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EDITORIAL ANALYSIS

India's Semiconductor Moment — From Design Strength to Fab Reality

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GS3

India's Semiconductor Moment — From Design Strength to Fab Reality

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INTERVIEW ANGLE

"India has 20% of the world's chip designers but cannot manufacture a single chip domestically. Kaynes OSAT changes the packaging equation — but does it change the strategic equation?"

WHY IN NEWS

PM Narendra Modi inaugurated the Kaynes Technology OSAT facility at Sanand, Gujarat on March 31, 2026 — India's first semiconductor assembly and test facility to reach commercial production under the India Semiconductor Mission (ISM). The inauguration coincides with the global semiconductor onshoring wave triggered by COVID-19 supply chain failures and the Taiwan concentration risk.

THE ASYMMETRY AT INDIA'S CORE

India's semiconductor situation has always been characterised by a peculiar asymmetry: the country is home to approximately 20% of the world's chip designers — including the CEOs of Intel, AMD, Google, and Microsoft — yet until March 2026, it could not manufacture a single semiconductor chip domestically.

This asymmetry is not an accident. It reflects the different economics of the semiconductor value chain's stages:

- **Design:** Requires talent (abundant in India), CAD software, and relatively modest capital investment. Indian engineers have excelled here for three decades.
- **Fabrication:** Requires billions in capital, extreme precision manufacturing (ASML EUV machines costing $200 million each), and supply chains that took Taiwan 40 years to build. India had none of this.
- **OSAT (Assembly + Packaging + Testing):** Requires less capital than fabs, but demands precision clean-room manufacturing. India now has this.

Kaynes's OSAT facility represents India's first step from the "only design" column into "design + assembly." It is real industrial progress. But it is important to be clear-eyed about what it is — and what it is not.

WHAT THE KAYNES OSAT ACTUALLY MEANS

What It Is

The Kaynes facility in Sanand (Rs 3,307 crore, 50% funded by ISM) will assemble, package, and test chips. Its first commercial product — **Intelligent Power Modules (IPMs)** — are semiconductor packages used in electric vehicle motor controllers, industrial drives, renewable energy inverters, and air conditioners.

India imported approximately Rs 12,000 crore of IPMs and similar power semiconductors in FY 2024-25, mostly from Japan, South Korea, and China. Kaynes will begin substituting a portion of that import — a tangible Make in India outcome.

At full scale (6.3 million units/day), Kaynes will be one of the larger OSAT facilities in Asia. For IPMs specifically — where Japan's Mitsubishi, Infineon (Germany), and Fuji Electric dominate — an Indian competitor is strategically significant for India's EV supply chain.

What It Is Not

Kaynes does not make chips. It takes finished wafers — made by foundries like TSMC in Taiwan — and packages them. If TSMC were to face disruption (a Taiwan Strait conflict, a natural disaster, US-China technology restrictions), Kaynes's facility would have no wafers to package.

The strategic autonomy question requires answering: where will the wafers come from?

THE DHOLERA ANSWER — AND ITS TIMELINE

The answer, in theory, is the **Tata Electronics-PSMC Dholera fab** — a Rs 91,000 crore silicon wafer fabrication plant in Gujarat targeting 28nm logic chips, expected to produce first wafers by 2027-28. When operational, it would create a partial India-internal supply chain:

- Wafer design: Indian design centres
- Wafer fabrication: Tata+PSMC Dholera (domestic)
- Assembly + packaging: Kaynes/Tata Assam OSAT (domestic)
- End product: Made in India chip

The gap: This domestic chain will serve the 28nm market — automotive, IoT, industrial, power management. It will NOT serve the 5nm/3nm market for smartphones and AI chips. That market remains a TSMC/Samsung monopoly for the foreseeable future.

THE GLOBAL CONTEXT — WHY ALL OF THIS MATTERS NOW

The editorial situates India's semiconductor push within a global onshoring wave:

COUNTRY/REGION	PROGRAMME	SIZE
USA	CHIPS and Science Act (2022)	$52.7 billion
EU	EU Chips Act (2023)	€43 billion target
Japan	RAPIDUS + TSMC Kumamoto	~¥3 trillion
India	India Semiconductor Mission (2021)	Rs 76,000 crore
China	Various state funds	$150+ billion

All major economies are simultaneously de-risking semiconductor supply chains from Taiwan. The strategic logic is identical: Taiwan produces ~60% of global chips and ~90% of advanced chips. A conflict or natural disaster could devastate global electronics manufacturing.

India's advantage in this race: Unlike other latecomers, India has a pre-existing design talent base. The pipeline from design skill to manufacturing capability is shorter for India than for, say, Germany or Japan.

THE UNRESOLVED QUESTIONS

The Indian Express editorial raises three questions that the ISM has not yet answered:

1. Who builds the equipment? The machines used to manufacture chips — ASML's EUV lithography tools, Applied Materials deposition systems — are controlled by Western companies (Netherlands, USA). India has zero presence in semiconductor equipment manufacturing. Without this capability, India cannot be truly autonomous.

2. Can quality compete? OSAT quality is measured in defect rates per million units. Taiwan, Malaysia, and China's OSAT industries have refined their processes over decades. Kaynes starts from zero. The quality ramp-up will take time.

3. Is the demand base ready? IPMs for EVs are the first product — but India's EV market, while growing rapidly, is still a fraction of global EV volumes. Will domestic demand be sufficient to run Kaynes's facility at scale, or will export markets need to be developed?

THE EDITORIAL'S CONCLUSION

The Indian Express editorial argues: Kaynes's inauguration is a genuine milestone — it should be celebrated. But the celebration must not substitute for honest assessment. India's semiconductor strategy needs:

1. **Patience and sustained funding** beyond the current ISM cycle
2. **Ecosystem investment** — materials, equipment, specialised chemicals (photoresists, gases) — not just assembly
3. **Export market strategy** — to achieve the scale that makes semiconductor manufacturing economically viable

The Kaynes inauguration is the beginning of a very long journey. The framing of "India is now in semiconductors" should not mask the 15-20 year timeline to genuine semiconductor self-reliance.

UPSC RELEVANCE

ISM; OSAT; IPM; Kaynes Technology; Sanand; Dholera fab (Tata-PSMC); 28nm; DLI; MeitY; Rs 76,000 crore outlay.

MAINS GS-3:

"Semiconductors are the new strategic resource. Critically evaluate India's India Semiconductor Mission — its design, progress, and gaps."

ESSAY:

"Technology sovereignty in the 21st century — can India become self-reliant in strategic technologies?"

INTERVIEW:

"India has design talent but lacks fabrication capacity. Is the Rs 76,000 crore ISM sufficient to close this gap, or is India already too late to the semiconductor race?"

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KAYNES TECHNOLOGY OSAT (SANAND, GUJARAT):

Investment: Rs 3,307 crore (50% ISM subsidy + 50% Kaynes equity/debt)

Function: Assembly + Packaging + Testing (OSAT)

First product: Intelligent Power Modules (IPMs) — EVs, industrial drives, renewable energy

Capacity: ~6.3 million units/day (full scale)

First facility to achieve commercial production under ISM

Inaugurated: March 31, 2026 by PM Modi

INDIA SEMICONDUCTOR MISSION (ISM):

Launched: December 2021; Nodal ministry: MeitY

Total incentive outlay: Rs 76,000 crore

Fiscal incentive: 50% of project cost for fab/OSAT/display fabs

DLI (Design Linked Incentive): 50% cost + 6% net revenue (up to 5 years) for chip design

ALL ISM-APPROVED PROJECTS:

Tata + PSMC (Taiwan): Dholera fab (28nm; Rs 91,000 crore) — under construction

Tata Electronics: Assam OSAT (Rs 27,000 crore) — under construction

CG Power + Renesas (Japan) + Stars Micro (Thailand): Sanand OSAT (Rs 7,600 crore)

Kaynes Technology: Sanand OSAT (Rs 3,307 crore) ← operational

SEMICONDUCTOR VALUE CHAIN:

Design: USA (Qualcomm, AMD, Apple), UK (ARM), India (~20% of global designers)

Fab: TSMC (Taiwan, ~60%), Samsung (South Korea, ~17%), Intel (USA)

OSAT: ASE (Taiwan), Amkor (USA), JCET (China); now Kaynes (India)

Equipment: ASML (Netherlands, EUV monopoly), Applied Materials (USA), Tokyo Electron (Japan)

INDIA'S SEMICONDUCTOR MARKET:

Import dependency: ~85% of chips consumed are imported

Annual consumption: ~$30 billion (2024)

2030 market target: $100 billion

India chip designers: ~20% of global workforce; Bengaluru, Hyderabad, Pune

OTHER RELEVANT FACTS:

ASML: Dutch company; monopoly on EUV (Extreme Ultraviolet) lithography machines used for sub-7nm chips; export-controlled to China since 2019

CHIPS Act (2022, USA): $52.7 billion; brought TSMC, Intel, Samsung to build/expand US fabs

India imported ~Rs 12,000 crore of IPMs and power semiconductors (FY 2024-25) from Japan, South Korea, China

28nm node: critical for automotive electronics (largest growing segment); approximately 40% of global chip demand by volume

Sources: Indian Express , MeitY , PIB , BusinessToday

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