Chips & Capital:
The Investment Landscape of Indian **Semiconductors**

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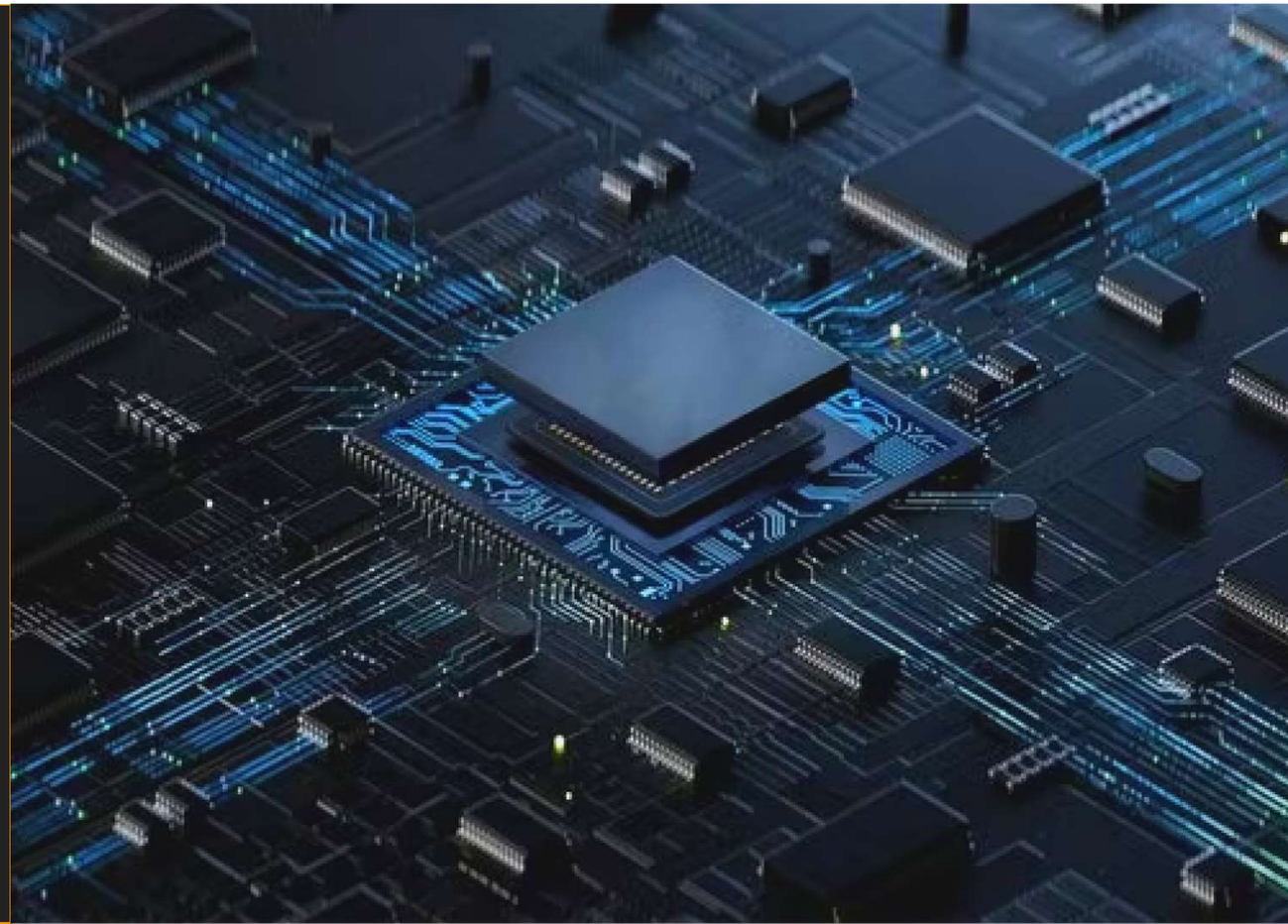
MAR 2025



Why Semiconductors Matter?

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Imagine waking up one day and your phone, laptop, or even your car **stops working!**
This is what happens if semiconductors disappear

Without semiconductors, **no electronic device** would function!

What is a Semiconductor?

A **semiconductor** is a **material** that is used to **make chips**

The most common semiconductor material is **Silicon (Si)**

What Makes a Material "Semiconductor"

Conductors

Electricity flows easily

Example: Copper

(used in wires)

Insulators

Electricity does NOT flow

Example: Rubber

(used in coatings)

Semiconductors

Can conduct electricity in some situations but block it in others

Example: Silicon, Germanium

As the name suggests : Semi = Not Always | Conductor = Allows Eletricity to Pass
So, a **semiconductor is a material that can act like a conductor (allowing electricity) when needed and like an insulator (blocking electricity) when not needed**

Decoding Semiconductors: The Brains Behind Modern Tech

Addressing fundamental questions about Semiconductors

What materials are semiconductors made of?

Some elements are semiconductors by themselves, or they can be mixed with another element to become semiconductors

Semiconductors are classified into elemental (e.g., silicon, diamond) and compound (e.g., gallium nitride, gallium arsenide, silicon carbide) types, depending on their composition

What do semiconductors have to do with computers?

Everything. No computer can function without the semiconductor (device) in it

Computers process and store data as **binary digits (0s and 1s)**, represented by **voltages**. These voltages are controlled by **transistors and diodes**, which are built using **semiconductors**.

What is Moore's Law and how does it relate to semiconductors?

Moore's Law is an observation (not a law!) that **states the number of transistors** (made of semiconductors) **on a chip doubles every two years**, increasing **computing power**.

Moore's Law is nearing its limit as shrinking transistors further becomes increasingly difficult

Fun Perspective: If semiconductor engineers had slowed down, Moore's Law might not have come true—but the industry's relentless pursuit of efficiency made it a self-fulfilling prophecy

Why have there been concerns about semiconductor shortage?

A shortage occurs when **supply falls short of demand.** Rapid growth in **AI, EVs, 5G, and consumer electronics** outpaced semiconductor production.

Efforts like **onshoring fabs**—building semiconductor manufacturing plants within national borders **(US CHIPS Act, India's Semicon Program)** aim to reduce future shortages.

Source : Stanford Report

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Semiconductor Manufacturing Process

Outlined below are key steps in chip making using Apple as an example

01 Silicon Wafer Production

(Turning Sand into Silicon Wafers)

Pure silicon extracted from sand & shaped into ultra-thin wafers

Apple's A17 chip uses 3nm wafers from TSMC for high efficiency

02 Deposition

(Laying the Atomic Foundations)

Thin layers of materials (silicon dioxide, metals) are added

This forms the base for transistors and circuits

03 Photolithography

(Printing Trillions of Transistors)

EUV Lithography projects Apple's chip design onto the wafer

Uses ultraviolet light to achieve nanometer-scale precision

04 Etching

(Carving the Circuit Pathways)

Removes unwanted material, leaving microscopic pathways for electrons

Essential for Apple's high-speed chip performance

05 Ion Implantation

(Supercharging Transistors with Ions)

Boron & phosphorus ions are embedded to create electrical properties

This ensures efficient power & performance balance

06 Annealing

(Baking the Chip to Perfection)

Wafers are heated to fix crystal defects, improving chip efficiency

Critical for Apple's power-efficient chip design

07 Layering & Metallization

(Building the Neural Pathways)

Multiple layers of circuits are stacked & connected using copper interconnects

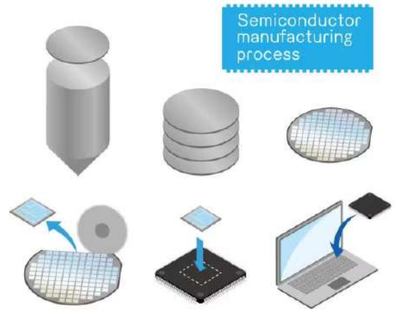
Enables the seamless data flow in Apple's processors

08 Testing & Packaging

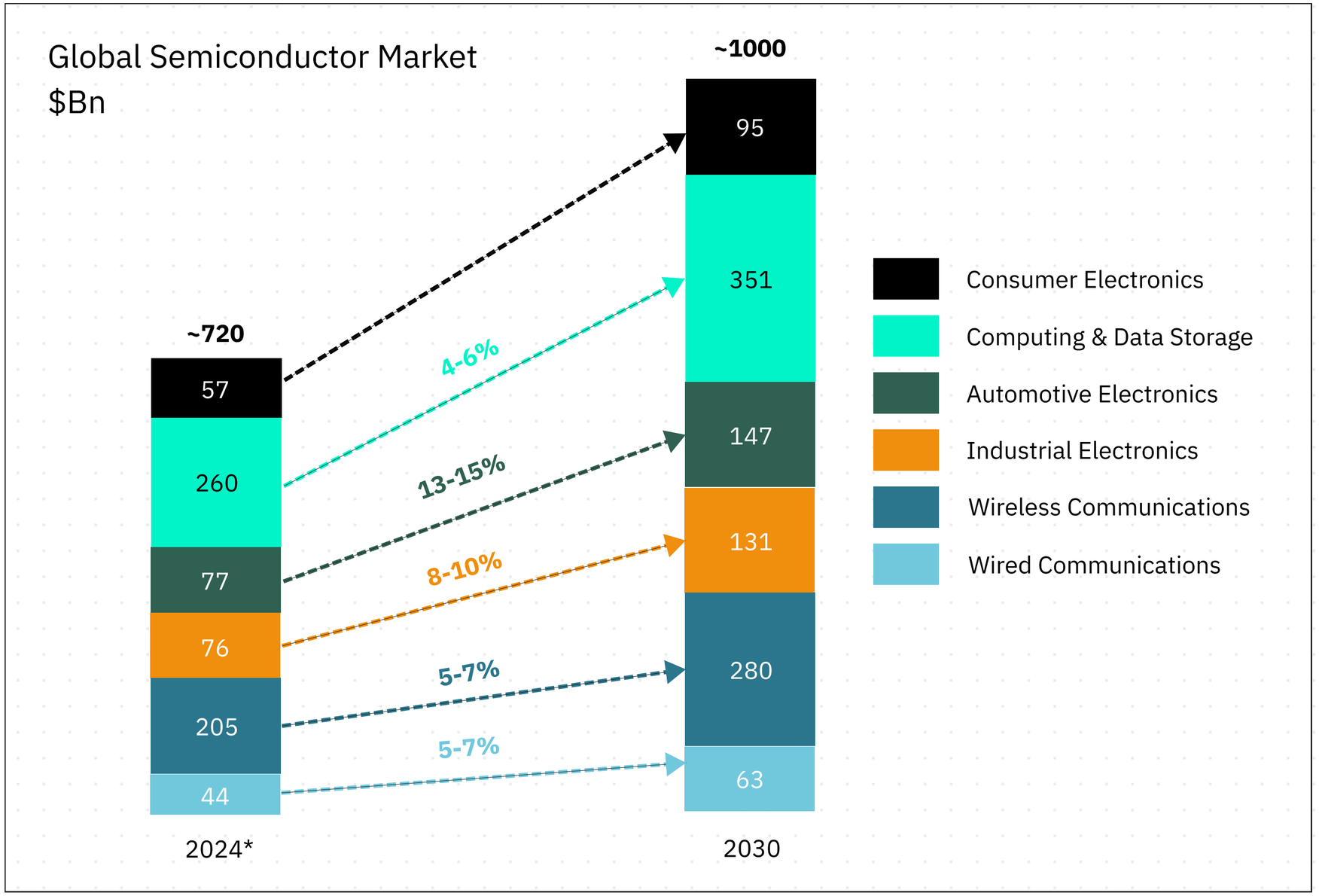
(Only the Best Make the Cut)

Chips undergo rigorous testing, with defective ones discarded

Final chips are packaged & ready for iPhones, iPads, and Macs



The **Global Semiconductor Market** is set to hit $1Tn by 2030



Insights

The global semiconductor market will **add ~$280Bn in just six years** (2024 → 2030)

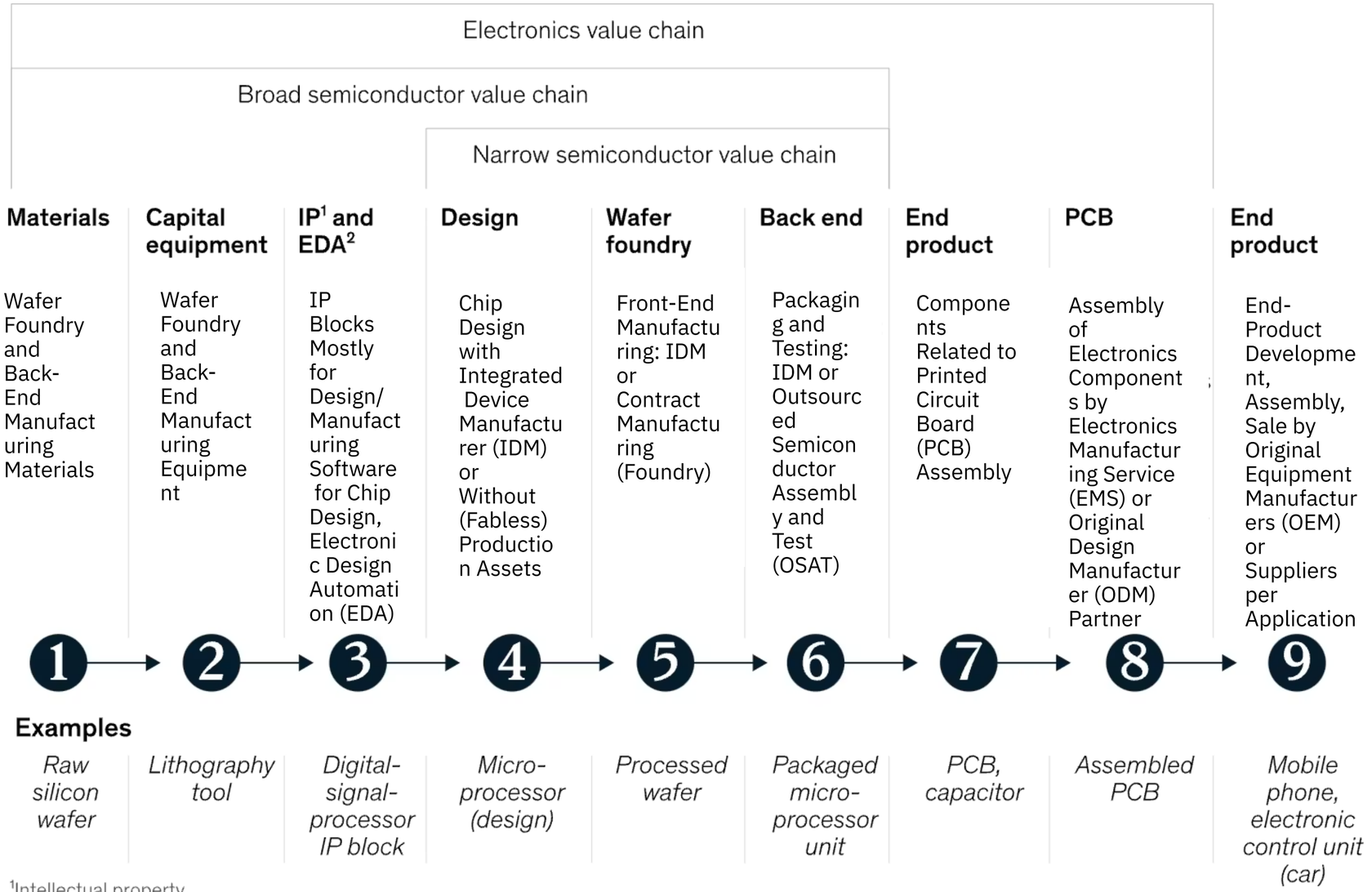
Fastest-Growing Segment: **Automotive Electronics** Nearly **doubles in six years**, driven by:

- **EV & Hybrid Vehicles**: More chips per car (power management, battery systems)
- **ADAS & Autonomous Tech**: Higher demand for processing power & AI chips

ADAS - Advanced Driver-Assistance Systems

Source : McKinsey

Semiconductor Value Chain



[1]Intellectual property.
[2]Electronic-design automation.

Semiconductors, the **world's fourth-most-traded product**, have one of the most **complex and globally dispersed** value chains.

The production process spans **multiple stages**, from raw material procurement to **end-product manufacturing**, involving diverse players across different geographies.

Source : McKinsey

Key Players in the Semiconductor Value Chain

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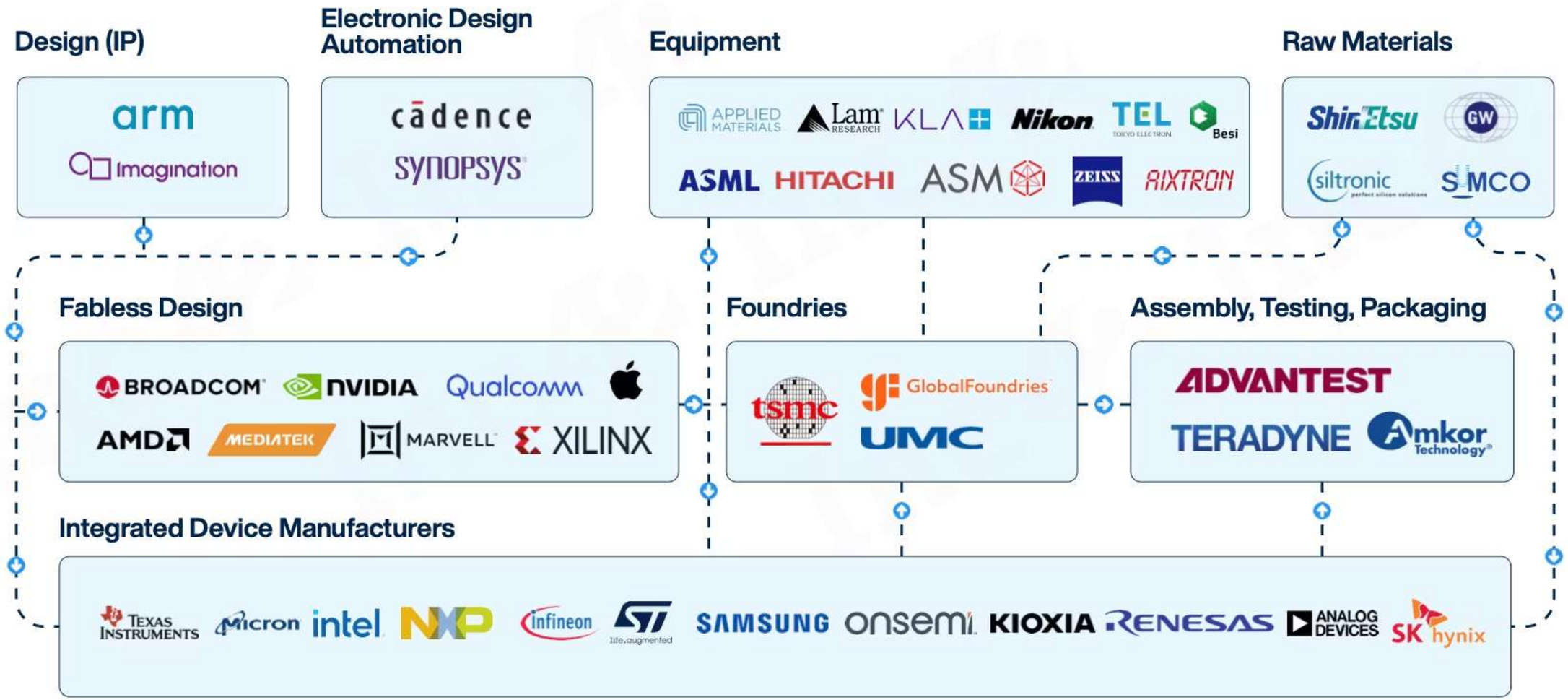


Design (IP) Provides core chip designs

EDA Enables chip design & simulation

Raw Materials Supplies wafers & chemicals

IDM Designs & manufactures in-house

Equipment Provides chip-making tools

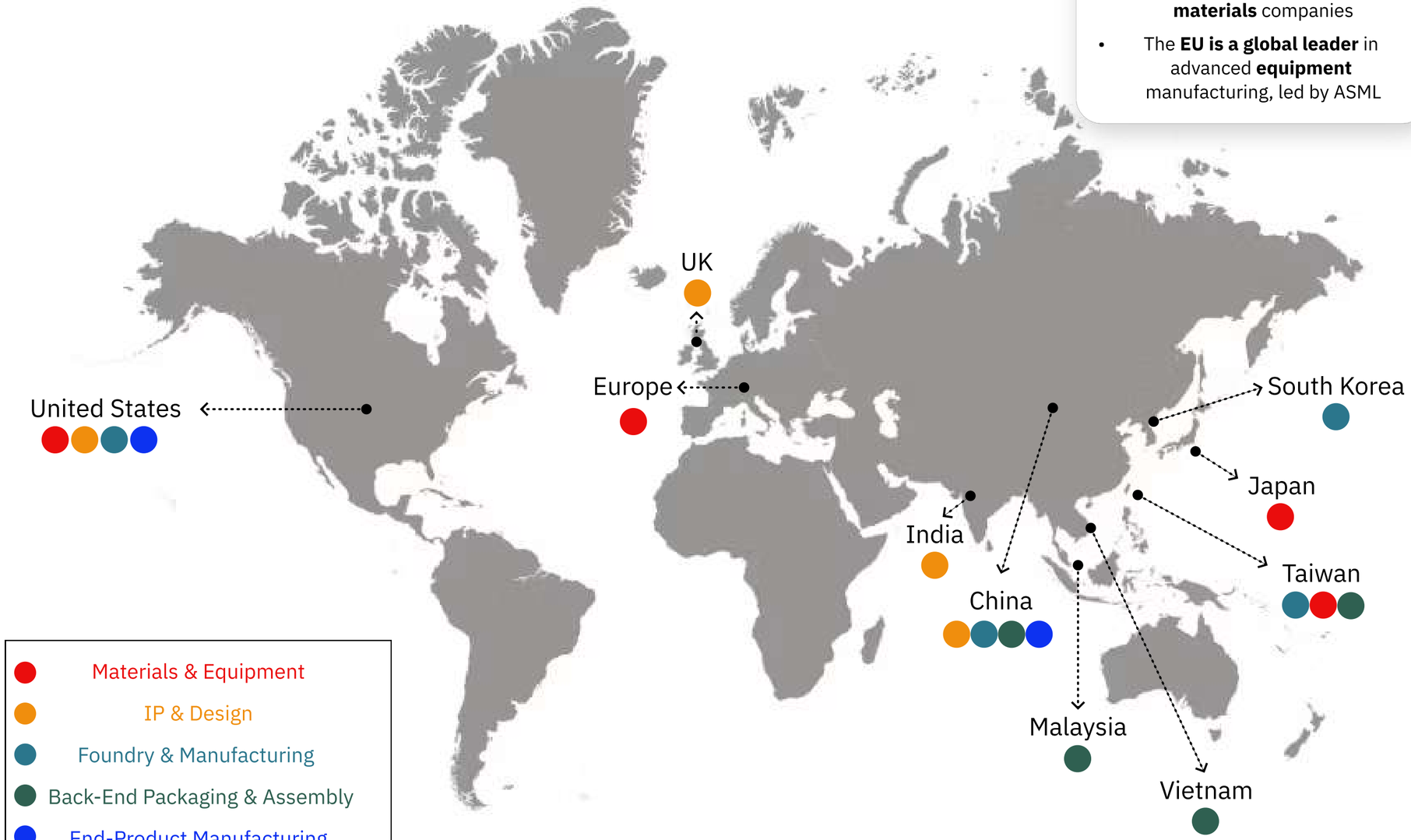
Fabless Design Designs chips, outsources manufacturing

Foundries Fabricates semiconductor wafers

Assembly, Testing, Packaging Packages & tests chips

Source : Inc42, Quartr

Global Semiconductor Hubs: Key Players Across the Value Chain



Materials & Equipment

- **Japan** is home to many leading **materials** companies
- The **EU is a global leader** in advanced **equipment** manufacturing, led by ASML

IP & Design

- **US leads in semiconductor design**, with US-headquartered companies holding 51% of the design market
- **ARM (UK) dominates chip architecture licensing**
- **India** contributes significantly to chip design, possessing nearly **20% of the global design workforce**

Foundry & Manufacturing

- **Taiwan (TSMC)** produces over 50% of the world's chips and over 90% of advanced (below 10nm) chips
- The **EU is a global leader** in advanced **equipment** manufacturing, led by ASML

Back-End Packaging & Assembly

- Packaging, testing, and assembly are labor-intensive and largely handled in **Southeast Asia**
- **China dominates this stage**, together with Taiwan hosts nearly 60% of global ATP capacity

End-Product Manufacturing

- Packaging, testing, and assembly are labor-intensive and largely handled in **Southeast Asia**
- **China dominates this stage**, together with Taiwan hosts nearly 60% of global ATP capacity

Movers & Shakers in Semiconductor **Wealth Creation**

Grew from a contract foundry to a trillion-dollar company, enabling fabless giants like Apple, NVIDIA

Market Cap - $916.6Bn

Transitioned from gaming GPUs to AI powerhouse, becoming a $2T+ market cap leader

Market Cap - $2.8Tn

Taiwan’s fabless giant, competing with Qualcomm in mid-range smartphones

Market Cap - $71.7Bn

Monopoly over EUV lithography, critical to advanced chipmaking

Market Cap - $286.3Bn

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Understanding Manufacturing Models:
What's Right for Indian Startups?

OEM (Original Equipment Manufacturer)	Owns the semiconductor product design & branding but often outsources fabrication to a foundry	Qualcomm (Snapdragon), AMD (Ryzen)
ODM (Original Design Manufacturer)	Designs & manufactures semiconductors that other brands customize & sell under their own name	MediaTek (chipsets for smartphones & IoT), Novatek
EMS (Electronics Manufacturing Services)	Provides end-to-end electronics assembly & testing, including chip integration into devices	Foxconn, Jabil (Chip assembly & packaging
CEM (Contract Electronics Manufacturer)	Focuses on semiconductor assembly, PCB mounting & chip-on-board manufacturing	Wistron, Pegatron
CMO (Contract Manufacturing Organization)	Purely provides semiconductor fabrication services, often working with fabless OEMs & chip designers	TSMC, GlobalFoundries

For Indian startups, focusing on a **fabless chip design model (OEM/ODM)** is the **most viable & scalable** path. With government support & a **strong design talent pool**, India can **develop a robust semiconductor IP & design ecosystem** before scaling to **manufacturing partnerships in OSAT & ATMP**

STRENGTHS

✅ **Strong Semiconductor Design Talent**
India contributes ~20% of the world's chip design workforce

✅ **Growing OSAT & ATMP Ecosystem**
Companies like Tata, Micron, and Kaynes, are investing in advanced chip packaging & testing

✅ **Government Incentives**
India has launched PLI & DLI schemes to boost domestic chip design & manufacturing

CHALLENGES

❌ **Lack of Advanced Foundries**
India lacks cutting-edge semiconductor fabs (TSMC, Samsung dominate)

❌ **Supply Chain Dependencies**
Heavy reliance on imports for wafers, photomasks, specialty gases & chemicals

❌ **Capital-Intensive Industry**
Semiconductor fabs require multi-billion-dollar investments

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What's Driving Semiconductor **Demand?** (1/2)

Industrial & Automation

Growing adoption of robotics, smart manufacturing, and IoT is driving demand for semiconductors, enabling precision control and real-time monitoring

Telecom & 5G

Expansion of 5G networks and high-speed connectivity fuels demand for secure, efficient semiconductor solutions

Automotive & EVs

Growth of electric vehicles (EVs) and ADAS requires advanced chips for safety, performance, and automation

Consumer Electronics

Growing popularity of consumer devices such as smartphones, tablets, and gaming consoles drives the demand for semiconductors

Image sources: Techmer PM, Mobility outlook, ET Article, STL, TXOne

What’s Driving Semiconductor **Demand?** (2/2)

Generative AI & Computing

The rapid rise of generative AI (GenAI) and computing is driving an unprecedented surge in semiconductor demand, pushing the industry to develop more powerful and efficient chips

1. **Surging Computational Needs**
   AI models like ChatGPT and Sora are fueling **exponential growth** in computational power, creating a new **S-curve** for semiconductor advancements

2. **Diverse Market Applications**
   GenAI demand is split, with **70% from B2C** applications and **30% from B2B**, spanning both compute-intensive training

3. **Data Center Expansion**
   Tech leaders are making massive investments in data centers and semiconductor fabs to support AI-driven workloads

4. **Advanced Chip Requirements**
   AI acceleration is increasing demand for logic chips (CPUs, GPUs, AI accelerators), high-bandwidth memory (HBM, DDR), NAND storage, power semiconductors, and optical transceivers

Geopolitics in Semiconductors: The New Tech Battleground

Semiconductors tiny chips that power everything from smartphones to fighter jets — are at the heart of global geopolitics.
Countries and companies are fighting for dominance in this critical technology because control over semiconductors means control over the future of artificial intelligence, 5G, defense systems, and advanced computing

1

Global Semiconductor Powerhouses

🇺🇸 **United States**
Design & advanced R&D
🇹🇼 **Taiwan**
Cutting-edge manufacturing
🇨🇳 **China**
Largest consumer, but lags in advanced chipmaking
🇰🇷 **South Korea**
Memory chip dominance
🇯🇵 **Japan &** 🇪🇺 **Europe**
Critical materials & equipment

2

The US-China Tech War

Export Bans: US bans China from accessing advanced chips & chip-making tools

China's Response: Investing billions but struggles with cutting-edge fabrication

Tech Alliances: US, Japan, South Korea, Netherlands work to limit China's access

3

Taiwan: The Semiconductor Flashpoint

TSMC produces ~90% of the world's most advanced chips

China's Interest: Taiwan's semiconductor dominance is a strategic reason for tensions

US Response: Strengthening military ties with Taiwan to protect chip supply chains

4

Fragile Supply Chains & Self-Sufficiency Push

Global Risks: Trade wars, conflicts threaten supply chains.

Policy Moves:
🇺🇸 **CHIPS Act –** $52B investment in US chip manufacturing
🇪🇺 **EU Chips Act –** Aims for 20% of global chip production by 2030.
🇮🇳 **India's Play:** Incentives to attract semiconductor manufacturing.

5

Future: Tech Decoupling & Alliances

US & Allies:
"Chip 4" (US, Taiwan, Japan, South Korea) to control semiconductor tech

China's Strategy:
Self-reliance, aggressive R&D investment

The Next Decade:
A race for semiconductor independence will reshape geopolitics

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India's Semiconductor Moment:
The Opportunity Unfolding

$150Bn+

Total Market Opportunity for Semiconductors in India by 2030

$21Bn+

AI Semiconductor Market Opportunity in India by 2030

50%

of Semiconductor Manufacturing Cost Setup to be Fulfilled by the Central Government

100+

Semiconductor Startups in India

Two-Third*

of Indian Semiconductor Startups Operate out of Bengaluru

20%

of Global Semiconductor Integrated Circuit (IC) Design Workforce is from India

*This is an approximate value, the exact share of Bengaluru in total semiconductor startups is about 64%

Source : Inc42, Semicon India (2022)

India’s Semiconductor Moment:
Can It Build the Next Chip Powerhouse?

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Government Policy: A Strategic Push	**India Semiconductor Mission (ISM):** Launched with a $10Bn incentive package to attract global players and develop domestic capabilities	**Design-Linked Incentive (DLI) Scheme:** Encourages innovation in chip design by supporting startups like Saankhya Labs and Sensesemi Technologies	**Ecosystem Development**: Focus on supply chain localization (chemicals, gases, equipment) and leveraging design expertise	**State-Level Support:** Gujarat emerging as a hub due to proactive policies and robust infrastructure
Underlying Trends: Driving Demand	**Accelerating demand for electronics and semiconductors** in India is driven by rising incomes, increasing digital adoption, and a large domestic market projected to reach **$110Bn by FY30**	The transformation of the automotive industry towards **Electric Vehicles (EVs) and autonomous driving is leading to a surge in semiconductor demand**	**Surge in Design Startups:** India now has **100+ semiconductor design startups**, growing **2.4x since 2014**, with continued momentum expected.	
Key Enablers for India’s Semiconductor Ambition	**Participation of Large Corporates:** The entry of large Indian conglomerates like Tata Group into semiconductor manufacturing provides momentum and scale	**China +1: India’s Strategic Positioning**	**Geopolitical considerations and concerns about supply chain vulnerabilities in East Asia** are prompting companies and policymakers to actively seek alternative manufacturing locations like India	

India’s Semiconductor Moment:

With $18 billion invested across five projects, India's semiconductor ambitions are taking shape

Company	Investment	Type	Location	Exp. Completion
Tata Electronics (with PSMC, Taiwan)	$11Bn	Foundry	Dholera, Gujarat	By 2026
Tata Electronics	$3.3Bn	OSAT (Outsourced Semiconductor Assembly and Test)	Morigaon, Assam	Phase 1 in 2025
Micron Technology	$2.8Bn	ATMP (Assembly, Testing, Marking, and Packaging)	Sanand, Gujarat	Phase 1 in 2025
CG Power (With Renesas, Japan and Stars Microelectronics, Thailand)	$0.9Bn	OSAT	Sanand, Gujarat	Mini factory in 2026-27 and main facility by 2027-28
Kaynes (with Globetronics, Malaysia and Aptos, Taiwan)	$0.4Bn	OSAT	Sanand, Gujarat	Expected to start operations by 4QFY26

Source: PIB, Company, Media articles (Economic Times, Business Standard), Jefferies

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India's Emerging Semiconductor Innovators

	AGNIT	Incore	MINDGROVE	cientra	Saankhya Labs
Incorporated In	2019	2018	2021	2017	2007
Location	Bengaluru	Chennai	Chennai	Bengaluru	Bengaluru
Target Industry	Telecommunication, Drone, Power Electronics	Automotive, Storage, Security, Edge AI	Security, Smart Watch, Thermal Printer, Biometric Module	Automotive, Telecommunication, Consumer Electronics	Satellite and 5G communications
Description	Specialising in GaN materials and electronic components for radio-frequency applications	Processor design company, is revolutionising industries with its innovative RISC-V-based solutions.	Mindgrove designs, scalable, and reliable System-on-Chips (SoCS) in India	Cientra is an end-to-end semiconductor solutions provider specialising in VLSI, ASIC, FPGA, and system-on-chip (SoC) design	India's earliest fabless semiconductor companies and has pioneered innovations in satellite communication and 5G new Radio
Funding	$4.87Mn	$3Mn	$10.4Mn	NA (Acquired)	$27.9Mn (Acquired)
Investors	3One4, Zephyr Peacock	peak xv PARTNERS, SPECIALE INVEST, Whiteboard	peak xv PARTNERS, SPECIALE INVEST, Ventures, Whiteboard	accenture	TEJAS NETWORKS

Key Enablers of Semiconductor Ecosystem in India

The current semiconductor ecosystem in India is largely dominated by global MNCs and Indian corporates

Startups

AI Semiconductor

KRUTRIM
KALATRONICS Semiconductors Private Limited
BLUEBERRY
SEMICONSOUL
Netrasemi
SENSE SEMI

Consumer Electronics

SION Semiconductors
CIREL SYSTEMS Inspired by Innovation
Vervesemi
BHIVE-DESIGN INNOVATIVE MINDS AT WORK
SIGNALCHIP

Industrial Automation

SEMICONSOUL
BHIVE-DESIGN INNOVATIVE MINDS AT WORK
incore

Automative & Autonomous Vehicles

MINDGROVE SILICON
cientra
wafer space
MAXVY MAXimum Value for You
Digicomm Semiconductor

Telecom & Wireless Communication

Saankhya Labs
SIGNALCHIP
FERMIONIC
cientra
Vervesemi
Digicomm Semiconductor
KALATRONICS Semiconductors Private Limited
AGNIT

Global MNCs & Indian Corporates

NVIDIA
AMD
arm
Micron
intel
Qualcomm
NXP
Texas Instruments
GlobalFoundries
Mentor A Siemens Business
Cognizant

TATA
vedanta transforming for good
HCL
Dixon The brand behind brands
LARSEN & TOUBRO
भारत इलेक्ट्रॉनिक्स BHARAT ELECTRONICS
wipro
CG Power and Industrial Solutions Ltd.
Natronix
mosChip

Source : Inc42

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Funding Landscape for Indian Companies

$879Mn	**Seed & Series A**	**62 Acquisitions**	**$25.1Mn**
Total Investments across Stages	Most Funding Rounds	Between 2018 to 2024	Average Acquisition Price

$421Mn
Electronic Manufacturing Services

$148Mn
Semiconductor Design and Manufacturing Services

$146Mn
Analog and Mixed Signal ICs

$427Mn
Late Stage & Post IPO Rounds

The Indian funding landscape is still in its early stages compared to established ecosystems in the US, China, Netherlands, Taiwan, and Japan

Qualcomm ventures
intel capital
SFAL Semiconductor Fabless Accelerator Lab
VentureCatalysts India's 1st Multi-Stage VC
Venturast We differentiate.
growX
JAFCO ASIA
1crowd
StartupXseed
3ONE4 CAPITAL
IIMA VENTURES
ideaspring CAPITAL
Whiteboard
pi Ventures
ANICUT
Celesta
peak xv PARTNERS
DVC
Ventures
8∞ EIGHT ROADS™
athera VENTURE PARTNERS
sidbi VENTURE
Z47 fka Matrix Partners India
ZEPHYR PEACOCK INDIA
JUNGLE
SPECIALE INVEST
IVYCAP
navamcapital
Inflexor
MOTILAL OSWAL Private Equity
YOURNEST VENTURE CAPITAL

Sub sectors considered in the above data - Sensors | Embedded Systems | Display Technology, Services, & Manufacturing | Electronics Manufacturing, Design & Equipment | Digital, Printed, Analog & Mixed Signal ICs | Semiconductor Design, Manufacturing, Equipments, IP and Diversified Semiconductors

Source : Tracxn

A Silicon Future:
India’s Rise in the Global Semiconductor Arena

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India is no longer just a consumer of semiconductors but is actively shaping up to be a **global hub for chip design, manufacturing, and packaging**, backed by **robust incentives, partnerships, and long-term vision**

Strengthening Domestic Fab Capabilities

- **$10Bn incentives** driving domestic semiconductor manufacturing
- **$18Bn+ investments underway**, incl. **Tata-PSMC’s $11Bn fab** (28-110nm chips)
- Govt covers **up to 70% of fab costs**, attracting global players

Expanding Design & IP Portfolio

- **20% of global chip design workforce** based in India
- **DLI & C2S programs** supporting domestic chip design
- **25+ firms** approved for semiconductor design incentives
- Push towards **owning chip IP** instead of just design services

Global Collaborations Driving Growth

- Partnerships with **PSMC (Taiwan), Renesas (Japan), Micron (USA), Stars Micro (Thailand)**.
- **US-India iCET & supply chain MoUs** enabling knowledge transfer.
- India securing global suppliers for **raw materials & equipment**.

India’s Market Potential is Huge

- **Electronics market to hit $500Bn by FY31**, chip demand **$109Bn by 2030**
- Targeting **10% of the global semiconductor market** by 2030
- Despite **supply chain & talent gaps**, strong policies + cost benefits = **high investor confidence**.
- Potential to **replicate auto industry success**

THANK YOU

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