely on most RTL code, netlists, process recipes, yield data, and fabrication know-how is protected by neither. India has no dedicated trade secrets statute; disputes are litigated case-by-case under the Indian Contract Act, 1872 and common-law breach of confidence, with no statutory definition, no dedicated forum, and no predictable remedy.  This gap is arguably more urgent to close than reforming SICLD itself, since it is the one legal tool early-stage design start-ups and foundries actually need.

The 22nd Law Commission's March 2024 report, "Trade Secrets and Economic Espionage," proposed a draft Protection of Trade Secrets Bill, 2024: a sui generis statute defining trade secrets, routing disputes to Commercial Courts, and providing injunctions, damages, compulsory licensing and whistleblower protection. As of 2026, it remains unenacted, and India is the only major chip-manufacturing hopeful without a codified regime. Every peer semiconductor economy has moved further than India's draft bill, and the more assertive Asian regimes emerged directly from major theft episodes.

| Jurisdiction | Regime | Key Feature |
|---|---|---|
| **United States** | Defend Trade Secrets Act, 2016 | Federal civil action; ex parte seizure remedy |
| **European Union** | Trade Secrets Directive, 2016/943 | Harmonised EU-wide minimum standards |
| **South Korea** | Trade Secret Protection Act + Industrial Technology Act | Chip process tech = "national core technology"; criminal penalties, export controls |
| **Taiwan** | Trade Secrets Act + National Security Act (2022) | Up to 12 yrs' prison for leaks to China; extraterritorial reach |
| **China** | Anti-Unfair Competition Law (2019) | Punitive damages up to 5x loss; SAMR enforcement |
| **India** | Draft Bill, 2024 (unenacted) | No criminal offence; no sector designation; civil-only |

# 5.5 Strategic Outlook

1. **Diversify beyond accelerators.** Around 92% of India's tracked tech-sector filings sit in accelerators; extending into packaging, HBM and chiplets would hedge the portfolio against a single-cycle downturn.

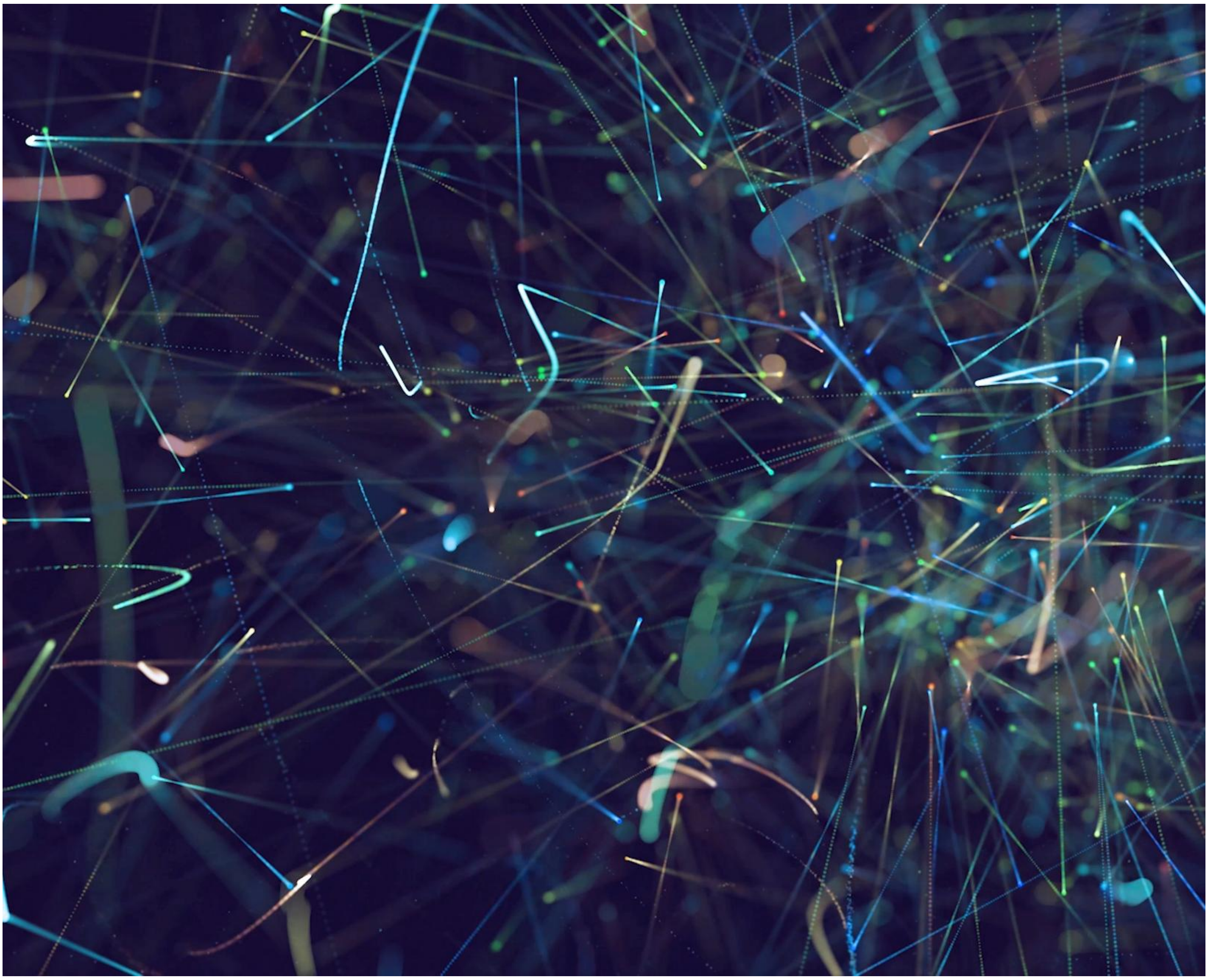
2. **Expect the fab buildout to open new IP.** ISM 2.0's ~USD 13.4B push into OSAT, ATMP and packaging should drive patenting in process technology, thermal management and interconnects — exactly where India's grant counts are thinnest today.

3. **Close the filing-to-grant gap.** India's 28,257 grants against 78,188 published applications is a 36% conversion rate that trails leading jurisdictions, pointing to stronger prosecution quality and international filing strategy.

4. **Engage the chiplet standards process.** As UCIe consolidates as the de facto die-to-die interconnect standard, sustained standards engagement — not filing volume alone — will determine India's voice in future specifications.

5. **Reform the SICLD Act.** The statute has been effectively stagnant for two decades; peers like Taiwan, South Korea and China hardened their frameworks only after a costly theft episode forced the issue.

6. **Enact trade-secrets legislation.** India still has no dedicated statute; passing the Protection of Trade Secrets Bill, 2024 — ideally with a narrow 'core technology' designation for ISM-funded projects — would close the gap that matters most.



6

# Way forward and recommendations

*Strategic interventions to strengthen India's semiconductor ecosystem*

# 6. Way forward and recommendations

India's semiconductor opportunity extends beyond meeting domestic demand to establishing a globally competitive and resilient ecosystem. To maximise value capture, strengthen technological sovereignty and enhance supply-chain resilience, India should pursue a phased strategy that scales existing strengths, builds critical ecosystem capabilities and gradually advances into emerging semiconductor technologies requiring higher levels of innovation, talent and capital investment. Realising this pathway will depend on five strategic enablers: deepening the domestic supply chain, building a future-ready talent ecosystem, strengthening R&D, innovation and IP creation, fostering strategic global partnerships, and enhancing infrastructure and ease of doing business.

.

**Accelerate India's transition into a globally competitive and resilient semiconductor hub**

**Niche R&D and manufacturing intensity**

**Strategic frontier**

- Advanced node R&D
- Advanced memory technologies
- AI infrastructure chips
- High performance computing chips
- Next-generation packaging technologies
- Emerging semiconductor technologies

*Long-term opportunities requiring sustained investments in innovation, R&D and talent*

**Technology sophistication**

**Build capabilities**

- R&D and innovation ecosystem
- Technology commercialisation ecosystem
- Semiconductor materials
- Specialty chemicals and gases
- Testing and qualification ecosystem
- Equipment ecosystem

*Ecosystem capabilities to support manufacturing scale and long-term competitiveness*

**Ecosystem maturity**

**Scale now**

- Semiconductor design
- Fabless IP development
- AI accelerator and ASIC design
- Mature-node and compound fabs
- Advanced packaging (ATMP/OSAT)
- Connectivity and power ICs

*Strong alignment with India's existing strengths and faster pathways to value creation*

**Strategic enablers: The foundation that powers the journey**

- Deepen domestic supply chain
- Build a future-ready talent ecosystem
- Strengthen R&D, innovation and IP creation
- Foster strategic global partnerships
- Enhance infrastructure and ease of doing business

# Recommendations

**Deepen domestic supply chain**

- Develop a national programme to support semiconductor equipment servicing, refurbishment and calibration capabilities
- Establish supplier development partnerships between domestic SMEs and global semiconductor manufacturers
- Create a certification framework to improve quality standards among domestic semiconductor component and material suppliers
- Support shared testing and qualification facilities for semiconductor materials, components and equipment
- Develop targeted supplier-development programmes to nurture specialised semiconductor SMEs in materials, equipment components, testing, calibration and equipment servicing, drawing lessons from Taiwan's supplier ecosystem.

**Build a future-ready talent ecosystem**

- Launch a global semiconductor talent return programme targeting experienced Indian professionals in overseas fabs, IDMs and equipment companies
- Create sector-specific semiconductor fellowships linking industry, academia and research institutions
- Establish industry-led apprenticeship programmes within semiconductor manufacturing and equipment companies
- Introduce retention incentives for critical semiconductor talent in manufacturing and R&D roles
- Create structured pathways for semiconductor professionals to transition between industry, academia and public research institutions, facilitating continuous knowledge transfer and capability development.
- Establish an “India Semiconductor Academy” to enhance talent in fabrication, process engineering, equipment, materials, packaging, testing, quality, operations and semiconductor business leadership.

**Create IP commercialisation mechanisms**

- Create mission-driven semiconductor research programmes focused on areas where India can build differentiation (e.g., power semiconductors, compound semiconductors, automotive electronics and chiplets)
- Establish collaborative pilot-line facilities to bridge the gap between laboratory research and commercialisation
- Support IP monetisation and commercialisation mechanisms for semiconductor research institutions and start-ups
- Create industry-led semiconductor research platforms that bridge academia and manufacturing, taking inspiration from Taiwan's ITRI and South Korea's ETRI-driven capability-building models.

**Enhance infrastructure and ease of doing business**

- Introduce a semiconductor-specific single-window clearance mechanism with defined service-level agreements
- Create plug-and-play industrial infrastructure for semiconductor suppliers and support industries
- Standardise utility, environmental and regulatory approval processes across states
- Develop specialised infrastructure for semiconductor equipment maintenance, logistics and hazardous material management
- Promote geographically concentrated semiconductor clusters integrating manufacturers, suppliers, R&D institutions and supporting infrastructure to drive ecosystem efficiency and collaboration, as demonstrated by Taiwan, South Korea and China.

**Foster strategic global partnerships**

- Facilitate joint semiconductor R&D programmes with international universities, laboratories and technology institutes
- Expand participation in international semiconductor standards, packaging and research consortia
- Establish reciprocal researcher and engineer exchange programmes between India and leading semiconductor ecosystems
- Develop cross-border collaboration mechanisms for semiconductor equipment, materials and process technologies
- Facilitate technology acquisition and co-development partnerships with global semiconductor leaders to accelerate capability building and technology localisation, reflecting successful practices observed in South Korea and Taiwan.

# Abbreviation list - 1/2

| Abbreviation | Full Form |
|---|---|
| ADAS | Advanced Driver Assistance Systems |
| AI | Artificial Intelligence |
| AP | Advanced Packaging |
| ASIC | Application-Specific Integrated Circuit |
| ATMP | Assembly, Testing, Marking and Packaging |
| ATP | Assembly, Testing and Packaging |
| BFSI | Banking, Financial Services and Insurance |
| C2S | Chips to Startup |
| CAGR | Compound Annual Growth Rate |
| CGPDTM | Office of the Controller General of Patents, Designs & Trade Marks |
| CoWoS | Chip-on-Wafer-on-Substrate |
| CPU | Central Processing Unit |
| DC | Data Centre |
| DLI | Design Linked Incentive |
| DPI | Digital Public Infrastructure |
| DPIIT | Department for Promotion of Industry and Internal Trade |
| DPU | Data Processing Unit |
| DRAM | Dynamic Random Access Memory |
| ECMS | Electronic Component Manufacturing Scheme |
| EDA | Electronic Design Automation |
| ETRI | Electronics and Telecommunications Research Institute |
| EV | Electric Vehicle |
| FPGA | Field-Programmable Gate Array |
| GaN | Gallium Nitride |
| GNSS | Global Navigation Satellite System |
| GPU | Graphics Processing Unit |
| HBM | High-Bandwidth Memory |
| HS Code | Harmonized System Code |
| IC | Integrated Circuit |
| iCET | Initiative on Critical and Emerging Technology |
| IDM | Integrated Device Manufacturer |
| IDTA | India Deep Tech Alliance |
| IGBT | Insulated Gate Bipolar Transistor |
| IoT | Internet of Things |
| IP | Intellectual Property |
| ISP | Image Signal Processor |
| ISM | India Semiconductor Mission |
| ISRO | Indian Space Research Organisation |
| IT | Information Technology |
| ITRI | Industrial Technology Research Institute |

# Abbreviation list - 2/2

| Abbreviation | Full Form |
|---|---|
| LiDAR | Light Detection and Ranging |
| LLM | Large Language Model |
| LPDDR | Low-Power Double Data Rate |
| MCU | Microcontroller Unit |
| MEMS | Micro-Electro-Mechanical Systems |
| MOSFET | Metal-Oxide-Semiconductor Field-Effect Transistor |
| MPU | Microprocessor Unit |
| MSME | Micro, Small and Medium Enterprise |
| NAND | Not AND (Flash Memory) |
| NAPMP | National Advanced Packaging Manufacturing Program |
| NFC | Near Field Communication |
| NPU | Neural Processing Unit |
| NSTC | National Semiconductor Technology Center |
| ONDC | Open Network for Digital Commerce |
| OSAT | Outsourced Semiconductor Assembly and Test |
| PE-VC | Private Equity and Venture Capital |
| PLI | Production-Linked Incentive |
| PMIC | Power Management Integrated Circuit |
| PMP | Phased Manufacturing Programme |
| R&D | Research and Development |
| RDI | Research, Development and Innovation |
| RF | Radio Frequency |
| RTL | Register-Transfer Level |
| SAMR | State Administration for Market Regulation (China) |
| SEMI | Semiconductor Equipment and Materials International |
| SICLD Act | Semiconductor Integrated Circuits Layout-Design Act, 2000 |
| SME | Small and Medium Enterprise |
| SmartNIC | Smart Network Interface Card |
| SoC | System-on-Chip |
| SRAM | Static Random Access Memory |
| STEM | Science, Technology, Engineering and Mathematics |
| TRIPS | Trade-Related Aspects of Intellectual Property Rights |
| TRUST | Transforming the Relationship Utilizing Strategic Technology |
| TSV | Through-Silicon Via |
| UCIe | Universal Chiplet Interconnect Express |
| UPI | Unified Payments Interface |
| UWB | Ultra-Wideband |
| V2X | Vehicle-to-Everything |
| VLSI | Very Large-Scale Integration |
| WTO | World Trade Organisation |

# About KPMG in India

KPMG in India brings significant experience supporting stakeholders across the semiconductor value chain, including chip design, manufacturing, ATMP/OSAT, equipment and materials suppliers, electronics OEMs, ESDM companies, and broader ecosystem participants. Through its Global Semiconductor Practice, KPMG in India combines a broad network of industry specialists, regional Centers of Excellence (CoEs) and thought leaders who collaborate across geographies to deliver insights and solutions tailored to client needs. Our semiconductor practice draws on deep industry knowledge, multidisciplinary capabilities, strategic alliances and market-leading thought leadership to help organisations navigate an increasingly complex and dynamic semiconductor landscape.

Leveraging expertise across the semiconductor value chain, KPMG in India supports clients in addressing both strategic and operational priorities, including investment planning, market entry, supply chain resilience, capacity expansion, trade and regulatory developments, talent availability, infrastructure readiness and ecosystem development. By combining global perspectives with deep local market understanding, KPMG in India helps organisations navigate industry transformation, respond to market disruptions and make informed decisions that drive sustainable growth and long-term competitiveness in a rapidly evolving semiconductor ecosystem.

## What we bring

**Global semiconductor expertise**

Deep semiconductor and electronics sector experience backed by KPMG's global semiconductor practice

**India Ecosystem Understanding**

Deep understanding of India's semiconductor landscape, policy environment and ecosystem dynamics

**Multidisciplinary Advisory Capabilities**

Integrated expertise across strategy, operations, tax, regulatory, risk and transactions

**End-to-end**

Support spanning investment planning, ecosystem development, growth strategy and execution

## Our semiconductor offerings

KPMG semiconductor offerings

- Semiconductor strategy and market assessment
- Investment and commercial due diligence
- Supply-chain resilience and localisation strategy
- Major project advisory – advising large scale capital projects
- Digital, data and AI transformation
- Risk, regulatory, compliance and sustainability advisory
- Human capital advisory
- Tax, audit and assurance services

# About NDA

At Nishith Desai Associates, we have earned the reputation of being Asia's most Innovative Law Firm — and the go-to specialists for companies around the world, looking to conduct businesses in India and for Indian companies considering business expansion abroad. In fact, we have conceptualized and created a state-of-the-art Blue Sky Thinking and Research Campus, Imaginarium Aligunjan, an international institution dedicated to designing a premeditated future with an embedded strategic foresight capability.

We are a research and strategy driven international law firm with Indian offices in Mumbai, New Delhi, Bangalore and GIFT City and foreign offices in New York, Palo Alto (Silicon Valley) and Singapore. Our team comprises of specialists who provide strategic advice on legal, regulatory, and tax related matters in an integrated manner basis key insights carefully culled from the allied industries.

As an active participant in shaping India's regulatory environment, we at NDA, have the expertise and more importantly — the VISION — to navigate its complexities. Our ongoing endeavors in conducting and facilitating original research in emerging areas of law has helped us develop unparalleled proficiency to anticipate legal obstacles, mitigate potential risks and identify new opportunities for our clients on a global scale. Simply put, for conglomerates looking to conduct business in the subcontinent, NDA takes the uncertainty out of new frontiers.

As a firm of doyens, we pride ourselves in working with select clients within select verticals on complex matters. Our forte lies in providing innovative and strategic advice in futuristic areas of law such as those relating to Blockchain and virtual currencies, Internet of Things (IOT), Aviation, AI, Privatization of Outer Space, Drones, Robotics, Virtual Reality, Ed-Tech, Med-Tech and Medical Devices and Nanotechnology with our key clientele comprising of marquee Fortune 500 corporations.

The firm has been consistently ranked as one of the Most Innovative Law Firms, across the globe. In fact, NDA has been the proud recipient of the Financial Times – RSG award 4 times in a row, (2014-2017) as the Most Innovative Indian Law Firm.

We are a trust based, non-hierarchical, democratic organization that leverages research and knowledge to deliver extraordinary value to our clients. Datum, our unique employer proposition has been developed into a global case study, aptly titled 'Management by Trust in a Democratic Enterprise,' published by John Wiley & Sons, USA.

https://nishithdesai.com

# Special thanks

Sonica Bajaj, KPMG in India

Amit Bhargava , KPMG in India

Nikit Popli, KPMG in India

Avinash Ramachandran, KPMG in India

Apaar Bhatnagar, KPMG in India

Balamurali Radhakrishnan, KPMG in India

Elton Guedes, KPMG in India

Priyadarsini Shanmugam, Nishith Desai Associates & IPpro

Varun Kumar, Nishith Desai Associates & IPpro

Shweta Iyer, Nishith Desai Associates & IPpro

Praveen Vijapur, Nishith Desai Associates & IPpro

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