AI Server Power Supply Cost Composition and Proportion



Overview

Scaling AI Data Center Power Delivery with Si, SiC, and GaNTo understand where each technology fits into the present and future landscape of AI power deliv.

Key Takeaways

AI server power supplies (PSUs) represent a significant portion of AI server infrastructure costs, with high-capacity, high-efficiency units (>20 kW) dominating both expenditure and power consumption.

Cost Composition of A

I Server PSUsAI server PSUs are designed to handle the high power demands of GPU-intensive AI workloads, often consuming 5–7 kW per node, compared to 200–400 W for traditional servers. The cost composition of a PSU includes: Power Conversion Components: MOSFETs, silicon-carbide or gallium-nitride FETs, and transformers for efficient AC-DC or DC-DC conversion. These components are critical for high-efficiency operation and can account for 40–50% of PSU cost.

Control and Monitoring Electronics: Microcontrollers (MCUs) with Digital Signal Processing (DSP) capabilities manage real-time power distribution, predictive maintenance, and fault management. These advanced controllers contribute roughly 15–20% of the PSU cost. Mechanical and Thermal Management: Heat sinks, fans, and solid-state relays ensure reliability under high loads, typically representing 10–15% of the cost.



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Redundancy and Modular Design Features: N+1 redundancy, modularity, and failover systems add 10–15%, ensuring continuous operation in critical AI infrastructure. Compliance and Certification Costs: Energy efficiency certifications (e.g., 80 PLUS) and regulatory compliance add 5–10% to the total PSU cost.

Proportion of PSU Costs in AI Server Infrastructure

In AI-ready data centers, PSUs are a substantial fraction of total server and rack costs due to the high power density: Per-node PSU cost can range from $2,000 to $5,000 for high-capacity units (>20 kW), depending on efficiency and redundancy features. Rack-level power for AI servers can reach 50–65 kW, requiring multiple high-capacity PSUs, which can constitute 15–25% of the total rack CapEx, alongside GPUs, CPUs, memory, and cooling infrastructure. Operational costs are also influenced by PSU efficiency; higher-efficiency units reduce energy consumption and cooling requirements, indirectly lowering OpEx by 10–20% over the server lifecycle.

Market Trends and Implications

The >20 kW PSU segment dominates the AI server market due to GPU-intensive workloads. North America and Asia Pacific, particularly the United States and China, are leading markets, reflecting high AI adoption and data center expansion. Technological innovations, such as wide bandgap semiconductors, high-speed PWM control, and solid-state relays, are improving efficiency and reducing the proportion of PSU cost relative to total server CapEx.

Supply chain factors, raw material costs, and regulatory compliance can influence PSU pricing and cost composition, making strategic procurement and modular design critical for cost optimization. In summary, AI server PSUs are a high-value component, with their cost composition heavily weighted toward power conversion and control electronics. Their proportion of total server and rack costs is significant, particularly in high-density AI deployments, and efficiency improvements can materially impact both CapEx and OpEx in AI data centers.

Article Content

Scaling AI Data Center Power Delivery with Si, SiC, and GaN

To understand where each technology fits into the present and future landscape of AI power delivery, we''ll take a closer look at how Infineon''s power-supply designs have evolved to address the ever

Trends in AI Server Power Supply Architectures

The rapid scaling of artificial intelligence (AI) servers and hyperscale data centers is driving new requirements for high efficiency, high density power supply unit (PSU) architectures. AI workloads

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Meeting the Demanding Energy Needs of AI Servers with Advanced ...

Explore how innovations in power devices, gate drivers, and DSP-based controllers tackle AI servers'' high energy demands, optimizing efficiency in data centers.

The Role of PSU Design in Meeting AI Data Center Power and

Figure 2: AI servers are becoming significantly more efficient, but the rise of AI usage requires greater power densities to be delivered. Note – figures quoted are per server, not per processor.

Deconstructing the Data Center: A Look at the Cost Structure Igniting ...

By analysing a benchmark 100-megawatt facility and exploring the different data center models, we explore the immense upfront investments and the significant, recurring expenses that

Presentation title on multiple lines

Hybrid TCM/CCM control strategy offers a comprehensive approach, combining the strengths of both modes to achieve higher efficiency, performance, and reliability in high-power AI server PSUs.

Global AI High Power Server Power Supply Market 2026

Between 2024 and 2026, strategic momentum in AI high power server power supplies increasingly centered on enabling higher power density and better thermal/electrical performance for

AI PSU | Infineon Technologies

Infineon explores the latest advancements in AI server power supplies, addressing the challenges driven by increasing power demands and the evolution of AI server rack architectures.

Global AI Server Power Supply Unit (PSU) Market Outlook, In-Depth ...

The AI server power supply unit (PSU) is a component of the server hardware that is responsible for converting the electrical power from the main power source into the appropriate

AI Server Cost Analysis – Memory Is The Biggest Loser

The percentage of servers on units will be much lower, but on a dollar basis, the gap is massive. As datacenters move to accelerated computing, the cost allocated to various components

A review of power consumption models of servers in data centers

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Abstract This study provides an overview of power consumption models of servers in data centers. The server is the basic unit of both power and heat flow paths; therefore, its power

The cost of compute power: A $7 trillion race | McKinsey

Amid the AI boom, compute power is emerging as one of this decade''s most critical resources. In data centers across the globe, millions of

Comparative Analysis of Power Devices in Power Supply Units for AI ...

Each server rack within the data center necessitates a Power Supply Unit (PSU) to facilitate power delivery. The PSU is designed as a combination of a Power Factor Correction (PFC) converter and a

The Ultimate Guide to AI Server Power Supplies: Choosing the Right ...

The efficiencies gained from better power management can help mitigate electricity costs, not to mention potential damages caused by inferior units leading to hardware failures. Future Trends

Powering Intelligence: Analyzing Artificial Intelligence and Data ...

A fundamental uncertainty in projecting data center load growth comes from the broad emergence of artificial intelligence (AI) technologies in business and daily life—punctuated by the explosion into

Comparative Power Consumption of AI Servers and Normal Servers

Conclusion The comparison between AI servers and normal servers in terms of power consumption reveals a substantial disparity, with AI servers requiring up to 10 times more power at

Global AI Server PSU System Market Research Report 2025

An AI Server PSU System refers to the power supply infrastructure designed to support high-performance artificial intelligence (AI) servers. These power supply units (PSUs) are optimized

How to Choose an AI Server Power Supply Unit (PSU)?

AI Server Power Supply Solutions With the rapid development and widespread adoption of AI technology, the server market has undergone significant changes in recent years. The launch of

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