# First Principles - AI Power Infrastructure

## Following the Power

AI is creating a structural, multi-year demand cycle for power semiconductors driven by 1) massive grid/ micro-grid investments to feed AI data centers, and 2) the need for more efficient power conversion inside the data center, from AC-DC front-end conversion to point-of-load at the GPU. Both vectors demand advanced power semiconductor content such as silicon carbide (SiC), gallium nitride (GaN), next-generation MOSFETs, and intelligent power modules. This note discusses the AI power semiconductor market, the upcoming architectural shifts in the market, the opportunities from the shifts and the key players.

- **We forecast market to have 3-year CAGR growth of ~82% to 2028:** Based on JP Morgan forecasts of up to 80GW of new AI data center capacity to be installed in 2028 (vs. ~60GW in 2027) we size the AI power semiconductor market to be ~$16bn in 2028, with upside to $20bn+ under stronger content/ compute addition assumptions from our calculation of '25 market size of $2.7bn.
- **800V DC architectural shift will significantly increase semiconductor content:** The data center mkt is moving to 800V high-voltage DC distribution to reduce current, copper usage, and power losses. Today's architecture chains four to five conversion stages (transformer → UPS → PDU → server PSU → VRM), yielding only ~85–88% end-to-end efficiency. The 800V HVDC model removes three of these: the double-conversion UPS (replaced by DC-native battery backup connected directly to the 800V bus), the rack-level step-down transformer and PDU (replaced by simple 800V busbars), and the per-server AC-DC PSU (consolidated in power racks or further upstream). The new architecture increases semiconductor content through centralized AC-DC rectifiers built around high-voltage SiC MOSFETs. (In the longer term, Solid-State Transformers (SST) will convert AC directly to 800V DC); Solid-State Circuit Breakers (SSCB) using SiC; DC-native battery backup units (BBUs) with bidirectional DC-DC converters and BMS ICs and rack-level 800V-to-low-voltage converters to step down to 48V (two-stage) or directly to 6V (single-stage).
- **SiC and GaN will take share:** Silicon remains the largest dollar pool in AI power but we expect SiC content to rise from $30/kW today to $60/kW in the long-term, GaN from $3/kW to $46/kW, while Si grows more modestly from $150 to $180/kW. SiC dominates high-voltage grid-to-rack applications (SST, SSCB, ESS); GaN wins in Stage 1 (800V-to-low-voltage conversion); Silicon remains dominant in Stage 2 (VRM/PoL) on cost/performance grounds.

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**See page 52 for analyst certification and important disclosures, including non-US analyst disclosures.**

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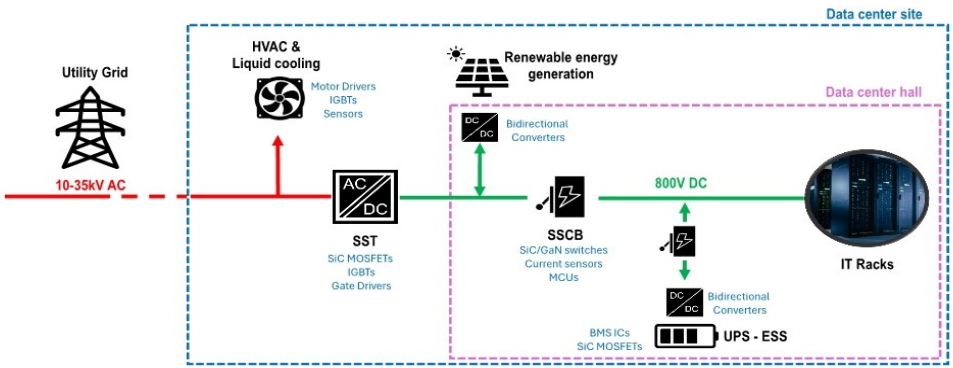
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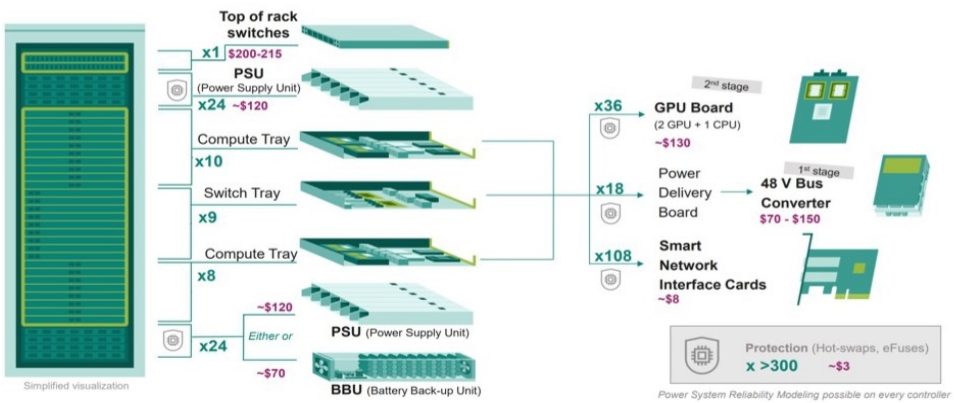
# AI Power Infrastructure Snapshot

**Figure 1: Grid to Rack power delivery in next-generation architecture.**




Source: J.P. Morgan, company reports.

**Figure 2: Infineon's AI power content within a data center rack.**




Source: Infineon Technologies.

## From Grid to Rack

Electromechanical components are being replaced by semiconductor solutions and renewables combined with energy storage systems is a compelling solution to power AI data centers:

- SiC-based Solid-State Transformers (SST) will replace conventional transformers (> $1bn semi market in 2030 according to Infineon)
- SiC-based Solid-State Circuit Breaker (SSCB) will replace electromechanical circuit breakers for high voltages
- Energy Storage Systems (ESS) and bidirectional DC-DC conversion will grow to act as buffer for AI power draws volatility
- Other positive contributors include renewable energy deployments (solar). HVAC and liquid cooling, microgrid systems

## Inside the Rack

Semiconductor content inside data center racks is increasing from higher power density, more efficient conversion and higher power draw:

- Infineon estimates ~$175 per kW of semi content which should grow with higher power racks, guidance of $100-250 per kW depending on power architecture.
- AI power protection becomes more important at 800V with a SAM estimated at ~€800m by 2030
- Stage 1 (800V step down to low voltage): Si and GaN-based intermediate bus converters expected to grow at ~50%+ CAGR to 2030 (Navitas, Infineon), with more players entering the market
- Stage 2 (VRM/PoL): Vertical power delivery solutions enabled by power modules increases content per chip (3x-4x). Largest dollar pool.

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# Executive Summary

AI is creating a structural, multi-year demand cycle for power semiconductors driven by 1) massive grid/micro-grid investments to feed AI data centers, and 2) the need for more efficient power conversion inside the data center, from AC-DC front-end conversion to point-of-load at the GPU. Both vectors demand advanced power semiconductor content such as **silicon carbide (SiC), gallium nitride (GaN), next-generation MOSFETs, and intelligent power modules.**

## The Numbers that Matter

JP Morgan forecasts up to 80GW of new AI data center capacity to be installed in 2028 (vs. ~60GW in 2027), of which ~63GW would be greenfield. On a base case of 65GW of AI compute addition and an average content of $250 per kW, we size the AI power semiconductor market to be **~$16bn in 2028, with upside to $20bn+** under stronger content/compute addition assumptions.

Semi content per kW currently stands at ~$175 (per Infineon), with a guided range of $100–$250 per kW depending on architectures. We expect this semiconductor content to rise towards the high end of this range and above, driven by stronger adoption of vertical power delivery modules and the replacement of electromechanical components by semiconductors for better efficiency and security at 800V.

## The Architectural Shift: 800V HVDC

The industry is moving to 800V high-voltage DC distribution or equivalents (Nvidia, Open Compute Project) to reduce current, copper usage, and power losses.

Today's architecture chains four to five conversion stages (transformer → UPS → PDU → server PSU → VRM), yielding only ~85–88% end-to-end efficiency. The 800V HVDC model removes three of these: the double-conversion UPS (replaced by DC-native battery backup connected directly to the 800V bus), the rack-level step-down transformer and PDU (replaced by simple 800V busbars), and the per-server AC-DC PSU (consolidated in power racks or further upstream).

The new architecture introduces: (1) centralized facility- or room-level AC-DC rectifiers built around high-voltage SiC MOSFETs and in the longer term, Solid-State Transformers (SST) to convert MV AC directly to 800V DC; (2) Solid-State Circuit Breakers (SSCB) using SiC for microsecond fault interruption versus milliseconds for mechanical breakers, necessary for safety at 800V; (3) DC-native battery backup units (BBUs) with bidirectional DC-DC converters and BMS ICs; and (4) rack-level 800V-to-low-voltage converters to step down to 48V (two-stage) or directly to 6V (single-stage).

## The Timeline

Adoption will be gradual and is best understood in three phases:

- **Today (2026-2027):** Conventional 215V-400V AC architecture dominates; racks are not 800V-native. Retrofitting work is underway to "future-proof" facilities, including sidecar power racks and power shelves feeding 48V DC into Stage 1.
- **Short-to-mid term (H2 2027–2028):** Ramp of 800V-native racks (Nvidia Kyber rack programmed for 2027). A dedicated 800V DC Power Side Rack housing AC-DC PSU, PDU, and BBU converts 480V AC to 800V DC outside the server rack. Schneider and Legrand do not see meaningful 800V traction before 2028.
- **Mid-to-long term (2028+)**: Power side rack and transformer consolidate into a single Solid-State Transformer converting utility MV AC directly to 800V DC, which feeds either a battery rack or 800V-native distribution boards stepping voltages down to 12V/6V. SST deployments are not expected before late 2027/early 2028.

## SiC and GaN Take Share

Silicon remains the largest dollar pool but we expect SiC content to rise from $30/kW today to $60/kW long term, GaN from $3/kW to $46/kW, while Si grows more modestly from $150 to $180/kW. SiC dominates high-voltage grid-to-rack applications (SST, SSCB, ESS); GaN wins in 800V-to-low-voltage Stage 1 conversion; Si remains dominant at Stage 2 (VRM/PoL) on cost/performance grounds.

## Key players

Infineon, Monolithic Power, Renesas Electronics, Texas Instruments, STMicroelectronics, Navitas, Analog Devices, On Semiconductor, Rohm, Innoscience, Alpha & Omega Semiconductor and Wolfspeed are the key players in this market. Today, the companies with the largest share in Stage 1 (Intermediate Bus conversion) and Stage 2 (Point of Load) are Infineon, Monolithic Power and Renesas Electronics. Nvidia has chosen many of the other named companies as potential future suppliers and we will likely see them become larger suppliers as the architecture transitions to 800V DC.

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# Structural Demand for Power Infrastructure

We see two structural demand vectors: **(1) the need for massive grid modernization and expansion**, and **(2) the need for more efficient power conversion inside the data center** (from AC-DC front-end to point-of-load at the GPU). Both demand advanced power semiconductor content such as silicon carbide (SiC), gallium nitride (GaN), next-generation MOSFETs, and intelligent power modules.

## Grid Expansion and Modernisation driven by AI and electrification

### Power-hungry AI is driving grid expansion

The explosive growth of AI workloads and the accelerating electrification are converging into a power infrastructure opportunity. Data center power demand globally is expected to reach 240GW - 280GW by 2030, with the US installed base projected at >160GW alone (based on various estimates and analysis). This represents a more than doubling data center power needs from 2025 levels (estimated at around ~115GW). BNEF's Grid Investment Outlook 2025 expects global grid capital spending to exceed $470bn this year, with the U.S. contributing $115bn. Separately, total global energy transition spending (encompassing renewables, grids, EVs, and storage) hit $2.3 trillion in 2025 (source: BNEF).

Every incremental GW of AI compute capacity requires not just server hardware and cooling, but a corresponding expansion of the high-voltage transmission and distribution network. Siemens Energy indicated that global customers are accelerating investments in transmission capacity to integrate renewables, meet rising demand and strengthen grid stability. Navitas highlighted that "The existing energy grid is not capable of supporting the projected rollout of AI development," framing grid modernization as a "large and long-term secular growth opportunity" with AI as the primary catalyst driving adoption of high-power solutions in both data centers and grid energy infrastructure.

### Data center growth could pull forward grid investments with new policy

In the US, the White House's Ratepayer Protection Pledge commits seven leading tech companies to "build, bring, or buy" their own power for hyperscale facilities and cover grid upgrade costs. The Department of Energy's SPARK initiative has allocated $1.9 billion specifically for grid upgrades, including re-conductoring and advanced transmission technologies. States like Oregon now mandate that data centers pay for the actual strain they place on the grid.

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## Powering Data Centers

**Demand = More Racks x More Power per Rack**

Power demand is fueled by two compounding factors: the expansion of data center capacity and the increase in power per rack as each new GPU generation demands more wattage and power density.

### Power constraints and distributed architectures multiply microgrid projects

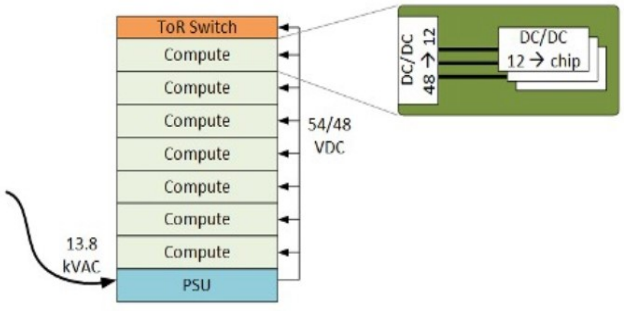
We are seeing the inflection of distributed AI data center architectures driven by power constraints. Frontier models are now too big to fit in one data center, which is constrained by the amount of power and cooling that can be drawn from one location. Thus the solution is to build data centers hundreds of miles aways and connect the back-end with massive bandwidth low-latency networking optics (scale across). This means data centers will multiply across geographically sparse locations, which drives the need for more microgrid investments at each location.

### The rack power escalation

NVIDIA's Blackwell B300 draws ~1,400W per chip and this is increasing to ~3,600W with Rubin Ultra GPUs. The Vera Rubin architecture with the Kyber rack (programmed for late 2026/2027) is expected to draw ~600kW per rack, and future generations are projected to exceed 1MW per rack. This escalation sparks demand for power delivery solutions capable of supplying thousands of amps at low voltage, hot-swappable power protection, advanced busbar distribution, and liquid cooling integration. It also introduces a sidecar architecture (Kyber), which decouples power and cooling infrastructure from the compute chassis to accommodate these densities.

**Figure 3: Current architecture - PSU inside each rack**

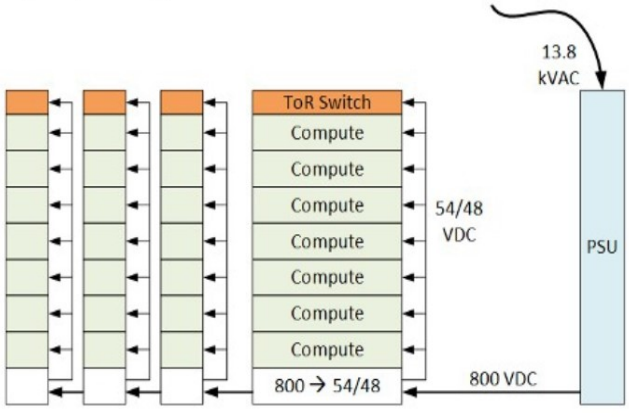
AC is fed to a power supply unit contained in a power shelf of each rack and is then converted to mid-voltage DC for each server board. Further voltage step down occurs on each board.




Source: Semiconductor Engineering.

**Figure 4: New architecture - Power rack feeding 800V DC to each IT rack**

With the 800V architecture, AC current is fed to a power rack (sidecar) which converts to 800V DC and distributed via HVDC bus bar to IT racks (800V native) where further voltage step down happens.




Source: Semiconductor Engineering.

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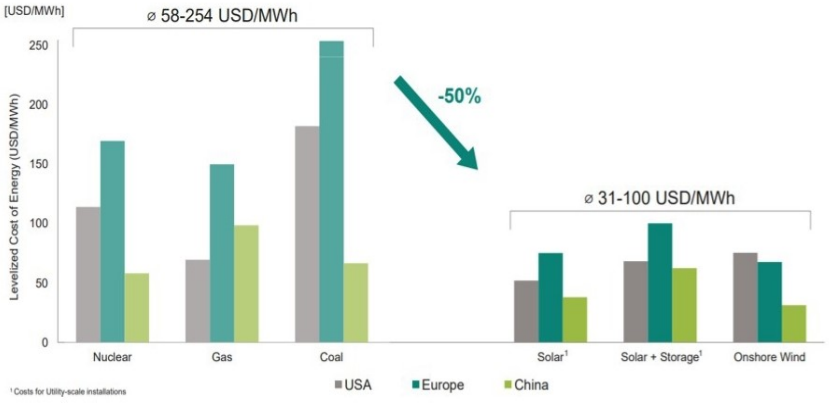


## Solar+storage as compelling solution to power data centers but global deployments constrained

### Solar+storage is a compelling alternative to power data centers

The economics of solar-plus-storage have reached an inflection point. In high-irradiance markets such as India, solar-plus-battery systems can now deliver power at costs below coal-fired generation, with the potential to meet up to 90% of electricity demand. In Saudi Arabia, utility-scale solar tariffs average $0.018/kWh, at or below gas-fired parity. Globally, solar LCOE (Levelized Cost of Energy) has collapsed from ~$150/MWh in 2011 to ~$30/MWh, and battery cost declines have made firm, dispatchable renewable power more affordable. Solar energy accounted for more than 72% of all new electricity generation capacity in the United States in 2025, with wind contributing another 16% (Federal Energy Regulatory Commission).

Figure 5: Levelized cost of energy by energy sources, in $ per MWh




Source: Infineon.

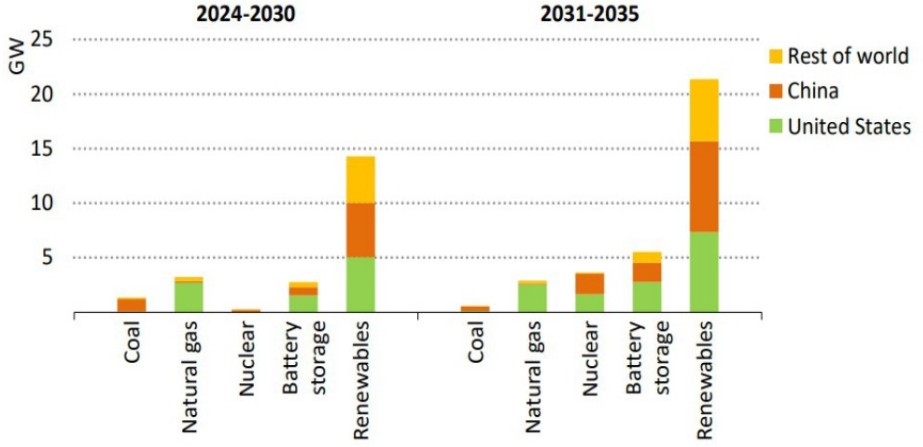
Table 1: Source of electricity for data centers comparison

| Electricity Source | Construction Period | Global average LCOE (USD/MWh) |
|---|---|---|
| **Utility solar PV** | 1-4 years | 60 |
| **Wind onshore** | 2-5 years (permitting bottleneck) | 50 |
| **Nuclear (new)** | 5-15 years | 90 |
| **Gas CCGT (Combined-Cycle Gas Turbine)** | 2-4 years | 80 |
| **Gas GT (Gas Turbine)** | 1-3 years | 220 |
| **Grid connection** | 3-7+ years | US: 350, Europe: 240, China:600 |

Source: IEA.

The only reliable electricity sources that can be added within an acceptable timeframe (~2 years) are solar PV and gas turbines, aligned with data center project timelines. Higher gas prices due to geopolitical issues make solar PV a more compelling alternative. Hyperscalers have responded accordingly (Google secured over 1.6 GW of wind, solar, and storage for its Minnesota and Texas data centers; Meta signed PPAs for 1.2 GW of solar capacity). The IEA expects renewables (including solar) and battery storage to account for the lion's share of data center power supply capacity added, with natural gas also being a significant contributor in the US specifically.

Figure 6: Annual average data center power supply capacity additions by fuel and region - IEA Base Case



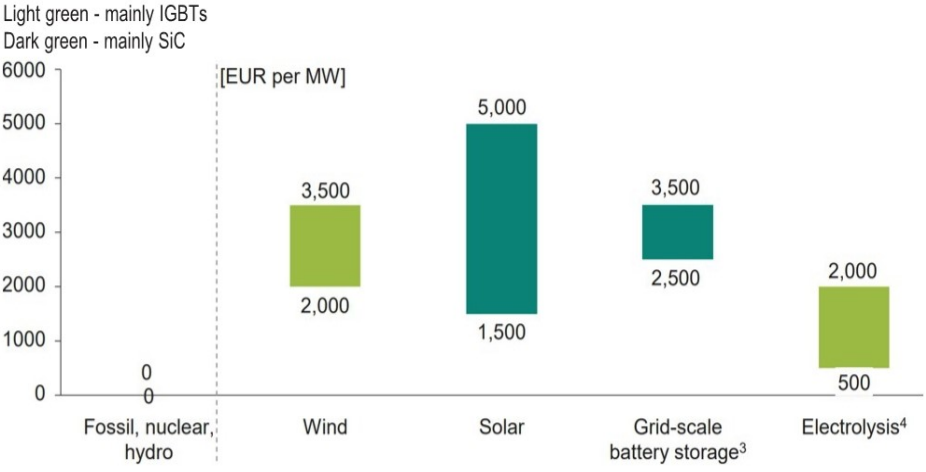

Source: IEA.

**But the binding constraint on solar deployment is infrastructure.**

The conversion rate from economically viable projects to commissioned, grid-connected capacity is not straightforward. In the US, median grid interconnection lead times run three to five years, transformer shortages have extended delivery times from weeks to years, and most queued solar projects never get built. In Europe, grid constraints put more than 120 GW of planned renewable capacity at risk across 20 EU countries, with permitting timelines stretching up. On the supply side, Chinese module overcapacity has driven prices below production costs for most manufacturers, compressing margins across the value chain and undermining the investment needed to sustain deployment growth.

## Semiconductor Content in Energy Generation

Figure 7: Power semi content in energy generation




Source: Infineon.

Power semiconductor content for energy generation is estimated at ~€3,000 per MW of power generation using renewable energy (wind/solar) to which should be combined grid-scale battery storage solutions adding another ~€3,000 of content.

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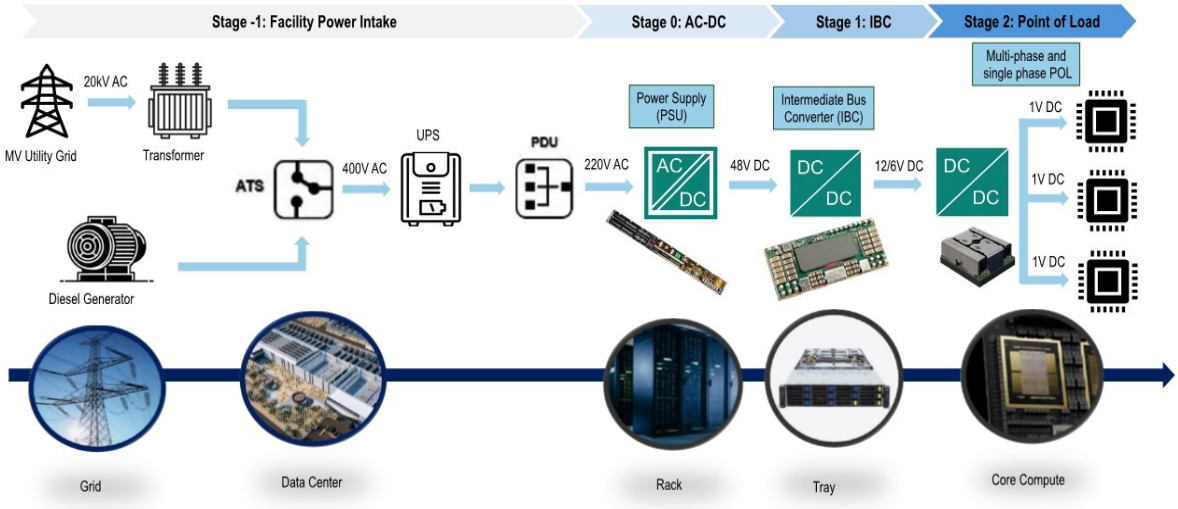




# Power Semis for AI Data Centers

Power undergoes multiple conversion stages from the utility grid to the processor die, and at each stage energy is lost as heat. Improving efficiency at every node is critical for cooling constraints and energy savings.

**Figure 8: AI Power Delivery Flow - Today's architecture**




Source: J.P. Morgan, Company reports.

## Stage -1: Facility Power Intake (Grid to PSU input)

Before any electronic conversion takes place, raw power must be delivered from the utility grid to the server rack. Power enters the data center from the utility at medium voltage (typically 10-35 kV) and is stepped down via MV/LV transformers to 400-480V AC. From there, it passes through:

1. Automatic Transfer Switch (ATS) that arbitrates between the utility feed and backup diesel generators upon grid failure;
2. Uninterruptible Power Supply (UPS) that bridges the seconds-long gap before generators reach full output and continuously conditions the AC waveform;
3. Power Distribution Unit (PDU) that distributes conditioned AC to individual racks. This outputs AC at 200-480Vwhich is the input to the Power Supply Unit (PSU), where the first electronic conversion, AC-DC (Stage 0), begins.

**Semiconductor content**

This stage is less semiconductor-intensive than downstream stages in the current architecture, containing mainly electromechanical components, though the UPS rectifier and inverter stages rely on high power **IGBTs**. In next generation architectures, this stage contains more semiconductor components, including **SiC MOSFETs** to reduce conversion losses, featuring a Solid-State Transformer (SST) and Solid-State Circuit Breakers (SSCB). The addition of energy storage systems (ESS) replacing the UPS and at the grid level are also semiconductor intensive.

**Key players:** High Voltage SiC providers (1.2kV and beyond SiC) including Infineon, Navitas, Wolfspeed, Rohm, STMicro.

## Stage 0: AC-DC Front-End (Facility-Level Conversion)

The first conversion stage transforms grid-level AC power into DC. In a traditional data center, this occurs in the Power Supply Unit (PSU) at the rack or server level, converting 220V+ AC to 12V or 48V DC.

**Semiconductor content**

The AC-DC front-end PSU is built around high-voltage switching transistors, traditionally **silicon super-junction MOSFETs**, but increasingly **SiC MOSFETs** and **GaN HEMTs** for higher-efficiency. SiC is gaining traction in high-power PSUs (3 kW and above) due to its higher breakdown voltage and superior thermal conductivity, while GaN is increasingly preferred for the primary-side switching stages due to its high-frequency switching capability, which enables smaller magnetics and higher power density.

**Key players:** Infineon (1.2k SiC MOSFETs, GaN HEMTs, PFC Controllers), Wolfspeed (650V, 1.2kV SiC MOSFETs and diodes), onsemi (SiC MOSFETs, diodes), STMicro (SiC MOSFETs, MasterGaN, integrated GaN drivers), Navitas (integrated GaN + driver, SiC MOSFETs), Texas Instruments (GaN FETs, PFC/LLC controllers)

## Stage 1: Intermediate Bus Conversion (Rack-Level DC-DC)

In a 48V-bus architecture (the current mainstream standard), power is distributed at 48V DC across the rack backplane and then stepped down to ~12V or directly to ~1V at the server board. In emerging 800V architectures, the first rack-level DC-DC stage converts 800V down to an intermediate voltage (typically 48V or 50V).

This is where GaN is growing rapidly. Navitas Semiconductor has introduced a 10 kW all-GaN DC-DC platform achieving 98.5% peak efficiency for 800V-to-50V conversion. Navitas has also debuted a 800V-to-6V power delivery board that eliminates the traditional 48V intermediate bus entirely, achieving up to 96.5% efficiency at 1 MHz switching frequency with a power density of 2,100 W/in$^3$. To put these figures in perspective, each percentage point of efficiency gained at 100 kW rack scale saves ~1 kW of waste heat, with a direct reduction in cooling requirements.

**Semiconductor content**

Current architectures (48V stepped down to low voltages) use different power modules solutions depending on topology. In 800V DC architectures, **high-voltage GaN HEMTs (typically 650V rated)** are gaining traction.

**Key players:** In today's AI data centers, the 48V bus is stepped down to load voltage primarily by Vicor (fixed-ratio Sine Amplitude Converters), MPS, and Infineon (multi-phase buck/hybrid topologies). At 800V, multiple industry players are ramping capacity: Onsemi and GlobalFoundries are co-developing 650V GaN power devices on a 200mm GaN-on-silicon process, with sampling expected in H1 2026. ROHM is deploying EcoGaN 650V HEMTs in AI server PSUs. Navitas has strong GaN technology at this stage. Infineon and Innoscience are manufacturing GaN at scale.

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## Stage 2: Voltage Regulator Module (VRM) /Point-of-Load

The final stage is the Point-of-Load or Voltage Regulator Module (VRM), which sits on or immediately adjacent to the processor and converts the intermediate bus voltage (typically 12V or 48V or lower) down to the sub-1V levels required by GPU and CPU cores. The VRM is the most demanding part of AI power because it must deliver hundreds/thousands of amps at strictly low voltages, with nanosecond-level transient response to cope with the rapid load swings of GPU compute cycles.

**Semiconductor content**

The VRM is constructed from **multi-phase arrays** of **low-voltage MOSFETs** (typically rated below 100V) acting as power stages, controlled by a digital multi-phase controller IC. This is the highest-volume battleground. The number of VRM phases per GPU is rising with each generation (as more phases are needed to deliver higher total current while maintaining voltage accuracy). This directly scales the MOSFET and controller IC content per server. **Vertical power modules** are gaining traction to increase power density, with 3x+ ASP than discretes.

**Key players:** Infineon (multi-phase controllers, smart power stages) and Monolithic Power Systems (integrated power stages, controllers) are leading with sockets at Nvidia. Renesas and Analog Devices are increasing their footprint in this market.

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# The HVDC 800V Architecture

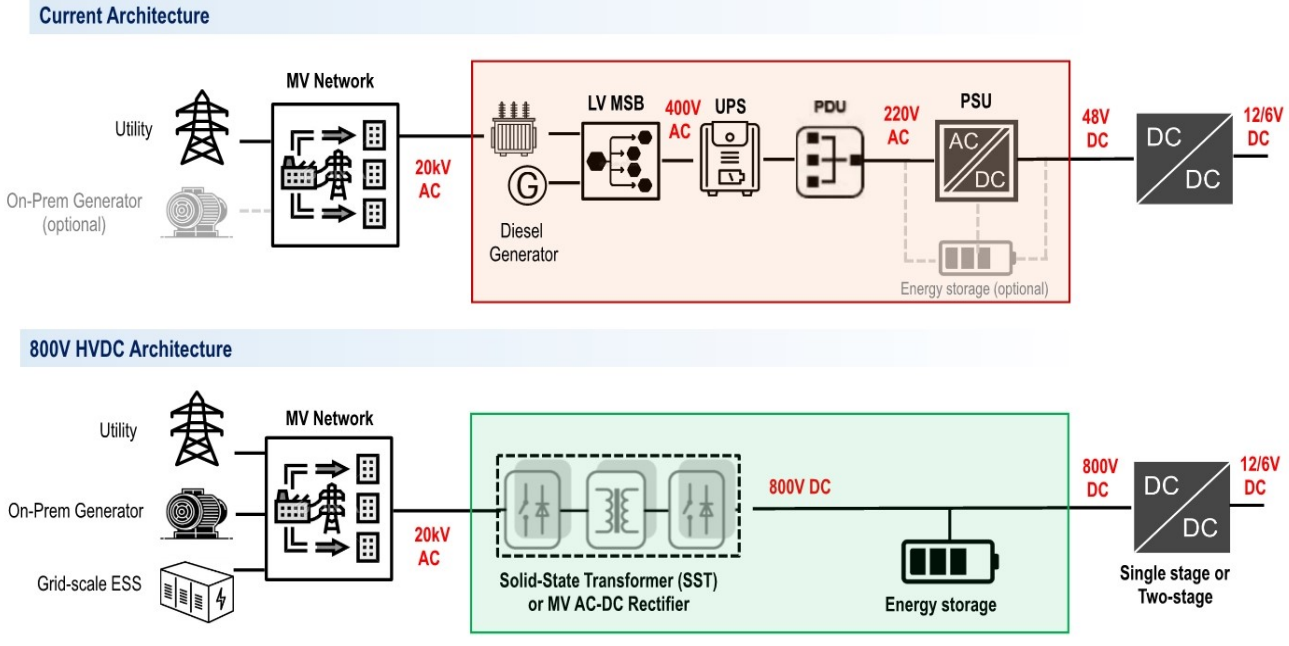
The industry is now undergoing a fundamental architectural shift which increases voltage $U$ to reduce the current $I$ which implies less copper and quadratically less power losses $Q$. Physically, the voltage is given by $U = R.I$ (resistance x current) and the power loss through heat (Joule's heating) is given by $Q = R.I^2$. For a given amount of power $P$ delivered to the load $(P= U.I)$, increasing the voltage $U$ enables lower current $I$ and thus much lower power loss $Q$. New AI-optimised facilities are moving towards high-voltage DC (HVDC) distribution (typically at 800V DC or ±400V DC) where AC-to-DC conversion is centralized at the facility or room level, and DC is distributed directly to racks. This eliminates redundant conversion stages, reduces current (and therefore copper and losses), and can deliver a DC-native rack driving efficiency gains and reduced thermal load.

## Legacy Data Center Power Delivery Architecture Inefficiencies

In a traditional data center, power flows from the utility grid through **four to five distinct conversion stages** before it reaches the processor die. Each of these stages introduces efficiency losses (typically 2–5% per stage) and each requires its own set of hardware: transformers, static transfer switches, UPS batteries and inverters, power distribution units (PDUs), server-level PSUs, and finally VRMs. A cumulative chain of four or five 97%-efficient stages yields an end-to-end efficiency of roughly 85–88%, meaning 12–15% of the power drawn from the grid is wasted as heat before it even reaches a transistor on the GPU. At 100 kW per rack, that translates to 12–15 kW of waste heat per rack that must be removed by the cooling system.

## HVDC Architecture: Fewer Stages, but More Semi-Intensive

Figure 9: Current Data Center Power Architecture vs. Long Term Vision




Source: J.P. Morgan, Company reports.

In today's architecture, a lot of the equipment in this legacy chain is **electromechanical or passive** in nature (copper-wound transformers, lead-acid or lithium-ion UPS battery banks, and mechanical circuit breakers). **The semiconductor content is concentrated at only two nodes: the server PSU (AC-DC conversion, typically using silicon super-junction MOSFETs) and the VRM (DC-DC conversion, using low-voltage MOSFETs). The earlier stages are semiconductor-light.**

**What is eliminated?**

- **The double-conversion UPS:** In current AC facility, the UPS converts AC to DC (to charge batteries), then inverts DC back to AC (to feed the IT load), introducing two conversion stages and ~6–10% losses. In an 800V DC architecture, battery backup is provided by DC-native battery systems connected directly to the 800V bus, eliminating the AC inverter stage.
- **The step-down transformer/PDU at the rack:** In current architectures, a transformer steps 480V AC down to 208V or 240V AC at the rack level, and a PDU distributes it to individual servers. In the 800V DC model, 800V DC is distributed directly to the rack via simple busbars or cables.
- **The server-level AC-DC PSU**: In current systems, each individual server contains its own AC-DC power supply unit (PSU), converting 208V AC to 12V or 48V DC. In the 800V DC architecture, this entire stage is eliminated from the server. AC-DC conversion is centralized at the facility level; the server receives DC directly.

**What is new?**

- **Centralized high-power AC-DC rectifier**: A new, facility-scale or room-scale AC-DC conversion stage replaces the distributed per-server PSUs. These centralized rectifiers operate at much higher power levels (hundreds of kW to MW scale) and are built around high-voltage SiC MOSFETs or SiC/Si. This is a new piece of power electronics infrastructure that did not exist in the legacy architecture and it is highly semiconductor-intensive (although it replaces rack-level PSUs which are semiconductor intensive)
- **Rack-level 800V-to-low-voltage DC-DC converter:** This is the most semiconductor-intensive new stage. Each rack requires a converter to step 800V DC down to an intermediate voltage at either 48V or, in the most advanced architectures, directly to ~6V at the board level.
- **DC-native battery backup units (BBUs)**: These replace the legacy UPS and connect directly to the 800V DC bus. While simpler than double-conversion UPS systems, they still require power electronics for charge/discharge management, including DC-DC converters and battery management ICs.
- **The VRM stage remains and is itself growing content:** The VRM/point-of-load stage is not eliminated by the 800V architecture; it remains the final conversion step from the intermediate voltage to the ~0.7–1.0V required by the GPU. As described in the prior section, this stage is itself seeing a major content increase driven by:
  1. **Rising GPU power draws (more VRM phases needed**),
  2. The **transition from lateral to vertical power delivery** (higher-ASP integrated modules), and
  3. The **adoption of GaN or advanced silicon in the power stages.**

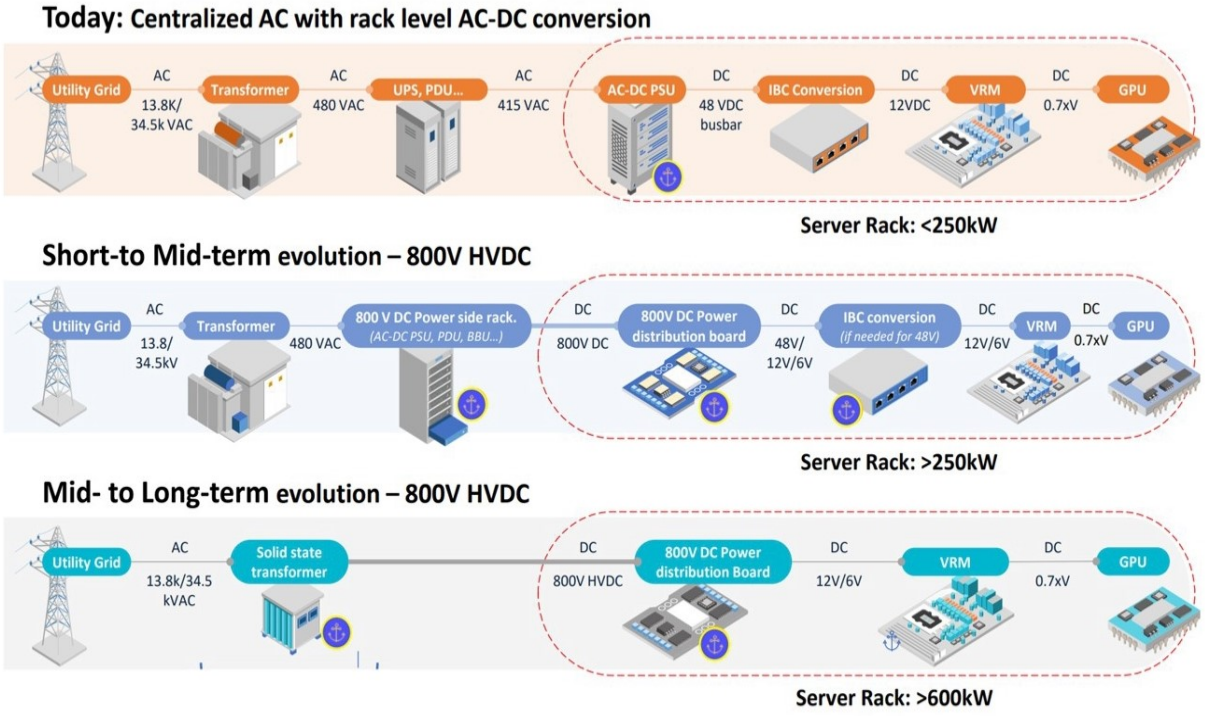
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## 800V Architecture roadmap & timeline

Figure 10: AI Data centers' architecture shifts over time




Source: Navitas

The shift to 800V HVDC distribution will not happen overnight. Schneider and Legrand do not see meaningful traction for 800V architectures before 2028, meaning the short-to-medium term revenue opportunity remains anchored in conventional 400V AC power chains, supplemented by the addition of energy storage systems. But the direction of travel is unambiguously positive for semiconductor content:

- **Today:** The current architecture has a long conversion chain and server racks are limited to <250kW. AC-DC conversion sits inside the server rack which happens at the PSU level. Current racks are not 800V-native and thus one cannot simply supply 800V DC directly into the compute blades. There is ongoing retrofitting work to "future-proof" the architecture for 800V native racks which will be coming in the market in 2027 (Kyber rack) by including a power side rack into the architecture and power shelves to supply 48V DC into Stage 1 (IBC Conversion).
- **Short-to-mid-term evolution:** With the ramp of 800V native racks, the architecture shifts to a more efficient supply consolidated into a power side rack directly supplying 800V DC to a power distribution board. A dedicated 800V DC Power Side Rack (housing AC-DC PSU, PDU, BBU) converts the 480V AC to 800V DC outside the server rack and directly supplies the power distribution board inside the rack which feeds into Stage 1 (IBC Conversion).
- **Mid-to-long term:** The architecture is made even more efficient by eliminating the power side rack and transformer, which are consolidated into a Solid-State Transformer (SST) directly converting utility-level AC to 800V DC. The 800V DC is then either fed into a battery rack or to the 800V native distribution board which directly steps down to 12V/6V, removing the IBC stage.

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## Table 2: 800V architecture evolution

| | Today | Short/Mid Term | Long Term |
|---|---|---|---|
| **Grid to rack** | | | |
| **Transformer** | Passive | Passive | Replaced by SST |
| **Switchgear** | Mechanical | Mechanical | Replaced by SSCB |
| **UPS** | Si IGBT power stages -> SiC | Moves to power rack, SiC | Moves to battery rack, SiC |
| **PDU** | AC PDU 415/208V | Moves to power rack, DC PDU | Absorbed into 800V busbar |
| **AC-DC Rectifier** | Inside rack PSU | Centralized in power rack, SiC or GaN HEMTs | Moves at facility level inside SST |
| **Protection** | Mechanical | SiC for HVDC protection | SiC for HVDC protection |
| **SST** | | | Replaces transformer + rectifier, SiC ~1.7-3.3kV |
| **SSCB** | | | SiC MOSFETs/JFETs for HVDC protection |
| **Inside the racks** | | | |
| **Power shelf/PSU** | AC-DC conversion to 48/12V DC, Si MOSFETs and Si controllers | Centralized in power rack, SiC or GaN HEMTs | |
| **HVDC Power Rack** | Sidecar as future-proofing concept | Centralize rectification and distribution + BBU feeding 800V to compute racks | Integrated at row/facility level |
| **Busbar** | 12V/48V passive copper within racks | 800VDC busbars for rack/row distribution | 800VDC busbars for rack/row distribution |
| **IBC Conversion** | Board-level 48V -> 12V | Board-level 48V -> 12V/6V | 800V -> 12V/6V without intermediate conversion |
| **Battery Rack** | Centralized UPS battery | BBUs move to rack level | 800V battery rack integrated into row-level HVDC, bidirectional flow SiC MOSFETs |
| **VRM** | Si trench MOSFETs, lateral delivery | Vertical power delivery, Si and GaN | Vertical power delivery, Si and GaN |

Contains semiconductors

Source: Company reports, J.P. Morgan.

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# From Grid to Rack

Higher investments in AI data centers and a growing share of renewables in the energy mix call for expansion and modernization of the power grid. Grid modernisation and expansion translate into demand for power electronics at every node of the electricity system: generation, transmission, distribution, and consumption. This will drive demand for SiC technology and related modules as well as large-scale energy storage systems.

**Table 3: Grid to Rack Semiconductor Map**

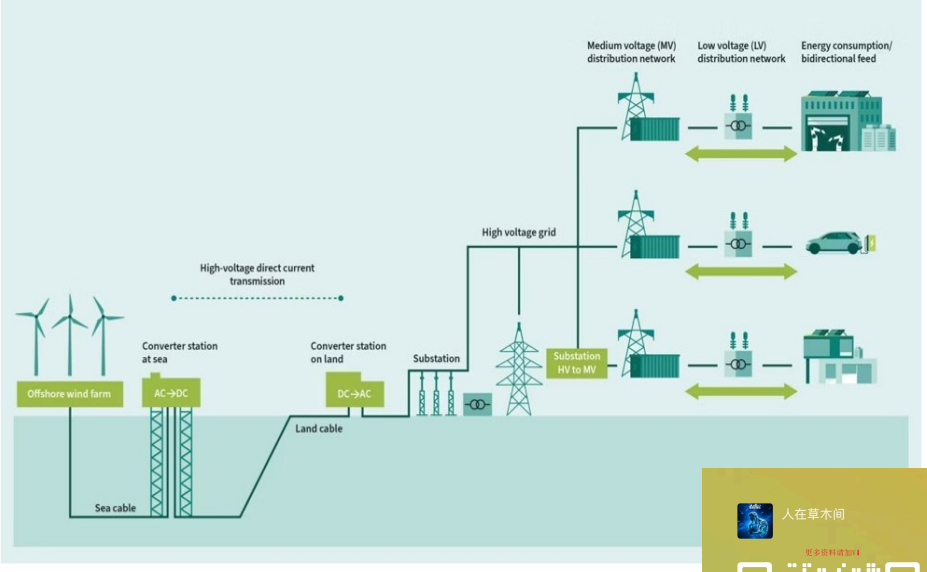
| Application | Key semi devices | Technology trend |
|---|---|---|
| **HVDC transmission** | High-voltage IGBT modules, SiC modules | Line Commutated Converter (LCC) -> Voltage-Source Converter (VSC) transition raises semi content |
| **Grid-scale BESS** | IGBT modules, SiC modules | Growing unit sizes, SiC for higher efficiency |
| **Solar/Wind inverters** | IGBT modules, SiC MOSFETs | Si -> SiC transition for higher efficiency |
| **Solid-State Transformers** | SiC modules, IGBTs | Emerging; orders-of-magnitude content uplift |
| **Solid-State Circuit Breakers** | SiC devices, IGBTs | Microsecond switching for smarter grids |
| **AC-DC Front-End (PSU)** | High-voltage switching transistors, PFC controllers | Si super-junction MOSFETs -> SiC MOSFETs, GaN HEMTs |

Source: J.P. Morgan, company reports.

## HVDC Transmission

High-Voltage Direct Current (HVDC) systems are the technology of choice for long-distance, high-capacity transmission to connect remote renewable generation (offshore wind, desert solar) to demand centers, and enable cross-border power trade. New HVDC projects are proliferating globally.

**Figure 11: HVDC technology in modern power infrastructure**




Source: Infineon Technologies.

**Semiconductor content:** HVDC converter stations are among the most power-semiconductor-intensive installations. Each converter valve requires hundreds/thousands of high-voltage IGBT or SiC modules arranged in series. Infineon commented that more than 16,000 6.5 kV IGBT modules can be installed in a single 2 GW HVDC project. As HVDC systems shift from line-commutated converters (LCC) to voltage-source converters (VSC), which offer greater controllability and are suitable for offshore wind connections, the demand for press-pack IGBTs and increasingly for SiC-based modules rises materially.

**Key players:** High-voltage DC transmission from grid to data center campus relies on ultra-high-voltage power semiconductors. Infineon, ABB (Hitachi Energy), and Mitsubishi Electric dominate with press-pack IGBTs and thyristors rated at 4.5kV–6.5kV, while Wolfspeed and STMicro are developing SiC devices that promise lower switching losses at these voltage levels.

## Energy Storage Solutions (ESS)

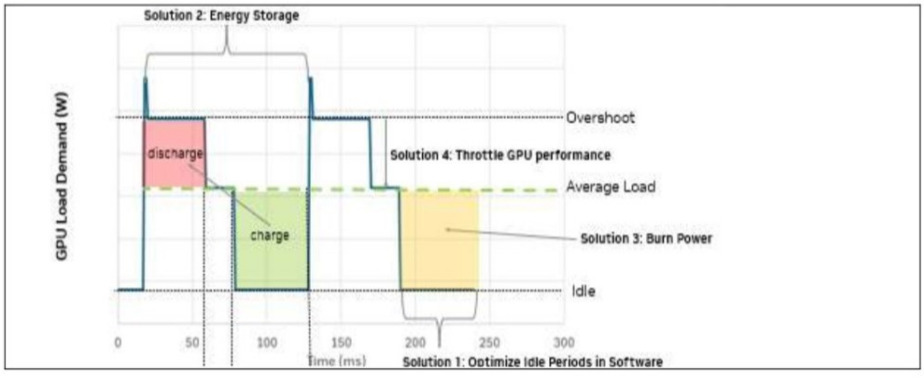
Energy storage systems (ESS) are essential for balancing intermittent renewable generation and are now being deployed alongside data centers to smooth demand profiles and bypass grid connection delays. Data centers are expected to account for 83% of commercial and industrial behind-the-meter storage deployments by 2030 (Source: SEIA). Energy storage serves multiple roles in AI power delivery:

- **Backup power and UPS replacement:** Advanced BESS (Battery Energy Storage Systems) are replacing or augmenting traditional diesel generators and lead-acid UPS systems, providing faster response times and cleaner backup.
- **Grid interconnection acceleration:** Behind-the-meter battery storage allows data centers to come online years faster than waiting for traditional grid upgrades.
- **Load buffering and peak shaving:** Grid-forming inverters allow BESS to act as virtual power generators, stabilizing the grid and absorbing rapid power swings caused by AI training and inference workloads

**Addressing AI workload power swings with multi-timescale energy storage**

AI workloads create a power profile that requires load buffering from ESS. A single rack can swing from 30% idle to 100% utilization and back in milliseconds, forcing every component in the power chain to be sized for peak, not average, load.

Figure 12: Energy storage to flatten the load demand




Source: Nvidia.

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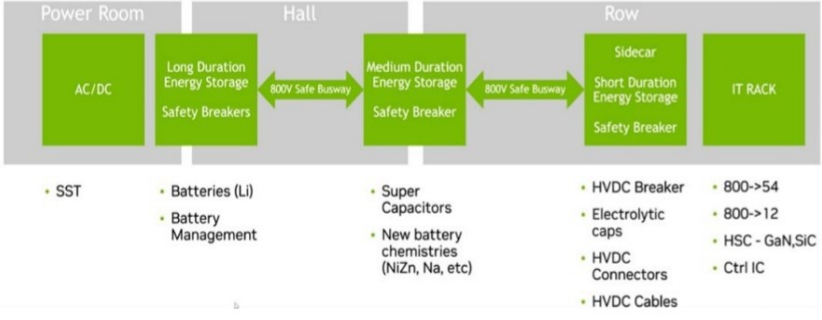




Aggregated across an entire data hall, these swings represent hundreds of megawatts ramping up and down in seconds. Energy storage must therefore shift from a passive backup role to an active, always-on buffer that decouples GPU power chaos from the grid.

- **Long-duration (seconds to minutes): Li-ion BESS.** Large battery energy storage systems sit at the facility edge, near the utility interconnection. They manage the macro-level power, the ramp-up and ramp-down of entire workloads, absorbing sustained load shifts across data halls. On this timescale, the BESS effectively replaces or supplements the traditional UPS.
- **Medium-duration (milliseconds to seconds): Supercapacitors and emerging battery chemistries.** This middle layer bridges the gap between the fast transients at the rack and the slower bulk storage at the facility. This tier handles the workload-level volatility: bursts of GPU activity across a row or cluster that are too sustained for capacitors alone but too fast for bulk BESS to track.
- **Short-duration (microseconds to milliseconds): Electrolytic capacitors.** Placed closest to the compute, bulk electrolytic capacitors provide the fastest response, absorbing the sharpest transients generated by individual GPU power state transitions. These are not energy storage in the traditional sense, but rather instantaneous current reservoirs that prevent voltage drops.

Figure 13: 800V DC Architecture and Energy Storage Systems




Source: Rohm.

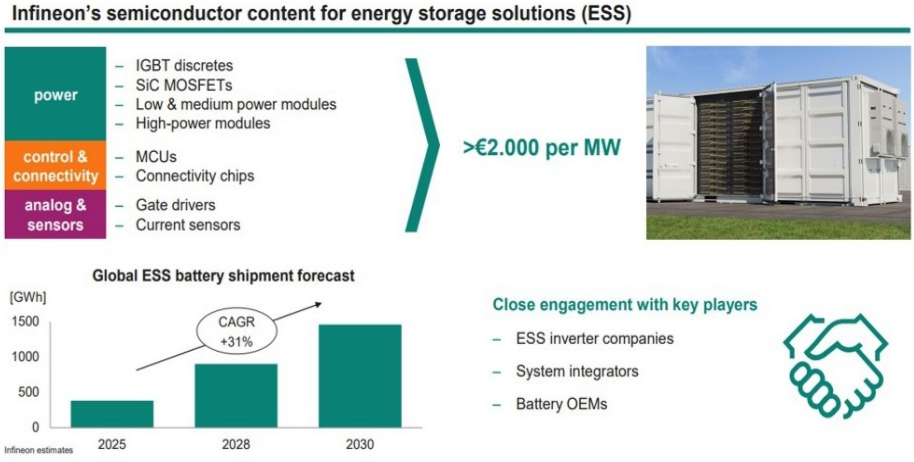
### Positive trends in BESS

Leading player CATL reported a 60% YoY increase in battery shipments in 1Q26, shipping over 200 GWh of batteries. The company has indicated that energy storage system batteries accounted for ~25% of total battery sales in 1Q26. The company is seeing growth in the market and completed a $5bn share placement to expand its production capacity.

**Semiconductor content:** Every ESS requires a power conversion system (PCS) (a large bidirectional inverter) built around IGBT or SiC power modules. As ESS unit sizes grow (from tens to hundreds of MW), the semiconductor content per installation scales proportionally. SiC-based PCS systems offer higher efficiency (lower round-trip losses) and smaller thermal management footprints, making them increasingly preferred for next-generation installations. The market is currently small but is expected to be the "next big growth market" after solar scale-up; Infineon expects meaningful contribution given breadth of content. Infineon has indicated semi content above €2,000/ MW & **expects to ship ~1,500GWh of ESS globally and using a 4 hour duration, this corresponds to a power capacity of 375GW or a market size of €750m using a €2,000/GW content assumption.**

**Key players:** Bidirectional converters for battery energy storage use Infineon CoolSiC MOSFETs and IGBT modules, onsemi EliteSiC, Wolfspeed SiC MOSFETs for high-efficiency DC-DC stages, and Texas Instruments for BMS (battery management) ICs and isolated gate drivers. Infineon explicitly highlighted large-scale energy storage as a key application for its SiC module portfolio. Infineon's content spans power (IGBT, SiC discretes/modules), control/connectivity (MCUs), and analog (drivers, regulators).

Figure 14: Infineon's semi content for ESS




Source: Infineon Technologies

### Solar and Wind Inverters and Bidirectional Converters

Power semis make the interface between generation, storage, and the electrical network, whether that network is the public AC grid or a data-center microgrid. Solar PV and batteries are inherently DC, so they use DC-AC inverters to export power to an AC grid and increasingly must provide grid-support functions. Wind turbines are not DC sources; they typically produce variable-frequency AC and therefore use AC-DC-AC conversion (a back-to-back converter) to deliver grid-quality AC and enable the same grid-support features.

**In a data-center microgrid** that distributes power on a high-voltage DC bus (often discussed as ~800V DC), the converter mix shifts. PV and batteries may connect directly to the DC bus via DC-DC (often bidirectional) converters, while any connection to the utility grid (or to on-site generators) typically requires bidirectional AC-DC converters/rectifiers to bridge between AC infrastructure and the DC bus.

**Semiconductor content:** Central and string inverters for utility-scale solar are built around IGBT modules (for higher-power systems) and increasingly SiC MOSFETs (for improved efficiency and power density). Each GW of installed solar capacity requires tens of thousands of power semiconductor devices. Infineon noted that while it expects the inverter market to be roughly flat in the near term as installation levels plateau, grid infrastructure (which includes grid-tied inverters and grid-forming systems) remains a growth area. Across large deployments, semiconductor demand scales materially with installed capacity, since each inverter/converter stage contains multiple high-power switches, diodes, gate drivers, sensing, and protection.

**Key players:** String and central inverters converting renewable DC/AC to grid-compatible power are dominated by Infineon (CoolSiC, IGBT modules), onsemi (EliteSiC diodes and MOSFETs), STMicro (STPOWER SiC), Wolfspeed (bare die SiC for high-power modules), and Navitas (GaN for residential/commercial string inverters)

## Solid-State Circuit Breakers and Solid-State Transformers

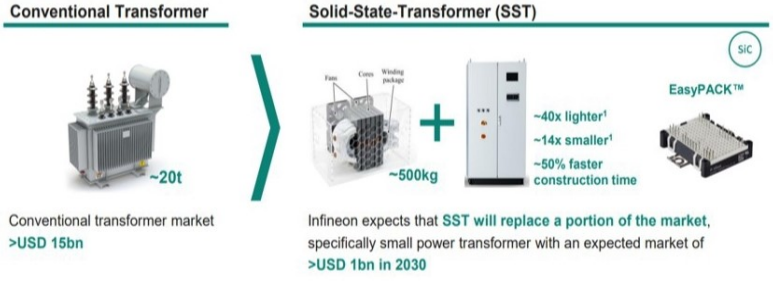
These are emerging applications that could represent a step-change in grid semiconductor content. Solid-state circuit breakers (SSCB) use SiC devices to interrupt fault currents in microseconds (vs. milliseconds for mechanical breakers), enabling smarter, more resilient grid architectures. Solid-state transformers (SST), essentially power-electronic converters that replace conventional copper-and-iron transformers, offer voltage conversion, power flow control, and reactive power compensation in a single compact unit.

**Semiconductor content:** These applications are very semiconductor-intensive (SiC). If solid-state transformers achieve commercial scale, the semiconductor content per transformer would be orders of magnitude higher than the zero content in a conventional electromagnetic transformer. Infineon expects the SST market to reach >$1bn in 2030 and the SSCB market to reach >$800m in 2030. SST deployments are not expected before late 2027/early 2028 with medium term AC-DC conversion expected to occur inside power sidecars.

**Key players in SST:** Infineon leads with SiC-based medium-voltage modules, Wolfspeed provides 10kV+ SiC MOSFETs enabling direct MV connection, GeneSiC (Navitas) offers high-voltage SiC devices, and CREE/Wolfspeed partners with research consortia on 15kV SiC IGBTs for this application.

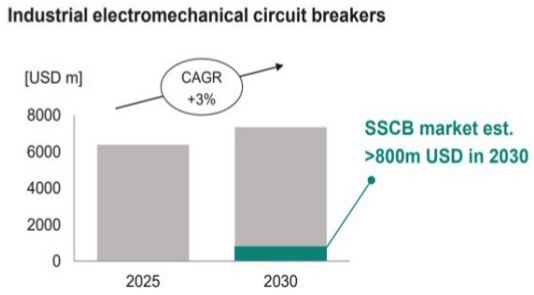
**Key players in SSCB:** Infineon and Mitsubishi Electric provide high-voltage IGBTs and thyristors for DC breaking but market is moving towards SiC technology. Infineon is collaborating with Siemens' advanced protection concepts with its CoolSiC MOSFET module (1.2kV). Wolfspeed and Ideal Power are developing bidirectional SiC switches, and ABB/Hitachi Energy integrates custom Si/SiC devices into solid-state breaker modules.

Figure 15: Transition towards Solid-State-Transformer (SST)




Source: Infineon Technologies

Figure 16: Circuit breakers market expectations




Source: Infineon Technologies.

**Solid-State Transformers is the long-term vision, conventional MV transformers will be deployed in medium-term**

The SST converting directly from MV AC (20kV) to 800V DC is the most advanced and forward-looking architecture where Infineon is actively engaged. However, it is not yet the mainstream deployed solution. Most 800V HVDC facilities being built or planned today use a more transitional architecture: a conventional copper-wound MV transformer stepping down to 400V AC, followed by a centralised AC-DC rectifier (built with SiC MOSFETs) that outputs 800V DC.

- **Near-term (being deployed now):** Conventional MV transformer → centralised SiC-based AC-DC rectifier → 800V DC bus
- **Long-term (emerging)**: Solid-State Transformer replacing both the MV transformer and the rectifier in a single device → 800V DC bus

## Power Supply Units (AC-DC front end consolidated in centralized SST or HVDC rectifier in the long term)

The PSU is the traditional AC-DC conversion point, sitting at the server or rack level and converting 200–480V AC to 12V or 48V DC. Today's high-end AI server PSUs (3 kW+) are already transitioning from silicon super-junction MOSFETs to SiC MOSFETs and GaN HEMTs in topologies driving efficiency above 97%. STMicroelectronics has secured multiple design wins for SiC and silicon-based PSU solutions in next-generation AI compute.

**Semiconductor content:** In the midterm, the PSU remains a significant and growing semiconductor opportunity as rack power densities are climbing from 20 kW to 100 kW+, meaning more and higher-rated PSUs per rack, each carrying richer SiC/GaN content. However, the longer-term trajectory points toward the PSU's gradual obsolescence as a discrete component. As 800V HVDC distribution and solid-state transformers mature, the AC-DC conversion function migrates upstream to a centralized facility- or room-level unit, and DC is distributed directly to racks. In this architecture, the per-server PSU is eliminated entirely (n*ote that its semiconductor content doesn't disappear but is consolidated and scaled up into the centralized SST or HVDC rectifier, shifting the value pool from thousands of distributed PSUs to fewer, much larger power-electronic systems*). Brownfield data centers will continue deploying conventional PSUs for years, while greenfield AI-optimized facilities increasingly adopt centralized HVDC, making the PSU a mid-term growth story that eventually cannibalizes itself at the rack level.

**Key players**: Infineon dominates with CoolSiC and CoolGaN for totem-pole PFC and LLC stages, Navitas pushes GaNFast integrated ICs for high-frequency/high-density PSUs, onsemi and Wolfspeed supply SiC for platinum/titanium-rated efficiency, and EPC provides eGaN FETs enabling MHz-frequency resonant topologies that shrink magnetics.ROHM is deploying 650V EcoGaN HEMTs in AI server PSUs.

## Semiconductor Content (From Grid to Rack)

- **Eliminated stages were mostly electromechanical, though PSUs consolidation is a headwind:** The stages being removed, namely transformers, mechanical PDUs and the AC side of the UPS are dominated by copper, iron, and passive components. Their semiconductor content was minimal. The server-level PSU did contain silicon MOSFETs and control ICs, but these were more commodity-grade, lower-ASP devices but at higher volume. Eliminating these stages is a headwind to semiconductor dollar content per GW which is offset by added components.
- **Added components are semiconductor-intensive**: In the midterm, PSUs remain at the rack level while electromechanical components are progressively consolidated into AC-DC rectifiers built around SiC and GaN power devices, and mechanical circuit breakers are replaced by solid-state alternatives (SiC/IGBT-based). In the longer term, the entire power chain consolidates into a single MV rectifier or solid-state transformer with semiconductor content orders of magnitude higher than the electromagnetic transformer it replaces. Energy storage systems, both at the grid edge and distributed across the power chain, add further semiconductor-intensive layers (bidirectional DC-DC converters, BMS ICs, current sensing). The net effect from grid to rack is clear: low-semiconductor-content electromechanical infrastructure is being replaced by high-semiconductor-content power electronics.

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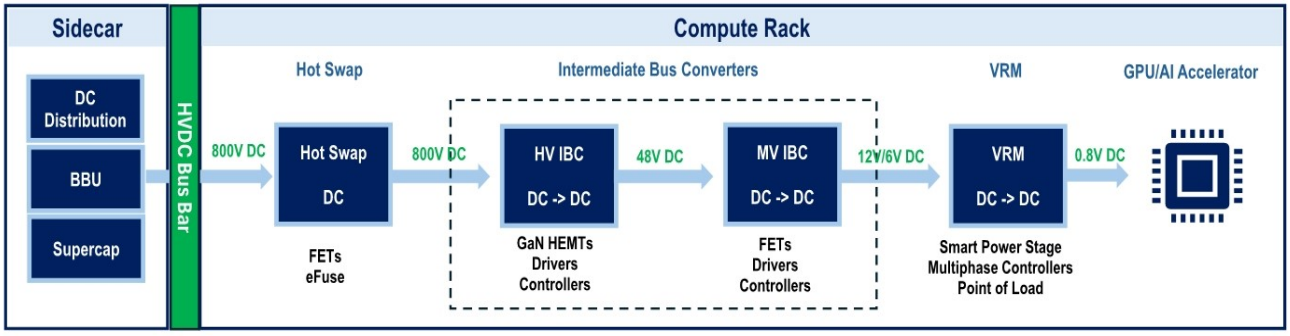




# Inside the Rack

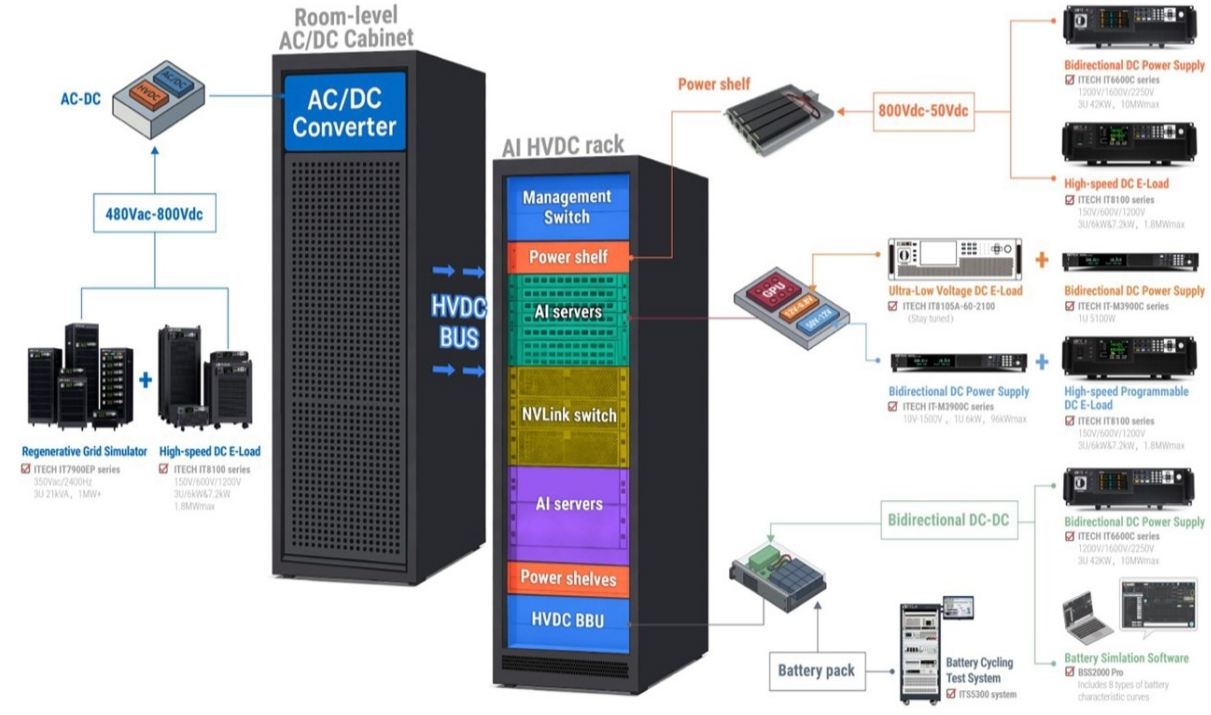
AI server racks are evolving towards 100 kW+ GPU-dense systems, with Nvidia's Kyber racks planned to exceed 1MW. Inside the rack, the input voltage (trending toward 800V) needs to be converted down to the sub-1V levels a GPU die consumes at extreme currents and with nanosecond-level responsiveness. High power efficiency is critical inside the rack because at 100kW+, a single percentage point of conversion loss means over 1kW of power loss and the corresponding heat that must be removed. This means that the power architecture inside of a rack has a meaningful impact on cost of ownership and thus on the bill-of-materials.

Figure 17: AI compute tray power chain




Source: J.P. Morgan, company reports.

Figure 18: HVDC Rack Architecture




Source: Rexgear.

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Table 4: Semiconductor Content Map - Inside Data Centers

| Power Delivery Stage | Key Devices | Traditional Technology | Emerging Technology |
|---|---|---|---|
| Protection | eFuses, hot-swap controllers | | |
| Rack-Level DC-DC (800V→48V/12V/6V) | High-voltage GaN HEMTs (650V) | Si IGBTs /MOSFETs | GaN HEMTs (all-GaN platforms) |
| Intermediate Bus (48V→12V) | Medium-voltage MOSFETs | Si MOSFETs | GaN FETs, advanced Si |
| VRM /Point-of-Load | Sub-100V MOSFETs, multi-phase controllers | Si MOSFETs (lateral) | Si/GaN MOSFETs (vertical) |
| Vertical Power Modules | Integrated power modules | N/A (new category) | Custom vertical modules |

Source: J.P. Morgan, company reports.

## Power path protection at every node

Power path protection refers to the semiconductor devices that monitor, control, and protect every node in the power delivery chain against overcurrent, overvoltage, reverse polarity, and short-circuit faults. The core devices include:

- **eFuses**: electronic fuses that can be reset and precisely programmed for current limits, replacing slow-blow physical fuses
- **hot-swap controllers:** which allow boards, PSUs, or entire rack modules to be inserted or removed under live power without arcing or inrush damage
- **Ancillary protection IC**s such as TVS diodes, ideal diode controllers, and current-sense amplifiers.

**Protection is distributed across the entire chain**

- **From grid to rack,** hot-swap controllers and eFuses protect PSU bays, battery modules, and PDU branches.
- **Inside the rack**, eFuses sit on server boards protecting individual 12V or 48V rails feeding GPUs, memory, and networking ASICs, while hot-swap controllers manage the insertion of compute trays and power shelves.

Figure 19: Power path protection from Grid to Rack



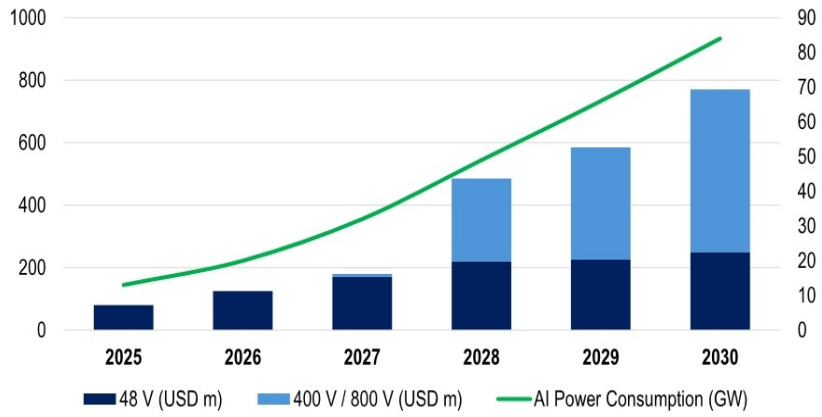

Source: Nvidia.

**Semiconductor content**

As rack power climbs toward 100 kW+ and voltages move to 800V DC, the protection requirements become more demanding: higher voltage ratings, faster response times, and higher current handling, all of which increase the semiconductor content and ASP per protection point. More power per rack means more points of failure, more modules that need to be hot-swappable for uptime, and tighter fault containment requirements. Every additional PSU slot, GPU tray, or BESS module in the architecture adds another set of protection devices. Infineon estimates a $800m SAM for AI power protection by 2030.

**Key players:** Analog Devices (Maxim) leads with LTC4282/LTC4286 hot-swap controllers rated for high-power 48V applications, Texas Instruments offers TPS2660x eFuses and INA series precision current-sense amplifiers, Infineon provides PROFET smart high-side switches and BTS series protection ICs, onsemi supplies NIS/NIF series load switches and eFuses, and Monolithic Power is gaining traction with integrated hot-swap modules combining FET and controller in a single package.

Figure 20: SAM AI Protection according to Infineon (USD m right-axis) and AI Power Consumption (GW)




Source: Infineon Technologies.

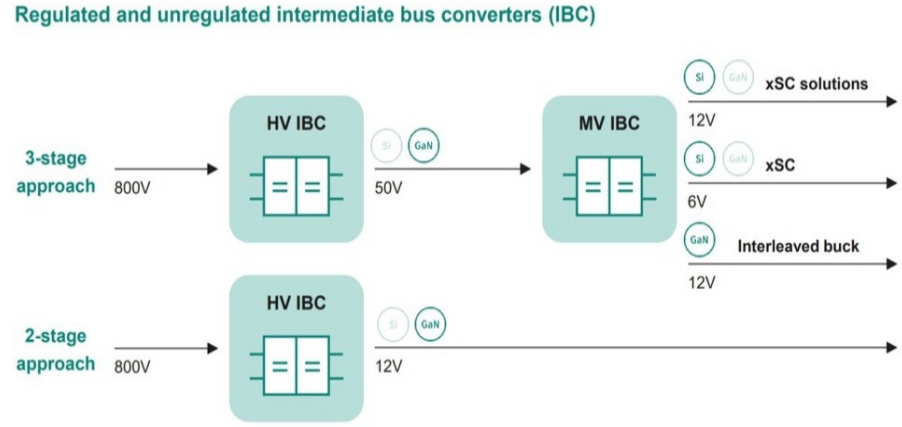
## Intermediate bus conversion stage (DC-DC 800V -> 48V/12V/6V)

**The intermediate bus DC-DC stage has variant architectures**

The intermediate bus conversion stage is here to step 800V down to an intermediate voltage (12V or as low as 6V) that the VRM can then convert to the sub-1V levels the GPU requires. There are two competing architectures:

- **Two-stage:** 800V → 48V (rack-level converter, using 650V GaN HEMTs) → 12/6V (IBC, using lower-voltage MOSFETs). This is the nearer-term approach.
- **Single-stage:** 800V → 6V directly, eliminating the 48V bus (e.g. Navitas's all-GaN board using 16 × 650V GaN FETs). This is the most aggressive architecture

Figure 21: Rack-level DC-DC converter options




Source: Infineon Technologies.

Navitas Semiconductor's all-GaN 800V-to-50V platform achieves 98.5% peak efficiency using high-voltage 650V GaN HEMTs. Their even more aggressive 800V-to-6V power delivery board eliminates the 48V intermediate bus altogether, using 16 × 650V GaNFast FETs in a stacked full-bridge configuration on the primary side and 25V silicon MOSFETs, achieving 96.5% peak efficiency at 1 MHz switching frequency and a power density of 2,100 W/in³ .

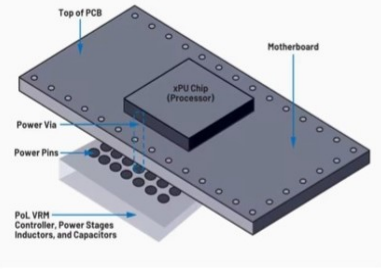
**Semiconductor content**

In a two-stage architecture, the heavy lifting is split between the high voltage 800V-to-48V converter and a mid-voltage 48V-to-12V/6V converter. In a single-stage architecture, the intermediate converter does more work (800V-to-12V/6V). High-voltage 650V+ GaN HEMTs are the main device at this stage and many players seek to enter this market.

**Key players:** Infineon (OptiMOS and CoolGaN portfolios), Texas Instruments (controllers, gate drivers, power stages for IBC), Analog Devices (IBC modules), Monolithic Power Systems, Vicor (factorized power module bus converters, pure play in IBC modules), Navitas (GaN). The shift to 800V architecture favors players on GaN (Infineon, Innosicence, Navitas, onsemi, Rohm).

## VRM /Point-of-Load (POL)

Figure 22: VRM vertically attached




Source: Analog Devices

The final conversion stage sits on or immediately adjacent to the processor. The **Voltage Regulator Module (VRM)** takes the intermediate bus voltage (12V, or 6V) converts it down to the sub-1V levels required by GPU and CPU cores. This is the most demanding conversion because the VRM must deliver hundreds/thousands, of amps at extremely low voltages, with nanosecond-level response to cope with the rapid load swings of GPU compute cycles.

The VRM is built as a multi-phase array with each phase consisting of a high-side and low-side MOSFET pair (the power stage) controlled by a digital multi-phase controller IC. The number of phases scales directly with total current demand: more phases allow the current to be shared across more devices, improving thermal distribution and response.

**Semiconductor content**

VRM is constructed from sub-100V MOSFETs, typically integrated into DrMOS / Smart Power Stages (SPS), which are now in extremely high demand for AI servers, creating significant incremental demand for sub-100V MOSFETs**. VRM/ POL are seeing a change in the way they are connected to the processors transitioning from lateral to vertical delivery which increases semiconductor content**. Additionally, rising core currents per GPU should be a tailwind for semi content.

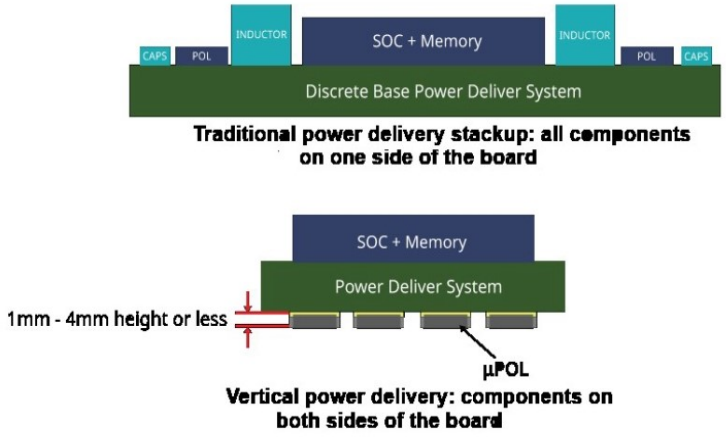
**Key players:** Infineon is a leading supplier of both point-of-load voltage regulators and power stages to all major GPU makers and hyperscalers. MPS (Monolithic Power Systems) is a key competitor, particularly strong in integrated power stage modules and digital controllers, and has been gaining share in high-end GPU VRM sockets. Renesas is also well-positioned through its portfolio of digital multi-phase controllers and smart power stages. nsemi offers FDMF5xxx DrMOS stages, Alpha Omega Semiconductor provides dual-side-cooled AOZ5xxx DrMOS for improved thermals, and Vicor

differentiates with its Factorized Power Architecture current multiplier mounted directly on the GPU package/interposer, eliminating PCB parasitics entirely.

## From Lateral to Vertical Power Delivery

VRM /POL are seeing a **transition from lateral to vertical power delivery at the processor level.**

Figure 23: Lateral vs. Vertical Power Delivery

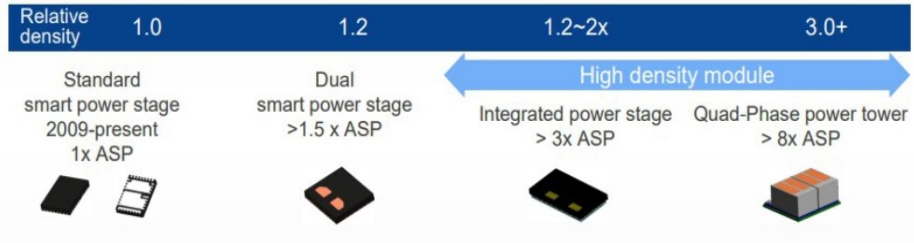



Source: TDK, Infineon, Power ElectronicTips.

- **In a lateral architecture**, power is distributed across the motherboard plane before being routed to the GPU/CPU from the side. As processor power draws have escalated into the hundreds of watts and beyond, the resistive losses and voltage drop in the PCB traces between the VRM and the processor become significant and limits how much power can be delivered cleanly.
- **Vertical power delivery** addresses this by placing the power conversion stage directly beneath the processor, delivering current through a very short vertical path. This requires switching huge power amounts and currents right next to the processor.

Vertical power modules have a much higher value content per rack compared to lateral solutions, and Infineon expects the share of vertical power in its business to increase over the coming quarters. The increase in ASP (3-4x) comes from module integration (which delivers better efficiency) rather than selling discrete products.

Figure 24: Modules solutions for AI power




Source: Renesas.

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## Powering CPUs

With the increasing intensity of CPUs in data centers, the CPU power market is gaining more traction. CPU players have commented on the ratio of CPUs to GPU could flip completely at the profit of CPUs, with up to 4 CPUs per GPU in agentic AI solutions. AI accelerator power content as being driven by very high power density per device and architectural shifts in power delivery, while CPU power content is driven more by rising socket power, core counts, and the growing role of CPUs in inference /agentic AI orchestration.

Table 5: GPUs/Accelerators power content vs CPU power content

| | AI Accelerators/GPUs | CPUs |
|---|---|---|
| Power driver | Very high wattage per accelerator and dense rack configurations | Rising CPU socket power and increasing core counts |
| Architectural implications | Moving toward vertical power delivery, higher-current deliver close to the processor, and new rack-level architectures | More traditional server CPU power management but scaling with higher core counts and CPU share in AI systems |
| Content indications | Infineon indicates $100-$250 of content per kW, with vertical power delivery towards the higher end of the range | Infineon indicated $50 of content per CPU, proportional to number of cores |

Source: J.P. Morgan, company reports.

## Semiconductor Content (Inside the Rack)

**Economies of scale and efficiency may work against semi-content increase**

The relevant metric is not semiconductor content per rack but content per GW delivered to compute because racks are getting dramatically larger (from 20 kW to 1 MW+), and the architectural thrust is to eliminate conversion stages and consolidate power delivery. Semiconductor content per kW tends to become more efficient as systems get larger because **power electronics has natural economies of scale.** A single 100 kW power stage does not require 10× the silicon of a 10 kW power stage. Control ICs, gate drivers, protection circuits, and monitoring functions do not scale linearly per conversion stage. At higher power levels you typically need more phases /more parallel power stages, each with its own gate driver and often its own current-sense and telemetry, but the controller remains fixed. Higher-rated power devices (a single SiC MOSFET rated for higher current) are more cost-effective per amp than many parallel smaller devices. PSUs disappear as AC-DC conversion moves upstream. Fewer conversion stages and larger, more efficient converters should yield economies of scale that limit semiconductor expansion on a per-watt basis.

**However new technologies and architecture increase semiconductor content for efficiency**

Working against this, however, are three forces: the transition from silicon MOSFETs to higher-ASP GaN HEMTs in the intermediate bus converter, more current cores per CPU/GPU implying higher content, and the emerging shift toward vertical power delivery (where voltage regulation is integrated into the processor package or interposer), which introduces new, high-value semiconductor content at the die level. All major power semiconductor players (Infineon, STMicroelectronics, onsemi, Navitas, Texas Instruments, Rohm) are guiding towards increasing content per GW of AI compute deployed. Whether this materialises depends on the balance between architectural simplification (fewer stages, economies of scale) and device-level value uplift (wider bandgap, higher ASP, vertical integration).

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# Sizing the AI Power Semis Market

Overall, we see the AI power semi market expanding towards a $16bn market in 2028 with upside to go as high as $20bn+ driven by strong demand for AI compute capacity and expanding semiconductor content. Our base case forecast equates to 3-year CAGR growth of ~82% from an estimated market size of $2.7bn in 2025.

**The JPM AI server model feeds into our sizing the AI power semis market**

Based on JPMorgan's forecasted AI accelerator volumes into 2028 (J.P. Morgan AI Server Model), we see a total AI data center capacity addition of up to ~80GW in 2028 (vs. ~60GW in 2027). This breaks down into ~63GW of greenfield capacity and ~18GW of capacity replacement.

Table 6: New AI Data Center capacity installation forecast

| AI server power | 2022 | 2023 | 2024 | 2025 | 2026E | 2027E | 2028E |
|---|---|---|---|---|---|---|---|
| **AI accelerators volumes** | | | | | | | |
| Nvidia | 775 | 1,911 | 4,500 | 5,500 | 7,425 | 8,910 | 9,801 |
| Nvidia - CPX | | | | | | 633 | 833 |
| Nvidia - LPU | | | | | 300 | 1,500 | 2,000 |
| AMD | 25 | 20 | 450 | 650 | 700 | 800 | 900 |
| **Total high-end datacenter AI GPU volumes (k)** | **800** | **1,931** | **4,950** | **6,150** | **8,425** | **11,843** | **13,534** |
| **ASIC AI chip volume (k)** | **1,353** | **1,701** | **2,865** | **4,170** | **7,620** | **12,250** | **14,700** |
| **AI chip power consumption (Watt)** | | | | | | | |
| Nvidia | 400 | 505 | 739 | 1,103 | 1,553 | 2,214 | 2,532 |
| Nvidia - CPX | | | | | | 1,200 | 1,200 |
| Nvidia - LPU | | | | | 750 | 750 | 750 |
| AMD | 560 | 750 | 750 | 875 | 1,650 | 2,588 | 3,234 |
| **high-end data center GPU** | **405** | **508** | **740** | **1,078** | **1,532** | **1,999** | **2,233** |
| **ASIC** | **150** | **200** | **300** | **500** | **800** | **1,200** | **1,600** |
| **Total AI silicon power consumption (MW)** | | | | | | | |
| Nvidia | 310 | 965 | 3,326 | 6,064 | 11,531 | 19,722 | 24,815 |
| Nvidia - CPX | | | | | | 759 | 1,000 |
| Nvidia - LPU | | | | | 225 | 1,125 | 1,500 |
| AMD | 14 | 15 | 338 | 569 | 1,155 | 2,070 | 2,911 |
| **high-end data center AI GPU** | **324** | **980** | **3,663** | **6,633** | **12,911** | **23,676** | **30,226** |
| **ASIC** | **203** | **340** | **860** | **2,085** | **6,096** | **14,700** | **23,520** |
| **Total AI silicon power consumption (MW)** | **527** | **1,320** | **4,523** | **8,718** | **19,007** | **38,376** | **53,746** |
| **Total AI IT equipment power (MW)** | | | | | | | |
| High end datacenter AI GPU server | 36% | 40% | 50% | 65% | 70% | 72% | 76% |
| ASIC AI server | 25% | 33% | 40% | 45% | 60% | 66% | 72% |
| Networking power consumption % of total IT equipment | 5% | 5% | 5% | 5% | 5% | 5% | 5% |
| **Implied High end GPU IT power draw** | **947** | **2,579** | **7,712** | **10,741** | **19,415** | **34,615** | **41,864** |
| **Implied IT ASIC AI IT power draw** | **854** | **1,085** | **2,262** | **4,877** | **10,695** | **23,445** | **34,386** |
| **Total IT equipment power new addition (MW)** | **1,802** | **3,664** | **9,973** | **15,618** | **30,110** | **58,060** | **76,250** |
| **Total New Power Installed at the Datacenter (MW)** | | | | | | | |
| PUE factor assumption | 1.20 | 1.18 | 1.13 | 1.10 | 1.07 | 1.06 | 1.06 |
| **high-end data center AI GPU** | **1,137** | **3,033** | **8,706** | **11,763** | **20,836** | **36,777** | **44,478** |
| **ASIC** | **1,025** | **1,276** | **2,554** | **5,341** | **11,477** | **24,909** | **36,534** |
| **Data center capacity installed (MW)** | **2,162** | **4,309** | **11,260** | **17,104** | **32,314** | **61,686** | **81,012** |

Source: J.P. Morgan AI Server Model, J.P. Morgan Data Center Power and Cooling Model, Company reports.

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### Semiconductor content per GW of power

Infineon has indicated that its current semiconductor content per kW of AI power currently stands at ~$175 and should rise with future architectures and technologies (HVDC 800V, vertical power etc.). The company has guided for content to be in the range of $100-250 per kW of compute (excluding SST contribution) in 2030 depending on architecture (with customers using vertical power delivery should be at the higher end of that range).

Table 7: AI power semiconductor market

| AI power semi market | 2022 | 2023 | 2024 | 2025 | 2026E | 2027E | 2028E |
|---|---|---|---|---|---|---|---|
| **AI DC New Power Installed** | | | | | | | |
| of which expansion | 2,162 | 4,309 | 11,260 | 17,104 | 30,151 | 55,214 | 63,281 |
| of which replacement | 0 | 0 | 0 | 0 | 2,162 | 6,472 | 17,731 |
| replacement as % of new power installed | 0% | 0% | 0% | 0% | 7% | 10% | 22% |
| **New AI power installed** | **2,162** | **4,309** | **11,260** | **17,104** | **32,314** | **61,686** | **81,012** |
| **Semiconductor content per MW** | | | | | | | |
| Semi content for new capacity ($k/MW) | | | | 160 | 180 | 230 | 260 |
| Semi content for replaced capacity ($k/MW) | | | | 96 | 108 | 138 | 156 |
| **Average semi content ($k/MW)** | | | | **160** | **175** | **220** | **237** |
| **Semiconductor market ($m)** | | | | **2,737** | **5,661** | **13,592** | **19,219** |

Source: J.P. Morgan estimates.

We assume semiconductor content could go to ~$260 per kW given that i) a widespread adoption of vertical power delivery modules should occur given proven higher efficiency, ii) SST and SSCB adoption with high semiconductor content (SiC) should start in 2028, iii) Battery racks could emerge to replace power rack sidecar, iv) GaN adoption with higher ASP, and v) higher CPU attach per AI accelerators which also draws power. We note this is at the higher end of Infineon's communicated range of $100 to $250 content per kW but we highlight that Infineon's range neither includes CPU content (which is becoming a key market) nor SST/SSCB content which is currently $0 of content (although some of the current PSU content gets displaced inside SST in the long run).

Table 8: AI power semiconductor market size - sensitivity analysis

| | | New AI Data Center Capacity Installed/Refreshed (GW) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 |
| Semiconductor content per GW ($M) | 175 | 7.0 | 7.9 | 8.8 | 9.6 | 10.5 | 11.4 | 12.3 | 13.1 | 14.0 | 14.9 | 15.8 |
| | 200 | 8.0 | 9.0 | 10.0 | 11.0 | 12.0 | 13.0 | 14.0 | 15.0 | 16.0 | 17.0 | 18.0 |
| | 225 | 9.0 | 10.1 | 11.3 | 12.4 | 13.5 | 14.6 | 15.8 | 16.9 | 18.0 | 19.1 | 20.3 |
| | 250 | 10.0 | 11.3 | 12.5 | 13.8 | 15.0 | 16.3 | 17.5 | 18.8 | 20.0 | 21.3 | 22.5 |
| | 275 | 11.0 | 12.4 | 13.8 | 15.1 | 16.5 | 17.9 | 19.3 | 20.6 | 22.0 | 23.4 | 24.8 |
| | 300 | 12.0 | 13.5 | 15.0 | 16.5 | 18.0 | 19.5 | 21.0 | 22.5 | 24.0 | 25.5 | 27.0 |
| | 325 | 13.0 | 14.6 | 16.3 | 17.9 | 19.5 | 21.1 | 22.8 | 24.4 | 26.0 | 27.6 | 29.3 |

Source: J.P. Morgan estimates.

Overall, we see the AI power semi market expanding towards a $16bn market in 2028 with upside to go as high as $20bn+ driven by strong demand for AI compute capacity and expanding semiconductor content.

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### Forecast by material

For high-voltage applications, we expect **SiC** to be the preferred material at higher voltages. SiC is better at high voltages primarily because it has a much higher critical electric field than silicon. That means a SiC device can block a given voltage with a much thinner and more heavily doped drift region, which sharply reduces resistance and losses. **Si** should continue to complement SiC in controllers, gate drivers, sensing, protection, and other adjacent ICs that support the broader power-delivery architecture.

**GaN** is expected to gain traction in **Stage 1**, where 800V is stepped down to lower voltages. 650V GaN HEMTs are becoming increasingly attractive because they offer very fast switching, low gate charge, and low output capacitance. GaN could also see selective adoption in **Stage 2**, where power-density requirements are important. However, we expect **Si** to remain the dominant material in Stage 2 given its strong cost/ performance profile at lower-voltage, high-current conversion.

Table 9: Semiconductor content estimates by functions in the AI power delivery

| 1GW content ($m) | Today | mid term | long term | Material |
|---|---|---|---|---|
| Facility level | 0 | 5 | 40 | SiC, Si |
| 800V Protection | 0 | 10 | 10 | SiC, Si |
| PSU | 40 | 35 | 0 | SiC, Si, GaN |
| BBU | 24 | 25 | 30 | SiC, Si, GaN |
| DC-DC step down | 27 | 40 | 50 | GaN, Si |
| VRM/PoL | 64 | 100 | 120 | Si, GaN |
| NICs | 14 | 15 | 15 | Si |
| hot swap/eFuses | 13 | 15 | 20 | Si |
| **Total** | **182** | **245** | **285** | |

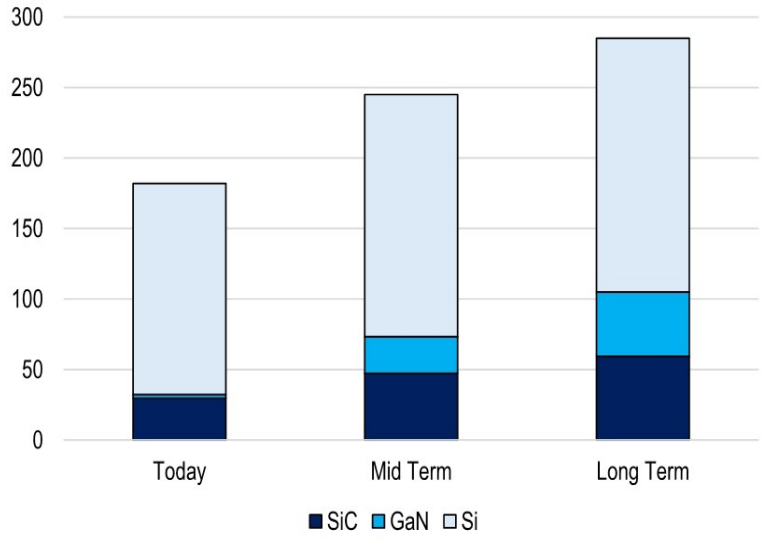
Source: J.P. Morgan estimates.

Table 10: Semiconductor content by material

| $m/GW | Today | Mid Term | Long Term |
|---|---|---|---|
| SiC | 30 | 47 | 60 |
| GaN | 3 | 26 | 46 |
| Si | 150 | 172 | 180 |
| **Total** | **182** | **245** | **285** |
| SiC | 16% | 19% | 21% |
| GaN | 1% | 11% | 16% |
| Si | 82% | 70% | 63% |

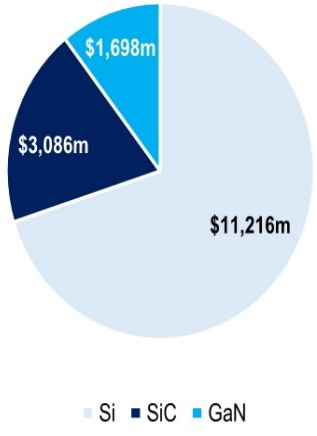
Source: J.P. Morgan estimates.

Figure 25: Semiconductor content evolution by material.




Source: J.P. Morgan estimates.

Figure 26: Estimated market size in 2028 by material.




Source: J.P. Morgan estimates.

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# Power Semiconductor Components

## Wide bandgap materials

Every power semiconductor device performs the same function: it acts as an electronic switch, turning current on and off at high speed to convert power from one voltage/ frequency to another. The key performance parameters of a power switch are its **breakdown voltage** (how much voltage it can block when off), its **on-resistance** (how much energy it wastes as heat when on), its **switching speed** (how fast it can transition between on and off) and its **thermal conductivity** (how well it dissipates the heat it generates). These parameters are primarily determined by the semiconductor material, which encompasses silicon (Si), silicon carbide (SiC) and gallium nitride (GaN).

Table 11: Power semi materials properties

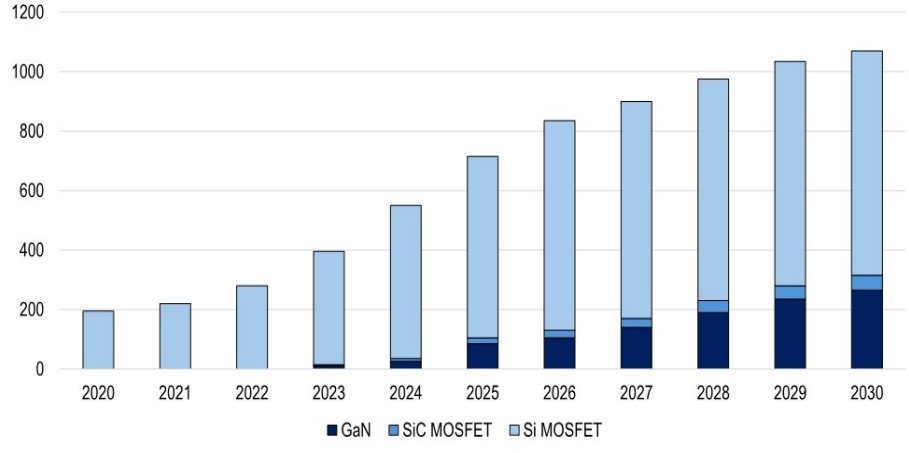
| Property | Silicon (Si) | Silicon Carbide (SiC) | Gallium Nitride (GaN) |
|---|---|---|---|
| Bandgap (eV) | 1.1 | 3.3 | 3.4 |
| Breakdown field (MV/cm) | 0.3 | 3.0 | 3.3 |
| Thermal conductivity (W/ cm.K) | 1.5 | 4.9 | 1.3 |
| Electron mobility | Moderate | Moderate | Very High |
| Switching speed | Moderate | Fast | Very Fast |
| Maturity | 50+ years | ~10 years commercial | few years commercial |

Source: J.P. Morgan, company reports.

The bandgap and breakdown field determine how thin the device can be for a given voltage rating: wider bandgap materials can block more voltage in a thinner layer, which directly reduces on-resistance and switching losses. This is why SiC and GaN are called **"wide bandgap" (WBG) materials** and why they are **fundamentally superior to silicon for power conversion**.

- **SiC** has the advantage of excellent thermal conductivity (3x silicon), making it **ideal for high-power, high-temperature applications** where heat removal is challenging.
- **GaN** has the advantage of very high electron mobility, enabling extremely fast switching, which is **critical for high-frequency applications** where smaller passives and higher power density are the goal.

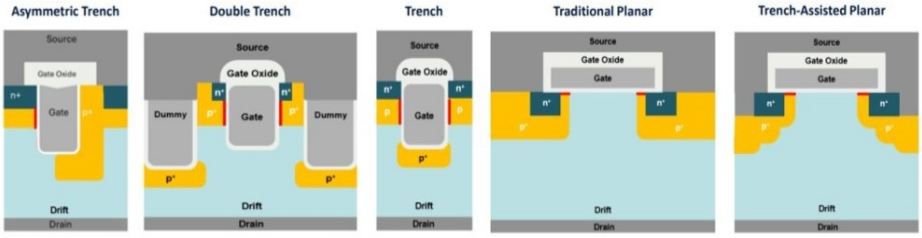
Figure 27: Data center power device market (USD m, split by device)




Source: Yole Group.

## MOSFET - Planar vs Trench

Figure 28: Cross-sectional view of various SiC MOSFET designs




Source: Navitas Semiconductor.

- **Planar:** The gate sits flat on the silicon surface. Current flows laterally then down. Simple to manufacture but wastes space. There is a parasitic resistance (JFET region) between cells that limits how tightly they can be packed.
- **Trench:** The gate is etched vertically into the silicon. Current flows straight down the trench walls. This eliminates the JFET resistance and enables cells to be packed densely: so for the same chip area, there is lower resistance and better performance.

Overall, planar are easier to make (better yields more quickly) but achieves worse performance per unit area and increase power loss (heating) which is not satisfactory for AI infrastructure. Trench designs achieve better performance and lower resistance but are harder to manufacture with initial yields thus lower.

- **Infineon** has adopted an asymmetric trench (CoolSiC) design with only one side of the trench to protect the oxide layer. They have been in volume production for several years and thus likely achieve high yields with thus better gross margin.
- **Navitas** has adopted a trench-assisted planar design which seeks to keep the manufacturing simplicity of planar while achieving trench-like performance.
- **Rohm** is using a double trench structure, which arguably provides the most efficient performance but likely at lower yields.

## Main power semiconductor devices

Table 12: Power infrastructure component stack

| Component | Function | Technology Trend | Voltage/Application | Key Suppliers |
|---|---|---|---|---|
| **Si MOSFET** | Low-voltage switching (VRM / POL) | Rising phase counts; supply tightness from AI | <100V; AI server VRM | Infineon, onsemi, MPS, Renesas |
| **Si IGBT** | High-voltage switching (legacy grid, inverters) | Declining share; being replaced by SiC | 600V-6,500V; grid, drivers, UPS | Infineon, STM, Mitsubishi, Fuji |
| **SiC MOSFET** | High-voltage, high-power switching | 150mm -> 200mm wafer transition, cost reduction | 650V-3,300V; EV, grid, DC, front-end | STM, Infineon, Wolfspeed, Onsemi, Rohm |
| **GaN HEMT** | High-frequency, moderate-voltage switching | GaN-on-Si, steepest cost curve, Infineon 300mm capacity | 100V-650V; DC-DC, PSU, OBC | Infineon, Navitas, EPC, onsemi, Innoscience |
| **Gate Driver** | Controls power switch on/off | Match switch technology; speed critical for GaN | All stages | Infineon, TI, STM, onsemi, ADI, Renesas |
| **Multi-Phase Controller** | Orchestrated VRM phases | Phase count rising with GPU power | VRM /POL | Infineon, MPS, Renesas, ADI, TI |
| **Power modules/integrated power stages** | Integrated version of MOSFETs, gate drivers and controllers | Higher current density and better thermal packaging | VRM/POL | MPS, Infineon, Renesas, onsemi, TI, ADI |
| **Protection/Monitoring ICs** | Protection and monitoring | More digital telemetry | All stages | ADI, TI, MPS, Infineon, onsemi, Renesas, Microchip |

Source: J.P. Morgan, company reports.

**Silicon MOSFET**

Si MOSFETs are the main power semiconductor in the industry. These are voltage-controlled switches that use a gate electrode to modulate current flow through a silicon channel. They are typically used from ~20V to ~600V. Below 200V, Si MOSFETs are hard to beat on cost and performance. Above 600-V, their on-resistance rises steeply and they lose competitiveness to IGBTs or SiC.

**Applications in AI power**: The VRM /PoL stage in AI servers. Sub-100V MOSFETs are deployed in multi-phase arrays (8-32+ phases) delivering hundreds to thousands of amps at sub-1V to the GPU. This is Infineon's largest AI exposure. Infineon described the sub-100V MOSFET market as previously worth €6-7bn, now seeing significant incremental demand from AI.

**Silicon IGBT**

Si IGBTs are hybrid devices combining the gate drive simplicity of a MOSFET with the current-carrying capability of a bipolar transistor. It was the dominant device for high-voltage, high-power applications from the 1990s through the 2010s. They are typically used for applications in 600V-6,500V. IGBTs dominate in applications above ~600V where silicon MOSFETs become impractical due to high on-resistance, but below the voltage levels where thyristors are used. **IGBTs are declining in strategic importance for Infineon and STM due to pricing pressures from Chinese competition.** Infineon is actively reducing exposure to "less differentiated silicon-based high-power parts" and converting IGBT fab capacity to MOSFETs for AI.

**Applications in AI power:** Legacy grid infrastructure such as HVDC converter valves, wind and solar inverters, large industrial drives, railway traction, and UPS systems. IGBTs remain the incumbent technology for many high-power applications, particularly where cost is the primary driver. They also still feature in grid-scale BESS power conversion systems

**SiC MOSFETs**

These are MOSFETs fabricated on a silicon carbide substrate instead of silicon. The wider bandgap (3.3 eV vs. 1.1 eV) and higher breakdown field (~10x silicon) allow SiC MOSFETs to block higher voltages with dramatically lower on-resistance and switching losses than silicon IGBTs. They are typically used in voltages between 650V and 3,300V with a sweet spot at 1,200V (dominant rating for EV traction inverters, grid infrastructure, and industrial applications).

**Applications in AI power:** i) HVDC converter valves, solid-state transformers, grid-forming inverters, BESS power conversion systems, solid-state circuit breakers. Infineon highlighted SiC modules as optimally positioned for grid upgrades, and described engagement in dozens of customer projects in solid-state transformers. ii) Centralised AC-DC rectifiers in 800V HVDC architectures use SiC MOSFETs for higher-efficiency conversion.

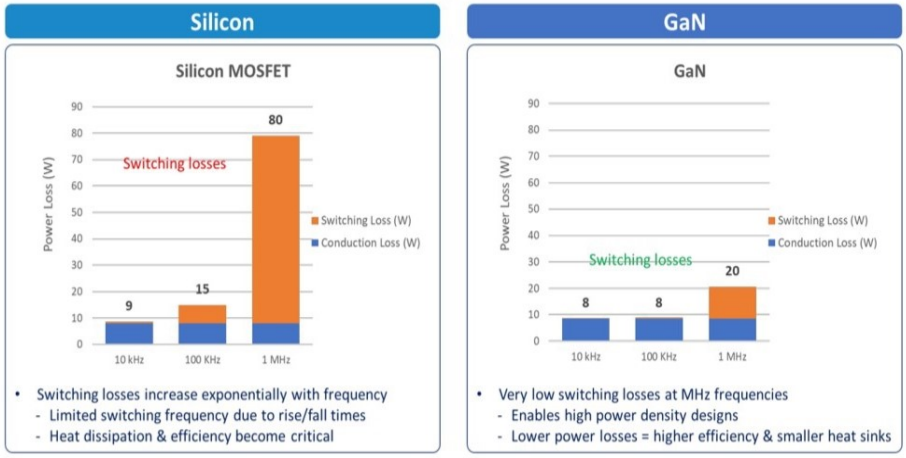
**GaN HEMT (High-Electron Mobility Transistor)**

GaN HEMTs are lateral devices fabricated by growing a thin GaN layer on top of a silicon (or SiC) carrier wafer. The very high electron mobility in the GaN channel enables switching speeds far beyond what silicon or SiC can achieve, allowing

operation at MHz frequencies versus the ~100 kHz typical of silicon or SiC devices. It is currently most mature at 100V-650V (650V relevant for 800V bus DC-DC conversion).

**Applications in AI power**: i) Rack-level DC-DC conversion in 800V HVDC data centers which is the highest growth application, ii) AC-DC front-end PSU primary-side switching and iii) Point-of-Load Converters (PoL) because high-frequency switching allows for faster response times to the sudden massive power surges required by AI workloads.

Figure 29: GaN efficiency at MHz switching frequencies




Source: Navitas

## Beyond the switch: other components

Power switches (MOSFETs, IGBTs, SiC, GaN) are the highest-value active components, but a power conversion stage also requires several supporting components

### Gate Drivers

Every power switch requires a gate driver IC which is a small circuit that translates the low-voltage digital control signal into the high-current pulse needed to turn the switch on and off. Gate drivers must be precisely matched to the switch technology (Si, SiC, or GaN gate drive requirements differ significantly). As power stages get faster (GaN at MHz frequencies), the gate driver becomes more critical. Gate drivers are typically low-ASP ($0.50–3.00 per device) but are required in high volume (one per switch or per phase).

### Digital Multi-Phase Controllers

The VRM in an AI server requires a digital controller IC that orchestrates the switching of all phases (8–32+), manages load-line regulation, implements current balancing, and communicates with the processor's power management interface. These are highly specialized, proprietary-designed ICs with significant IP content.

### Integrated power stages/modules

Integrated power stages and modules are co-packaged power devices that combine the power switch, gate driver, and often current or temperature sensing in one package. This includes DrMOS, smart power stages, power blocks, and integrated regulator modules. The technology trend is toward higher current density, better thermal packaging, lower

losses, faster transient response, and more integration around sensing and control. In AI power, these devices are used in high-current multiphase VRMs and point-of-load stages that feed GPUs, CPUs, AI ASICs, HBM, and accelerator boards from 12V or 48V intermediate rails.

**Protection/monitoring ICs**

Control and sensing devices that protect high-current power rails and give system operators visibility into power behavior. This category includes hot-swap controllers, eFuses, ideal-diode controllers, current-sense amplifiers, power monitors, sequencers, and telemetry ICs.

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# AI is driving better power MOSFET pricing

## AI has pushed power discrete suppliers into allocation

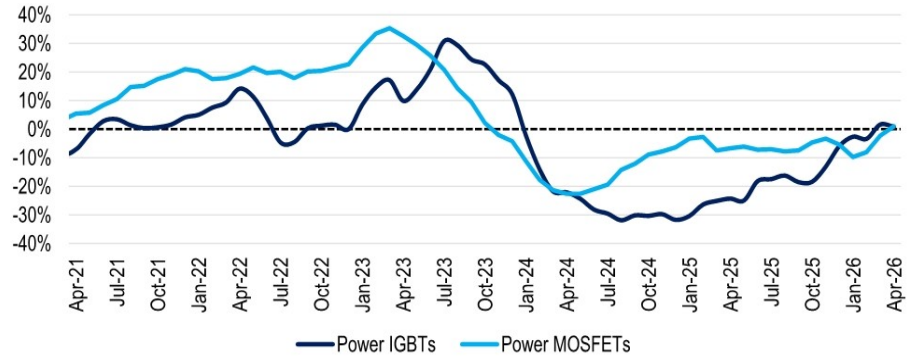
The clearest signal that AI is driving a broader pricing reset comes from Infineon. Management stated explicitly that the AI power business is 'in allocation' (i.e. demand strongly exceeds supply) and that the company is redirecting capacity from weaker segments (notably high-voltage e-mobility) into AI. ON Semiconductor echoes this, saying certain power technologies are already on allocation and lead times have stretched from 23 to ~26 weeks. This is the precondition for a broader halo effect: capacity is tight, and AI is the priority customer.

## Strong players moving to price-leading stance

- **Infineon:** Management stated that customers have been informed of price increases effective from April 1st, specifically in supply-constrained areas, and signaled that pricing dynamics will improve as the upcycle broadens beyond AI. At our TMT Conference in London, Infineon has also indicated that further increases would come where market conditions allow. The company highlighted that its MOSFET capacity is now a scarce asset and would take a price-leading stance as a result.
- **ON Semiconductor**: The pricing environment entering 2026 was "better than anticipated." ON is passing through commodity and energy cost increases across the board, with surgical price increases concentrated in fully constrained technologies. Management said the margin impact of these price actions will show up in H2 2026, implying a second leg of pricing realization is still ahead. ON also flagged the AI halo effect spreading into adjacent infrastructure (energy storage, micro-grids).
- **Texas Instruments:** Pricing was flat sequentially and y/y, versus TI's normal model of low-single-digit declines. Management explicitly said that "if demand remains strong, prices may go up in the second half of the year," evaluated case-by-case.
- **Analog Devices:** ADI raised prices in 2026 to absorb inflationary costs and explicitly guided that pricing actions would add a couple of points to full-year 2026 growth. Management stressed that price increases are "very sticky" given long product lifecycles and locked-in design wins, and signaled a willingness to make further price adjustments if cost pressures persist.

Based on WSTS data, Power MOSFETs pricing has stabilized and even started increasing in April 2026 (+3% YoY) and we expect better pricing dynamics to continue.

Figure 30: Power semis ASP (3MMA, YoY)




Source: WSTS Data updated to April 2026.

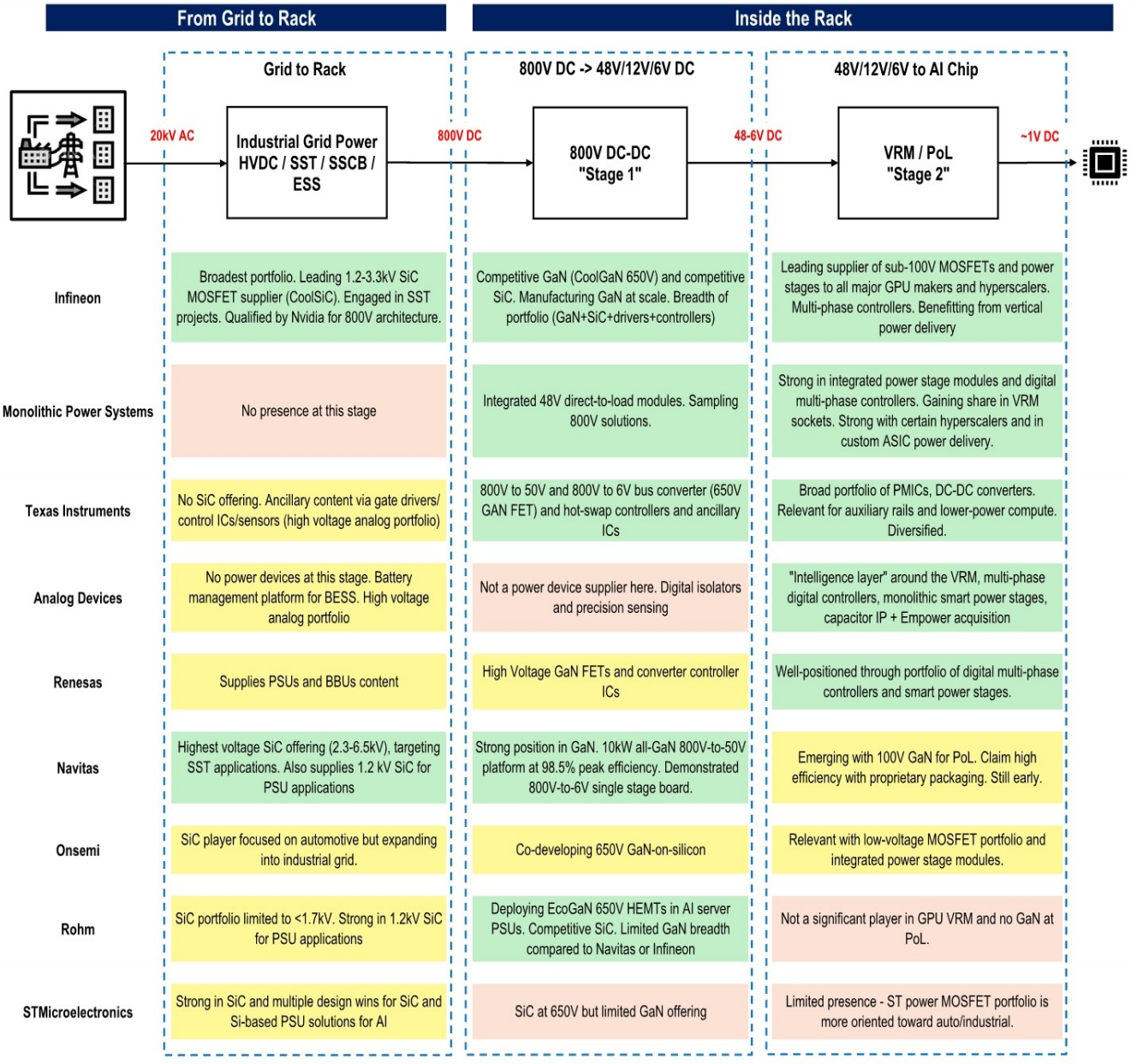
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# Key players

**Figure 31: AI power semiconductor competitive landscape**




Source: J.P. Morgan, company reports.

## Competitive dynamics

### From Grid to Rack

The market is dominated by the wide-bandgap players. Infineon holds the broadest portfolio (SiC at 1.2–3.3 kV, GaN at 650V, plus gate drivers, isolators, and sensing), is qualified by Nvidia for the 800V architecture, and is engaged in dozens of SST customer projects. Onsemi is strong in SiC with vertically integrated supply chain and is gaining traction in grid infrastructure. Navitas is the purest challenger: it holds the highest-voltage SiC (2.3–6.5 kV for SST) but remains a smaller company with

execution risk. This stage is still early in the revenue ramp (800V HVDC inflection expected ~2027+), so market shares are not yet established and the battle is being fought through design wins and qualification today for revenue in 2027–28 at the earliest.

### Inside the Rack

The market is already large according to Gartner's data ($4.4bn in voltage regulators + $1.8bn in power transistors for computing in 2025). On the controller and integrated module side, MPS is the market leader (27% share) followed by TI (26%), with IFX (7%), ADI (6%), and Renesas (5%) gaining share at triple-digit rates, likely winning the new AI/GPU-specific VRM sockets. On discrete power transistors, IFX is the clear leader (26% share), followed by Alpha & Omega Semi (10%), Onsemi (9%), Toshiba (7%), and ROHM (4%). The industry is moving toward integrated power stage modules (controller + FETs in one package), where MPS has led but Infineon is aggressively expanding from its discrete MOSFET stronghold (as its 360%+ % YoY growth in the regulator category reflects).

Table 13: Power Transistors for the computing end market (Revenue in $m)

| Power Transistors for Computing ($m) | 2024 | 2025 | YoY | 24 Share | 25 Share | YoY |
|---|---|---|---|---|---|---|
| Infineon Technologies | 403 | 469 | 16% | 27% | 26% | -0.8 |
| Onsemi | 136 | 158 | 16% | 9% | 9% | -0.3 |
| Alpha and Omega Semiconductor | 169 | 176 | 4% | 11% | 10% | -1.5 |
| Toshiba | 81 | 121 | 49% | 5% | 7% | +1.4 |
| Diodes | 68 | 80 | 18% | 5% | 5% | -0.1 |
| Rohm | 67 | 71 | 6% | 5% | 4% | -0.5 |
| Texas Instruments | 37 | 48 | 30% | 2% | 3% | +0.2 |
| Other | 522 | 653 | 25% | 35% | 37% | +1.6 |
| **Total** | **1,483** | **1,776** | **20%** | **100%** | **100%** | **-** |

Source: Gartner.

Table 14: Voltage Regulators/Reference for the computing end market (Revenue in $m)

| Voltage Reg/Ref ($m) for Computing | 2024 | 2025 | YoY | 24 Share | 25 Share | YoY |
|---|---|---|---|---|---|---|
| Monolithic Power Systems | 1,063 | 1,206 | 13% | 34% | 27% | -6.9 |
| Texas Instruments | 798 | 1,146 | 44% | 26% | 26% | +0.3 |
| Infineon Technologies | 68 | 315 | 363% | 2% | 7% | +4.9 |
| Analog Devices | 102 | 255 | 150% | 3% | 6% | +2.5 |
| Renesas Electronics | 29 | 237 | 717% | 1% | 5% | +4.4 |
| Other | 1,048 | 1,259 | | 34% | 28% | -5.2 |
| **Total** | **3,108** | **4,418** | **42%** | **100%** | **100%** | **-** |

Source: Gartner.

Table 15: Data center exposure at selected analog semi players, CY2025 ($m)

| Compute applications | TXN | Infineon | Renesas | MPS | NXP | STMicro | ADI | Microchip | Onsemi | Alpha & Omega | Rohm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MCUs | 25 | 636 | 376 | 0 | 1,136 | 378 | 0 | 328 | 2 | 0 | 6 |
| Voltage Reg/Ref | 1,191 | 328 | 240 | 1,249 | 26 | 21 | 269 | 66 | 53 | 145 | 51 |
| Data Converter/Switch | 65 | 0 | 14 | 37 | 5 | 0 | 160 | 17 | 1 | 0 | 1 |
| Other analog | 439 | 90 | 79 | 0 | 25 | 3 | 110 | 40 | 7 | 26 | 47 |
| Discretes | 50 | 568 | 14 | 0 | 0 | 8 | 0 | 16 | 204 | 179 | 116 |
| Power Management | 504 | 0 | 355 | 121 | 0 | 160 | 32 | 47 | 6 | 0 | 19 |
| Wired Connectivity App spec | 32 | 17 | 160 | 0 | 28 | 47 | 0 | 252 | 4 | 0 | 0 |
| **Total Data Processing** | **2,763** | **1,900** | **1,614** | **1,447** | **1,264** | **757** | **669** | **926** | **365** | **350** | **291** |
| Total Revenue | 16,775 | 16,491 | 8,515 | 2,780 | 12,136 | 11,284 | 11,511 | 4,209 | 5,758 | 679 | 2,755 |
| Compute % of revenue | 13.1% | 11.0% | 17.8% | 49.5% | 10.4% | 5.9% | 5.5% | 14.9% | 6.2% | 51.5% | 9.1% |

Source: Gartner

## Infineon

Infineon is the most comprehensively positioned company for this theme. Its portfolio spans the entire power delivery chain (from AC-DC front-end through DC-DC intermediate bus to point-of-load VRM) and it is a direct supplier to all major GPU makers and hyperscalers. Additionally, Infineon is a significant player in grid infrastructure, benefitting as well from micro-grid demand and solid-state transformers and circuit breakers. The company says it is represented across almost all relevant AI platforms and emphasizes its breadth across silicon, SiC, GaN, packaging, modules, and system-level power expertise. Infineon's AI power revenue nearly tripled to more than €700m in FY2025, and management guides to €1.5bn in FY2026 and at least €2.5bn in FY2027. AI power sizing currently excludes the significant CPU power opportunity (€500m market already in FY25). The company's primary competitive moats lie in three areas: its dominance in sub-100V MOSFETs (the highest-volume, most critical device in the VRM), its early investment in GaN at manufacturing scale for DC-DC and front-end stages, and its system-level expertise in defining power architectures with customers, including helping set the emerging 800V delivery standard.

### Exposure and products

- **From grid to rack:** At the grid layer, Infineon is exposed through products for uninterruptible power systems (UPS), general power supply (solar+BESS), and commercial HVAC/cooling-related power electronics. In the 800V architecture at the grid layer, Infineon is targeting solid-state transformers, solid-state circuit breakers, large-scale energy storage, and grid upgrades using SiC and module. Infineon announced in November 25 collaboration with SolarEdge on next-generation solid-state transformer technology for AI and hyperscale data centers using advanced SiC for direct medium-voltage conversion.
- **Inside the rack:** At the rack level, Infineon is benefiting from the shift toward higher-density power architectures, including vertical power delivery. Infineon is also benefitting from widebandgap materials adoption in DC-DC conversion inside the data center (GaN).

### Company outlook and data points

Infineon stated that its AI-related revenue target of ~€1.5 billion for FY2026 is supply-limited, not demand-limited. The company is converting IGBT lines to leading-edge MOSFETs and ramping the Dresden Smart Power Fab specifically to relieve this

bottleneck. The company projects AI-related revenues of ~€2.5 billion in FY2027, a 10× expansion within three years. Management also cited €500mm of CPU power revenue (separate from AI power numbers) which is now expected to grow significantly with inference, reinforcement training and agentic all demanding more CPUs as well as the number of CPU cores rising.

Company has indicated current data center content at $175 per kW and has given an expected content range of $100-$250 going forward, with vertical power integration tracking towards the high end of that range. Infineon has an estimated 30%-40% market share in AI power.

## Monolithic Power

Monolithic Power Systems (MPS) is a fabless company providing high-performance power management solutions. In AI infrastructure, MPS is primarily positioned in Stage 2 (VRM/PoL) and Stage 1 (IBC) power across CPU, GPU, and ASIC sockets, with additional data-center exposure in rails and content such as DDR5, HDD, SSD, and switch power.The competitive moat is framed around a proprietary BCD (Bipolar CMOS-DMOS) process (licensed to foundries but usable for MPS wafers only) that enables monolithic integration where a single die can replace what would otherwise be roughly five chiplets, improving efficiency, density, and thermal behavior. The company has increased its '26 Enterprise Data growth forecast to 85% YoY vs 50% previously, signaling strong demand from data centers.

### Exposure and products

- **From grid to rack:** MPS is deliberately not positioned ahead of demand at the medium-voltage/grid layer and does not have known solid-state transformer exposure.
- **Inside the rack:** In the emerging 800V architecture, management frames wide-bandgap opportunities as concentrated in Stage 0 and Stage 1, while emphasizing that Stage 2 remains silicon, where MPS is strongest today. The company has been sampling 800V full-system and modular designs for about a year, but views Stage 0 as not yet a true market; qualification is expected to play out next year, with meaningful volume more 2028-weighted. Stage 1/2 is where MPS is the strongest and will take advantage of vertical power delivery where MPS sells high value modules. On wide-bandgap, MPS sells GaN today and integrates it with its broader device portfolio, but expresses lower conviction on GaN versus SiC and notes it does not have a proprietary GaN process, while it does have proprietary processes on Si and SiC.

### Company outlook and data points

MPS does not provide a standardized $/kW content figure, arguing that design variability across platforms makes a single metric less meaningful; instead, management points to module mix and vertical power delivery as the clearest drivers of content and value capture, given that modules run at roughly 3–4x the ASP of discretes. Strategically, management frames MPS as a diversified growth company with the data center as the largest tailwind across compute and communications, and incremental SAM expansion via switches, optical modules, DDR5, and PMIC.

Co. states the outlook is not capacity constrained, supported by the fabless model and 12–13 foundry partners, while reiterating that demand can move faster than supply and capacity cannot be instantly reallocated across the industry. Competition is described as narrow in Stage 2 but more crowded in the coming Stage 0, though management is skeptical many can deliver high-quality modules at scale.

## Renesas

Today, Renesas is most credible in Stage 2 (VRM/PoL) for CPU, GPU and ASIC sockets with digital multiphase controllers and smart power stages. The co has a growing Stage 1 (IBC /48V intermediate bus) module presence and adjacent rack content across DDR5 PMICs, SSD/HDD power, switch power and clock/timing. Portfolio breadth across power, PMIC, MCU, analog, connectivity and timing supports system-level co-engagement. Renesas has emerging wide-bandgap optionality through Transphorm GaN. The co. had indicated having $10-$12k of power content inside a 130kW rack in their CMD in 2025. Renesas's strength is in digital multi-phase controller IP (legacy Intersil), tight integration with Intel/AMD/Arm CPU roadmaps, the ability to deliver modules co-designed with customers, and a one-stop system pitch that bundles VRM + IBC + DDR5 PMIC + BMS + e-Fuse + GaN with proprietary test tools and performance-optimization software.

### Exposure and products

- **From grid to rack:** Renesas has limited direct exposure to the medium-voltage, grid and solid-state transformer layer following the discontinuation of its SiC activities in 2025. Renesas supplies PSUs with a $900-1,000 content and BBUs with ~$1,900 of content for current ~130kW racks and will grow its content with the sidecar racks for AC-DC and power supply.
- **Inside the rack:** In Stage 2 (VRM/PoL), Renesas is one of three credible incumbents alongside MPS and Infineon, supplying CPU, GPU and ASIC sockets across major silicon vendors and hyperscalers via the RAA-series digital multiphase controllers, integrated power stages (DrMOS) and increasingly integrated power modules. In Stage 1 (intermediate bus), the company has a growing module presence that leverages controller IP and PMIC capability, competing with Infineon and traditional module makers. Like MPS and Infineon, Renesas benefits from the broader shift to higher-density, module-based vertical power delivery, which carries materially higher ASP than discrete implementations; its ability to integrate controller, driver and power stage in a co-designed module is a structural positive as customers narrow their qualified supplier set for vertical solutions. Adjacent rack content is meaningful: DDR5 PMICs are an important franchise where Renesas is recognized alongside MPS and a small set of others, with SSD, HDD and switch power. On wide-bandgap, Renesas sees a strong opportunity with GaN FETs, with an expected $3bn market in 2032, most of which is driven by high voltage GaN.

### Company outlook and data points

Renesas had indicated having $10k-$12k of power content per 130kW racks, concentrated inside baseboard ($6-7k), BBU (~$2k), IBC (~$1k), PSU (~$1k) and switches (~$600). On GaN specifically, the >$3B 2032 SAM spans xEV, infrastructure computing, industrial, and IoT, with vertical integration (own epi/process), optimized packaging, GaN-optimized IC controllers and drivers, and new topologies including a

GaN bidirectional switch.

## Texas Instruments

Texas Instruments provides power delivery, conversion, and management semiconductors that feed and regulate AI accelerators, CPUs, and boards and racks inside an AI data center. Texas Instruments has a broad-based portfolio and reported $~1.5bn of Data center (inside the walls) revenue in 2025, or 9% of total company's revenue. TI's strength comes from a breadth of analog content across the entire "power tree", from AC-to-DC at the wall down to point-of-load at the accelerator, supported by internal 300mm manufacturing and GaN. Management explicitly attributed Q1 strength in part to "ability to supply," signaling that capacity availability is converting into share gains while peers are capacity constrained. The multi-year transition to 800V DC rack architectures driven by AI accelerator power density is seen as the opportunity, where GaN (with its own supply) will have key share.

### Exposure and products

- **From grid to rack:** Texas Instruments has a broad general-purpose high-voltage analog portfolio supporting traditional rack PSUs and power-shelf designs. PSU content that was historically classified inside industrial was moved into the data center end market in the recent reclassification, reflecting that this is data-center-specific content.
- **Inside the rack:** TI is positioned everywhere on the board with general purpose analog and can fulfill almost every analog socket on an AI rack, spanning hot-swap controllers, clock/timing, current sensors, interface products and general purpose DC-DC regulators. TI is ramping application-specific Stage 1 high-voltage conversion (e.g., 800V to 12V/6V), intermediate bus converters, and GaN-based power stages tied to the long-term transition to 800V DC rack architectures. TI has invested in GaN for over 15 years and frames it as the key enabler for higher power density per rack, with meaningful revenue contribution from these application-specific sockets expected to build through 2H 2026 and into 2027. TI is sampling solutions at the GPU power-delivery socket (multi-phase controllers, smart power stages, and VRM/V-core solutions). The co. claims that design-in momentum is building, and TI is positioning to compete for the most contested and highest-value AI server sockets.

### Company outlook and data points

TI expects its GaN technology to gain traction with the transition to 800V DC rack architectures. Management of TI has indicated potential for price increases in 2H 2026 if demand remains strong. The company has not provided content data points.

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## STMicroelectronics

ST is a credible entrant in AI data center power, leveraging the 800V rack transition to convert a historically marginal position into a full-stack play across SiC, GaN, analog (thermal flow, systems). Management guides AI/data center revenue of ~$1bn in 2026 which could double in 2027 with a SAM standing at ~ $230M per GW, fully addressable today across ~400 products. However, AI power and analog is indicated to be roughly ~30% of AI revenue opportunity in 2026 and going down to ~20% in 2027. ST is adopting an opportunistic approach as hyperscalers seek multi-sourcing options, favoring challengers. The co. is looking to have full-stack offering in power but does not have solutions for below 20V voltages yet (absent at Stage 2 as a result).

**Exposure and products**

- From Grid to Rack: ST has a strong SiC offering with high voltage MOSFETs ranging from 650V to 2.2kV making it suited for grid-to-rack applications (AC-DC rectifiers, SSTs, SSCB, energy storage with bi-directional converters). ST provides AC/DC power shelf (800V) that sits inside the sidecar power rack using SiC and GaN . SST has mentioned the fast adoption of SSTs at 800V architecture with SiC playing a critical role, but did not disclose a specific product or opportunity there.
- Inside the Rack: ST has exposure at Stage 1 with a 800V-> 54V intermediate bus converter where ST co-developed a reference design with NVIDIA pairing a 1,200V SiC hot-swap protection circuit with a 650V GaN stacked half-bridge power converter. The 54V → 12V stage is in production with key customers. At Stage 2, ST is currently absent has it does not have low voltage (below 20V) silicon solutions.

## Navitas

Navitas has been repositioned into a pure-play on AI data center power + grid electrification, leveraging both GaN and ultra-high voltage SiC. Navitas is a fabless widebandgap semiconductor company. The company is currently a very small player (revenue expected below $100m until ‘27) but has ambition to become #2 to Infineon in the AI power market via product performance leadership and capabilities across the whole power delivery chain (from grid to core).

**Exposure and products**

- **From grid to rack:** Navitas is targeting solid-state transformers, battery energy storage, megawatt chargers and grid-scale solar with ultra-high-voltage SiC at 1.2kV, 1.7kV and ultimately 2-3kV, with the 800V SST inflection expected late '27-'28 in what management frames as a 50-year build-out. Navitas is not in EV SiC market and thus its portfolio starts at 1.2kV, where economics are far more attractive than the commoditized EV segment. Closer to the rack, the AC-DC PSU/sidecar (converting 480V AC to 800V DC) SiC content scales non-linearly: roughly $2 in a 5kW PSU today versus ~$200 per kW in a 30kW PSU expected in 6-9 months. Management framed AC-DC SiC content per megawatt at $5,000–$8,000. New Gen5/Gen6 1.2kV SiC is sampling, with initial customer feedback citing up to 50% higher power density and >98% system efficiency.

- **Inside the rack:** Navitas is expecting to be a strong player in Stage 1 with its GaN portfolio. Nvidia is targeting 800V→6V direct, and Navitas has now released a 20kW 800V-to-6V DC-DC platform on its latest GaN with 97.5% peak efficiency, alongside a 800V-to-50V AI DC-DC power brick; both attracting strong customer interest. Management estimates GaN content at $10,000–$15,000 per megawatt in data centers

**Company outlook and data points**

Navitas' 2030 SAM (AI Data centers + Grid Infrastructure) is indicated at $3.5bn at a ~60% CAGR, with roughly two-thirds coming from AI data centers and grid combined and a roughly 50/50 split between GaN and SiC. On supply chain, TSMC continues to ship through ~2029 with Navitas building buffers to ensure smooth customer transition, while the GlobalFoundries partnership (including TSMC's GaN technology license to GF) targets 8-inch U.S. production in 2027. Competitively, Infineon remains the biggest player according to the company but has signed a cross-license with Navitas. In terms of content, Navitas expects $10k-$20k of wide bandgap content per MW in the short to mid term (sidecar power rack) and expects this to rise to $25k-$35k in the long term (SSTs, battery rack.

Figure 32: Navitas expected content in AI HVDC infrastructure

| | GaN + SiC | GaN | SiC | Comments |
|---|---|---|---|---|
| Total $ content per MW | ~ $25K - $35K | ~ $10K - $15K | ~ $15K - $20K | Estimate factoring ASP trend, redundancy and number of devices per system. Using same assumption as the base SAM (moderate penetration of AI Data Centers with total demand in 2030 of 219GW, 50% of AI D/C using 800V HVDC) |
| Inside AI Data Center | | ~ $10K - $15K<br>Mostly driven by 800V HVDC | ~ $5K - $8K<br>Mostly driven by AC/DC PSU | Not factoring $2-3 of SiC JFET for circuit protection and hotswap |
| Outside Data Center (Energy & Grid Infra.) | | | ~ $10K - $12K<br>Mostly driven by SST, BESS | The energy grid re-architecture represents a very large opportunity for UHV (>2Kv) SIC and V-Gan (2030) |

Source: Navitas.

## Analog Devices

ADI has rapidly repositioned from a communications-and-industrial analog franchise into a top-tier AI data center power player, capped by the May 2026 announcement of the $1.5B acquisition of Empower Semiconductor, described by management as the "final piece" of its grid-to-core power platform. ADI's strength in AI power lies in (1) a differentiated multiphase VRM platform built around the MAX16602 controller (up to 16 phases) and the MAX20790 monolithic smart power stage (FETs, drivers, and current sensing in a single package), supported by coupled-inductor technology;(2) Empower's integrated voltage regulator (IVR) and silicon capacitor IP for vertical power deliver, targeting up to 4x power footprint shrink and 10–15% reduction in compute power consumption (answer to MPS's monolithic-density and Infineon's sub-100V MOSFET advantages); and (3) the ability to bundle power with optical and high-speed connectivity.

**Exposure and products**

- **From grid to rack:** ADI is exposed to grid investments via monitoring, metering and management solutions with its analog portfolio. The co. is also leveraging its high-performance battery management platform into energy storage systems.
- **Inside the rack:** ADI's Stage 2 (PoL/VRM) platform centers on multi-phase digital controllers, monolithic smart power stages, and patented coupled-inductor magnetics for CPU/GPU/ASIC sockets, supporting AI's volatile transient profile at high current. Empower's IVR + silicon capacitor IP enables vertical power directly underneath the CPU and is positioned by management as essential to "catch the wave" in AI data center power, moving content closer to the core where performance demands are uncapped. Optical and high-speed connectivity content sold into the same AI clusters drives meaningful pull-through on top of pure power

## On Semiconductor

Onsemi is a broad-based US power semi supplier with a comprehensive portfolio from 800V to 0.8V, spanning Si, SiC FET, SiC JFET, GaN and proprietary vGaN. AI data center revenue exceeded $250m in FY25 and is guided to double YoY to ~ $500m in FY26. Management is indicating to be engaged with all major power supply vendors serving every major AI hyperscaler, with named design wins at Delta, LiteOn, and Great Wall. Content is indicated at ~$15k per 120kW rack today and expected to rise to $115k per rack with the transition to 600kW-1MW racks supporting the 800V architecture.

**Exposure and products**

- **From grid to rack:** onsemi is positioning itself across the full chain with content opportunities in the SST, BESS DC-DC, HV PDY, HV CBU and HV BBU stages of the long-term architecture. onsemi supplies SiC hybrid modules for energy infrastructure and now sees a >40% revenue growth YoY in FY26 with market share approaching 60% per the company. onsemi is sampling 1.2kV ultra-low RDC SiC JFETs for AI data centers targeting the higher-voltage bus transition, SiC modules designed for UPS, BBU and PSU systens.
- **Inside the rack:** onsemi's lateral + vertical GaN strategy includes >30 new GaN devices (40V to 1,200V, discrete and integrated driver+GaN) sampling in 2026, with lateral GaN delivered via foundry partnerships (InnoScience, GlobalFoundries) generating revenue from 2026, and vGaN built on proprietary GaN-on-GaN technology in onsemi's US fab with first revenue in 2027. The GaN solutions design funnel exceeds $1.5bn, with 10 products already sampling and another 20 expected to sample in 2H26.

## Rohm

Rohm is a smaller player in the market but is one of the providers for Nvidia's 800V HVDC infrastructure. Management targets a JPY 100bn (~$620m) server business by FY2030. Rohm seeks to supply across the rack, combining silicon MOSFETs (DrMOS for ~1/3rd), SiC, GaN and analog/multi-phase controllers.

### Exposure and products

- **From grid to rack:** Management explicitly maps Rohm's SiC into the AC-DC and high-voltage DC stages of next-gen 800V architectures. This is where the collaboration with Nvidia jointly implemented with Delta sits. SiC device and module business is guided +55% in FY2026 (vs. SiC substrate external sales declining), with 5th-gen MOSFETs and the ramp in 8-inch production.
- **Inside the rack:** The offering centers on DrMOS (smart power devices) + multi-phase controllers for stage 2 (VRM/PoL) at the GPU socket. Rohm sizes content rising from ~20 DrMOS units per current GPU (~700W) to ~50 units per next-gen GPU (~3.6kW by 2027) i.e., 2.5x device count on top of GPU power growth. Rohm's Gen-2 DrMOS is sampling/launching now. By FY2030, management expects DrMOS to be ~30% of the JPY100bn server mix.

### Company outlook and data points

Rohm sees AI server power-device demand at a 48% CAGR 2025–2030 (1.5x every year), driven by power-per-rack scaling from ~13kW in 2023 to ~1,000kW in next-gen AI servers, implying 36x more power devices and 56x more analog devices per rack. Against this backdrop, the co. sees a servers business of JPY100bn by FY30 which was revised upward by more than 3x. SiC is growing >30% in FY26 and the device/module piece >55%, but absolute AI-server SiC dollars remain small with the inflection more 2028–2030.

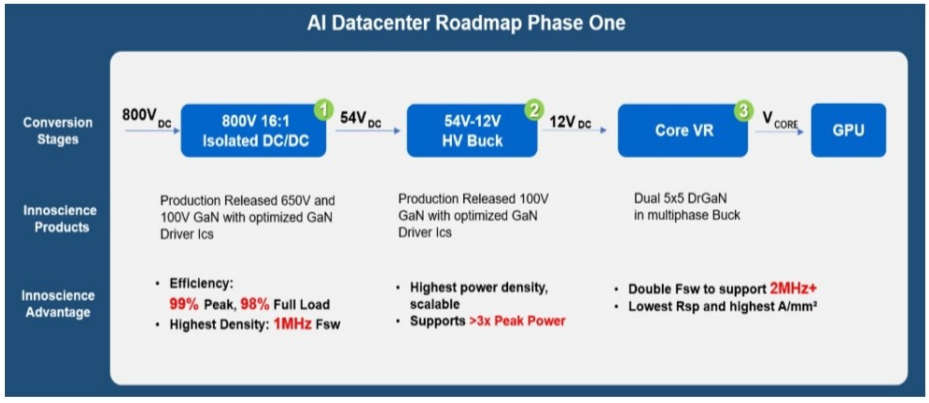
## Innoscience

Innoscience is the largest pure-play GaN IDM globally (headquartered in China), with a vertically integrated 8-inch GaN wafer manufacturing platform that has been the merchant capacity backbone of the broader GaN industry. The co. has a large GaN portfolio from 1.2kV down to 15V enabling conversion from 800V down to 1V. Innoscience lost a patent dispute to Infineon and the ITC has issued limited exclusion against Innoscience products which limits direct sales into US-bound AI servers. The ruling also introduces second-order IP/supply risk for fabless peers that use Innoscience as a foundry.

### Exposure and products

- **From grid to rack:** Innoscience's grid-to-rack participation is principally through 650V/700V GaN HEMTs sold into AI server PSUs and merchant power-supply OEMs, where its wafers underlie products from multiple downstream branded suppliers.
- **Inside the rack:** At Stage 1 (800V step down to low voltage), Innoscience provides 650V and 100V GaN with optimized GaN ICs. At Stage 2, the co. provides Dual 5x5 DrGaN in multiphase Buck, citing strong reduction in switching losses using GaN at the PoL.

Figure 33: Innoscience AI DC portfolio




Source: Innocience.

## Alpha & Omega Semiconductor (AOS)

AOS is a smaller cap company which announced that it is supporting Nvidia's 800V HVDC architecture providing SiC, GaN, MOSFETs and multi-phase controllers across every stage of power conversion. AOS expects to grow from BOM expansion as well as share gains and has indicated per-GPU content increasing from ~$5–6 in legacy platforms to $7–15 today and >$20 on new platforms, depending on GPU power draw.

### Exposure and products

- **On grid-to-rack:** AOS's 1.2kV SiC MOSFETs target high-voltage AC/DC conversion in 800V DC architectures, supporting both sidecar power configurations and direct 13.8kV AC -> 800V DC single-step conversion which may become the architecture in the long term.
- **Inside the rack:** AOS is shipping high-performance medium-voltage MOSFETs into hot-swap sockets and 48V to12V intermediate bus converters (Stage 1 IBC) that are now in the build phase at leading ODMs for major hyperscale customers, with solutions deployed across both GPU- and CPU-based architectures. At Stage 2 (VRM/PoL), AOS supplies multiphase controllers and smart power stages /DrMOS for both graphics and AI accelerator cards as a total solution, with the SmartClamp DrMOS family launched April 2026 specifically for AI servers and high-end GPUs. Management has acknowledged that direct VRM/PoL design wins for GPU power have been less than originally expected, prompting the strategic broadening into earlier stages (IBC and 48V to12V power delivery boards) where it is expected that competition will be less concentrated than at the GPU socket dominated by MPS, Infineon, and potentially ADI, and Renesas. AOS's GaN FET portfolio is positioned for high-density 800V to low-voltage conversion using high-frequency switching.

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## Wolfspeed

Wolfspeed is a post-restructuring SiC pure-play with a credible AI data center growth opportunity. Wolfspeed is well positioned on SiC with scale at 200mm and a 300mm SiC roadmap (with 300mm SiC demonstrated in Jan 26) to unlock next gen AI/HPC packaging architectures and cost efficiencies. Management acknowledges data center is not yet a large contributor against a long-term mix target of ~70% EV/~30% Industrial & Energy (including AI data center). Wolfspeed has the advantage of being a US-based vertically integrated supplier across SiC substrates through to devices.

### Exposure and products

- **On grid-to-rack:** Engagement spans the full power tree including power supplies, battery backup storage, air conditioning, and future solid-state transformers, with the fastest-ramping AI revenue opportunity in PSU applications
- **Inside the rack:** 300mm SiC substrates for next-gen AI/HPC advanced packaging are in early-stage discussions rather than design-win territory. Wolfspeed's AI in-rack participation is therefore primarily through the AC-DC PSU and intermediate-bus stages, and through future advanced packaging substrate optionality.

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