Semiconductors: Investing in the Foundation of the AI economy

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Executive Summary

Artificial intelligence is transforming the semiconductor industry from a cyclical consumer-driven market into a structural infrastructure market. Every AI application whether cloud computing, autonomous systems, robotics or enterprise software requires increasing amounts of advanced computing power, making semiconductors the critical foundation of the AI economy. As AI adoption accelerates, investment opportunities are created across the entire value chain.

This investment brief evaluates the semiconductor sector through three dimensions: market opportunity, financial quality and investment risks. Industry forecasts from McKinsey, IDC, Gartner and World Semiconductor Trade Statistics suggest that the global semiconductor market could approach $1.5–2.0 trillion by the end of the decade, supported by hyperscale AI infrastructure investment, digitalization, electrification and government initiatives to strengthen domestic semiconductor production. Unlike previous semiconductor cycles driven by PCs and smartphones, the current expansion is increasingly supported by enterprise investment and long-term computing infrastructure, suggesting a more durable demand profile.

From an investment perspective, the VanEck Semiconductor ETF (VVSM) provides diversified exposure to the industry's highest-quality companies, including semiconductor designers, foundries and equipment manufacturers. The ETF captures the broad AI investment theme while reducing company-specific risk through diversification. However, this report argues that investors should complement this exposure with a targeted allocation to memory manufacturers, particularly SK Hynix and Samsung Electronics. Memory chips are positioned as one of the fastest-growing and strategically important segments of the semiconductor industry.

Nevertheless, the sector is not without risks. Semiconductor valuations remain elevated, reflecting exceptionally optimistic expectations for AI-driven earnings growth. Future investment returns will increasingly depend on companies exceeding already ambitious forecasts rather than benefiting from further valuation expansion. Additional risks include semiconductor cyclicality, dependence on hyperscaler capital expenditure, geopolitical tensions surrounding advanced manufacturing, export restrictions and the capital-intensive nature of chip production.

Based on the analysis, this report recommends a core-satellite investment strategy consisting of approximately 80% allocated to the VanEck Semiconductor ETF (VVSM) and 20% allocated to leading memory manufacturers, primarily SK Hynix and Samsung Electronics. This approach provides broad exposure to the semiconductor ecosystem while

overweighting one of the industry's highest-conviction AI themes. For long-term investors with a 5–10 year investment horizon, this portfolio offers a balanced combination of diversification, structural growth and targeted exposure to the accelerating demand for AI infrastructure.

Market Outlook

Artificial intelligence has fundamentally altered semiconductor demand. Unlike previous computing cycles, generative AI requires unprecedented computational power across training, inference, networking, memory and power management. Every AI workload translates directly into higher semiconductor content, making chips the critical bottleneck for future AI deployment. According to McKinsey, AI could contribute between $17.1 trillion and $25.6 trillion annually to the global economy through productivity improvements across industries. Capturing this opportunity requires massive investments in computing infrastructure, with semiconductors representing the core enabling technology. Rather than a temporary product cycle, AI represents a structural increase in compute intensity.

McKinsey & Company

McKinsey & Company reports that the semiconductor industry is poised to reach $1.6 trillion to $1.8 trillion by 2030. The major variable is the expected trajectory for AI adoption. Estimated CAGR for the semiconductor market from 2024 to 2030 is 13 percent, but growth will vary significantly by segment as growth depends on the sector.

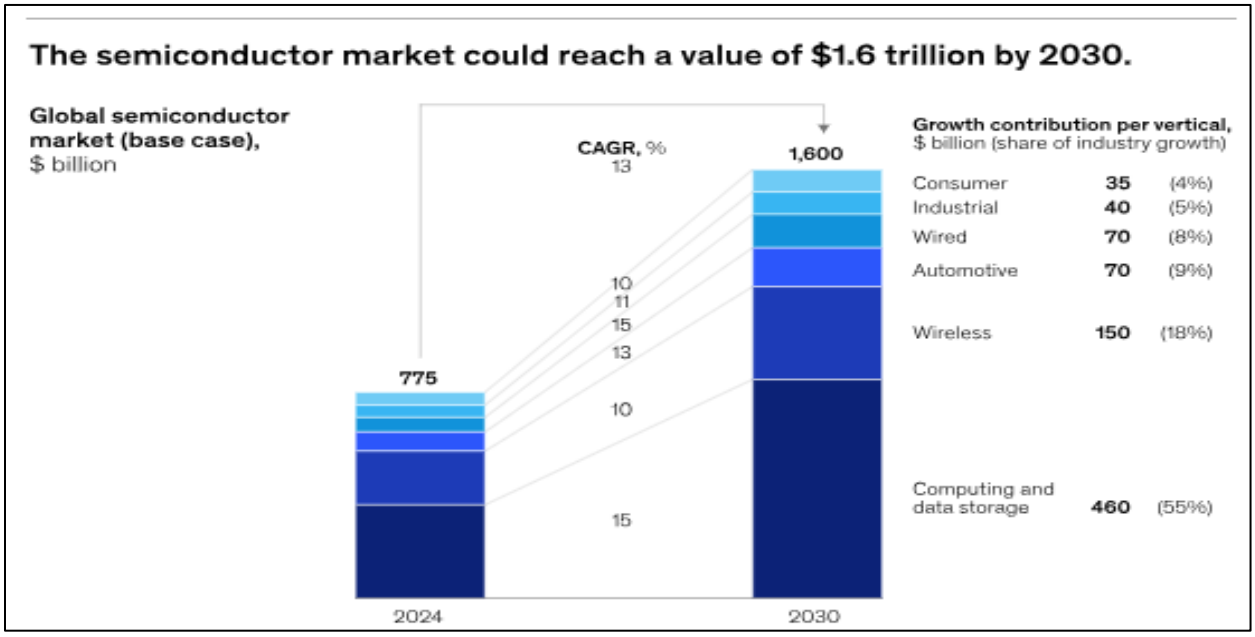

Chart 1:Semiconductor Market in 2030 (McKinsey & Company)

IDC Research

According to IDC Research, total semiconductor revenues are forecast to reach $1.29 trillion in 2026, up 52.8% year over year from $842.8 billion in 2025. The memory segment is at the epicenter of this shift: DRAM revenues alone are projected to nearly triple in 2026 to $418.6 billion, driven by demand for high-bandwidth memory (HBM) and DDR from hyperscalers and AI infrastructure providers. Meanwhile, non-memory semiconductors are growing at a robust but more measured pace, reaching $693.5 billion in 2026.

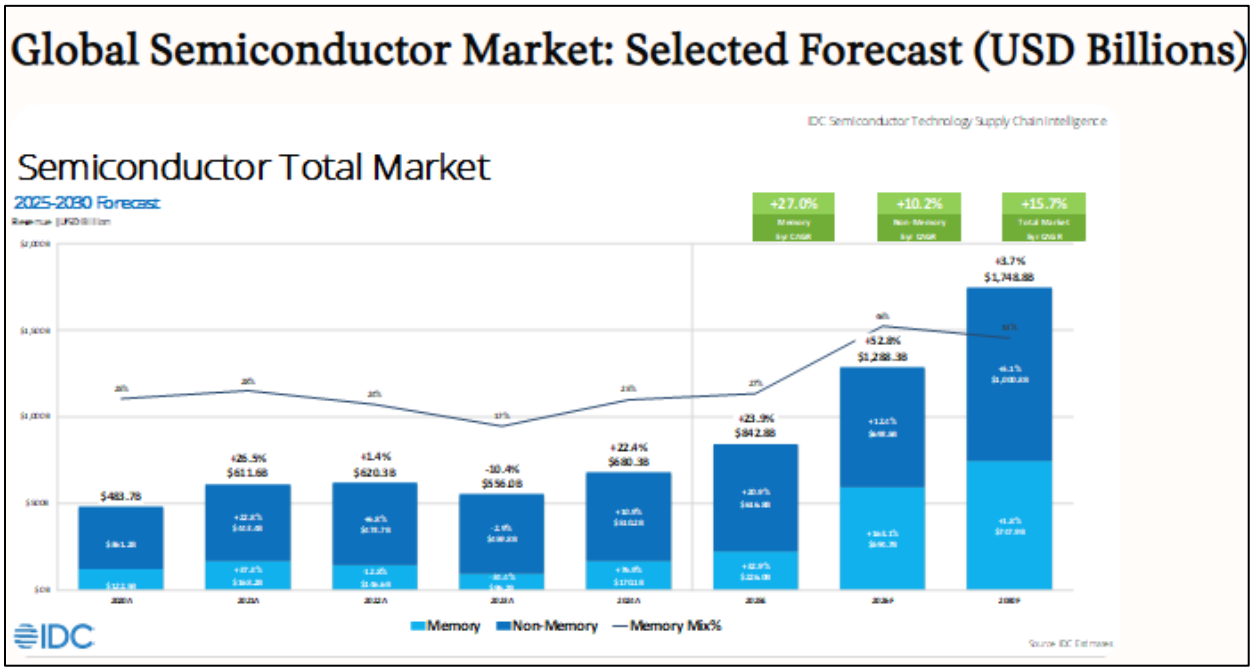

Chart 2: Global Semiconductor Market (IDC)

Gartner

Worldwide semiconductor revenue is forecast to reach $1.56 trillion in 2026, growing 92.2% year over year, driven by persistent strong demand for memory, AI accelerators and networking semiconductors. Memory revenue will exceed $830 billion in 2026, making it the largest semiconductor category and accounting for more than half of total semiconductor revenue. Because of this massive structural push, the baseline for 2030 sits comfortably above the $1.5 to $2 trillion range, structurally elevating the long-term terminal value of the market.

AI semiconductors are expected to account for approximately 30% of total semiconductor revenue in 2026 and will remain the driving force behind the overall industry growth. Hyperscaler investment in AI infrastructure buildouts remains strong with spending

expected to increase by more than 50% in 2026, driving demand for AI accelerators, including GPUs and custom non-GPU chips.

“Memflation” will destroy, or at least delay, non-AI demand into 2028, to varying degrees depending on the application. Technology suppliers should prepare for higher prices during the first half of 2026, followed by persistent but moderating price increases throughout the rest of the year. CIOs and IT leaders should be cautious about signing supply agreements with unfavorable pricing terms that extend beyond 2027. (Gartner)

World Semiconductor Trade Statistics

The global semiconductor industry has transitioned from a cyclical consumer-driven market into a highly intensive infrastructure market. The provided chart from World Semiconductor Trade Statistics (WSTS) illustrates a historic inflection point in global semiconductor revenues, moving away from historical linear growth patterns toward an exponential trajectory driven by the deployment of artificial intelligence. Historically, the semiconductor market operated on distinct 4-to-5-year cycles tied closely to personal computer and smartphone replacement waves.

- The Post-Pandemic Correction: Following a work-from-home surge that peaked in 2021 at $551 billion, consumer demand saturated.
- The 2023 Downturn: Overinventory and declining smartphone shipments caused an 8.7% contraction, dropping total market value down to $519 billion.
- The Inflection: This correction marked the final chapter of the consumer-led cycle, laying the groundwork for an infrastructure-led recovery in 2024.

The industry rebounded in 2024 by 21.5% to reach $631 billion, driven by memory price normalization and initial enterprise graphics processing unit (GPU) deployments. In 2025, steady momentum pushed the market up 26.2% to a value of $796 billion. The defining anomaly in the data occurs in 2026, where market revenue expands by an unprecedented 89.9% year-over-year, leaping to $1.511 trillion.

Following the immense capital expenditure boom of 2026, the market enters a period of stabilization rather than a traditional hard correction.

- Continued Expansion: In 2027, the market expands another 26.6%, reaching $1.914 trillion.
- Structural Elevation: Growth rates normalize through 2028 and 2029, yet the total addressable market stays elevated near the $2 trillion baseline.

- New Normal: This confirms that artificial intelligence is a permanent baseline alteration to global computing infrastructure rather than a brief speculative bubble.

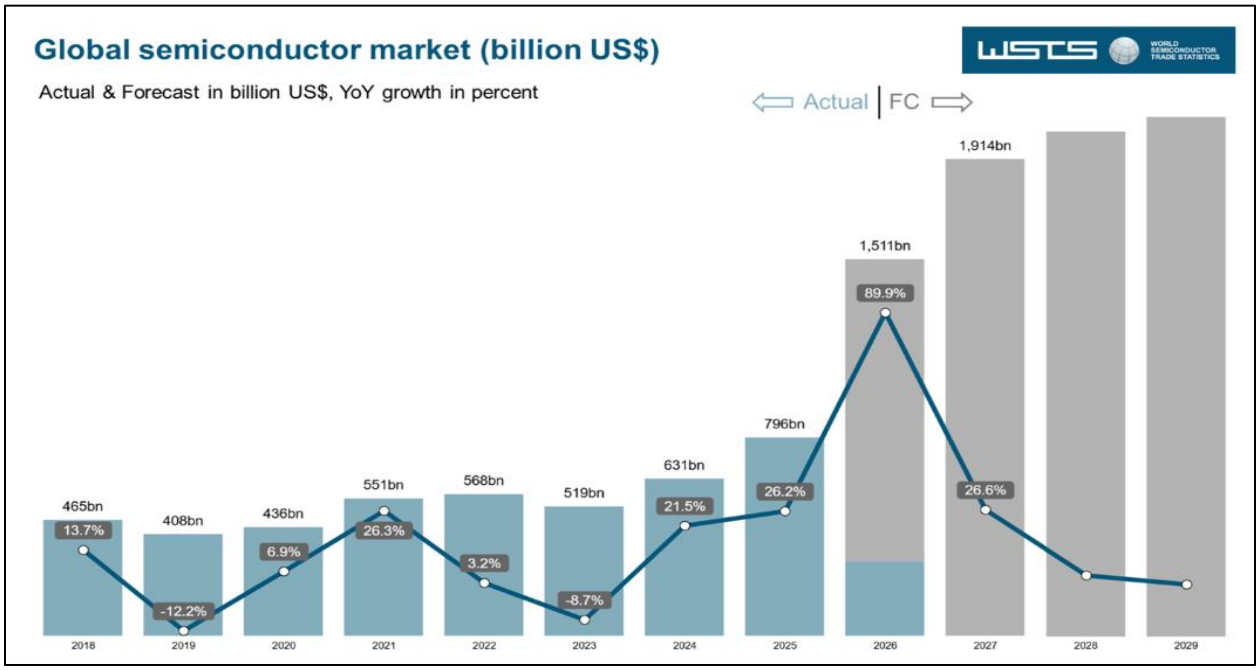

Chart 3: Global semiconductor market (WSTS)

Unlike previous technology cycles that mainly increased unit volumes, AI significantly raises the semiconductor value embedded in each system. AI servers require more semiconductor content than traditional enterprise servers. This creates broad-based demand across the semiconductor ecosystem rather than benefiting only GPU manufacturers.

Productivity Impact

The semiconductor industry is one of the primary beneficiaries of global AI adoption because productivity gains require additional computing capacity. McKinsey estimates generative AI could increase annual labor productivity growth by 0.1–0.6 percentage points over the next decade, while Goldman Sachs estimates AI could raise global GDP by approximately 7% over ten years. Below the relationship between Artificial Intelligence and Semiconductors.

The Value Chain is displayed below starting from Artificial Intelligence adoption all the way down to the equipment needed to manufacture the chips. Higher AI adoption drives investment in cloud infrastructure and data centers, increasing demand for networking equipment, advanced processors and memory chips. The demand ultimately benefits the semiconductor foundries and equipment manufacturers demonstrating that Artificial Intelligence creates broad based opportunities across the entire semiconductor ecosystem.

Policy & Geopolitics

Semiconductors have become strategic assets with significant geopolitical and macroeconomic importance. Several structural trends support long-term investment.

- Governments worldwide are subsidizing domestic semiconductor manufacturing through initiatives such as the U.S. CHIPS and Science Act, the European Chips Act, and similar programs in Japan, South Korea and Taiwan.
- AI infrastructure investment by hyperscalers is expected to exceed hundreds of billions of dollars annually, supporting sustained demand for advanced logic, memory and networking chips.
- Digitalization, electrification, autonomous systems and industrial automation continue to expand semiconductor intensity across the global economy.
- Semiconductor supply chains are increasingly viewed as matters of national security, encouraging long-term capital investment despite cyclical fluctuations.

These trends suggest the current investment cycle is driven by structural demand rather than a typical semiconductor replacement cycle.

Financial performance

The semiconductor sector combines structurally attractive economics with pronounced cyclicality. Its strongest businesses benefit from technological barriers, concentrated market structures, high switching costs and substantial intellectual property. However, financial performance differs materially between fabless chip designers, foundries, equipment manufacturers and memory producers.

VVSM provides diversified exposure across these business models. Its largest constituents typically include AI-compute designers, advanced foundries, semiconductor-equipment

manufacturers and connectivity specialists. It consists of pure play semiconductor stocks, (companies that derive at least 50% of revenues from semiconductors or related activities.)The fund remains heavily exposed to the AI capital-expenditure cycle and has assets totaling 7.5 Billion USD. (VanEck)

Holding Name	% of Net Assets
Broadcom Inc	11.31
Advanced Micro Devices Inc	10.79
Nvidia Corp	10.77
Taiwan Semiconductor Manufacturing Co L	10.42
ASML Holding Nv	10.1
Micron Technology Inc	9.42
Intel Corp	6.12
Applied Materials Inc	5.35
Lam Research Corp	4.76
Texas Instruments Inc	3.82
Kla Corp	3.1
Analog Devices Inc	2.66
Total	**88.62**

Table 1: Holding of VVSM ETF

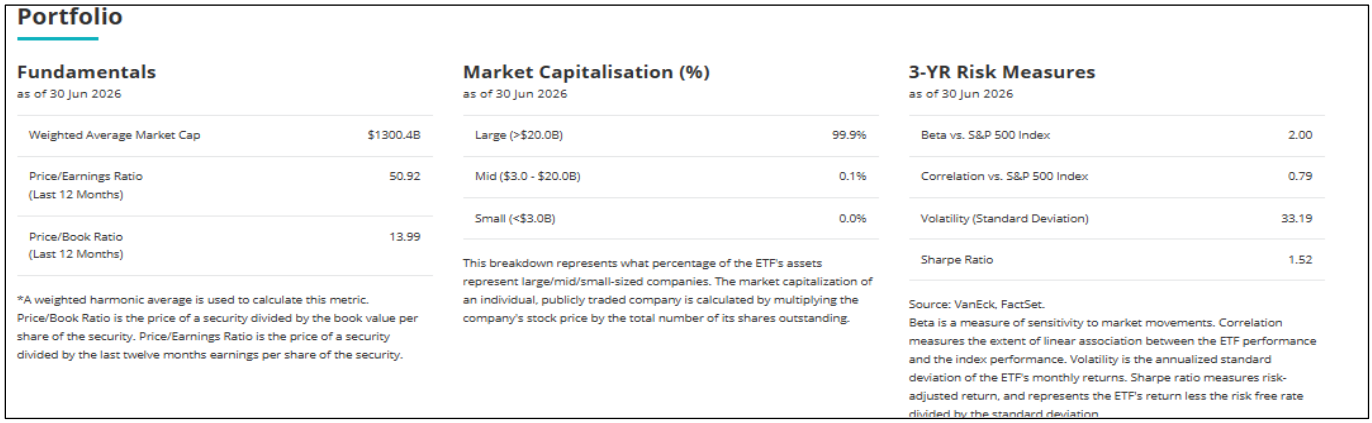

Figure 1: ETF Fundamentals, Market Capitalization and Risk Measures (VanEck)

Figure 1 highlights the financial profile and risk characteristics of the VanEck Semiconductor ETF (VVSM), reinforcing why it serves as an effective proxy for the global semiconductor industry.

The ETF is almost exclusively invested in large-cap companies, with 99.9% of assets allocated to firms valued above $200 billion and a weighted average market capitalization of approximately $1.3 trillion. This reflects the highly concentrated nature of the semiconductor industry, where a small number of global leaders dominate innovation, manufacturing capacity and profitability. Companies such as NVIDIA, Broadcom, TSMC and

ASML possess significant economies of scale, substantial research and development budgets, and strong competitive moats, making them the primary beneficiaries of long-term AI investment.

From a valuation perspective, the ETF trades at a price-to-earnings (P/E) ratio of 50.9x and a price-to-book (P/B) ratio of 14.0x. These multiples are significantly above those of the broader equity market and suggest that investors are assigning a considerable premium to future earnings growth. While such valuations can be justified by exceptional profitability and strong structural growth, they also imply that a large portion of the anticipated AI-driven expansion may already be reflected in current share prices. Consequently, future returns will depend not only on continued earnings growth but also on companies consistently exceeding the market's already elevated expectations.

The ETF's risk profile further illustrates the characteristics of the semiconductor sector. A beta of 2.0 indicates that semiconductor stocks are approximately twice as sensitive to market movements as the S&P 500, while an annualized volatility of 33.2% highlights the sector's inherently cyclical nature. Despite this elevated risk, the ETF has achieved a Sharpe Ratio of 1.52, demonstrating that investors have historically been well compensated for the additional volatility. Furthermore, the 0.79 correlation with the S&P 500 suggests that, although semiconductor stocks remain closely linked to the broader equity market, they still provide a differentiated source of returns driven by technological innovation and AI-related capital expenditure rather than the overall economy alone.

Overall, these metrics indicate that VVSM represents a high-quality but high-expectation investment. The ETF provides exposure to financially strong, globally dominant semiconductor companies with attractive long-term growth prospects, yet its elevated valuation and above-average risk profile reinforce the importance of maintaining a long investment horizon and recognizing that future performance will increasingly depend on earnings execution rather than multiple expansion alone.

The memory manufacturers present a particularly interesting investment opportunity.(Appendix Chart 4 & 5) SK Hynix and Samsung are currently benefiting from the memory cycle which has substantially improved pricing, margins and cash generation. Due to their importance to the sector and geographical diversification, the author suggests that these holdings should complement the VVSM ETF.

Company	Revenue GrowthYoY	Operating Margin	Beta	Forward P/E
SK Hynix	257%	76.3%	2.32	4.6
Samsung Electronics	130%	52.2%	0.88	4.8

Table 2: Memory makers financial metrics

Table 2 highlights the exceptional financial performance currently being achieved by the leading memory manufacturers. SK Hynix continues to outperform the industry, reporting 257% year-over-year revenue growth and an operating margin of 76.3%, reflecting strong demand for High Bandwidth Memory (HBM) used in AI accelerators. Samsung's semiconductor business has also benefited from the AI-driven memory cycle, delivering strong revenue growth and significantly improved profitability as memory pricing and utilization continue to recover. These results demonstrate that memory has become one of the fastest-growing and most profitable segments within the semiconductor industry.

Although both companies currently trade at elevated trailing valuation multiples, forward earnings expectations paint a different picture. Consensus estimates imply a forward P/E of approximately 4.8x for SK Hynix and 4.6x for Samsung Electronics, reflecting expectations of continued earnings expansion as AI-related memory demand remains strong. These relatively modest forward valuations suggest that, despite the recent share-price appreciation, analysts expect earnings growth to outpace stock-price growth over the next twelve months. From a risk perspective, SK Hynix remains the more volatile investment, with a beta of approximately 2.3, reflecting its concentrated exposure to the cyclical memory market. Samsung, with a beta of approximately 0.88, offers a more defensive profile due to its diversified operations across semiconductors, smartphones, consumer electronics and displays.

Key Risks: Strong Fundamentals, but Expectations Are Increasingly Demanding.

Valuation Risk

AI Growth May Already Be Priced In. The most immediate risk is not that semiconductor demand fails to grow, but that current share prices already discount an unusually favorable growth trajectory. Semiconductor equities have benefited simultaneously from accelerating AI infrastructure investment, rising earnings estimates, memory-price recovery and expectations of sustained supply constraints. As a result, investors may be paying today for several years of future earnings growth.

In mid-2026, the broader VanEck semiconductor strategy was reportedly trading at a price-to-earnings multiple above 50x. At the same time, semiconductor earnings estimates had already been revised sharply higher, with consensus earnings forecasts increasing considerably in 2026. This creates asymmetric expectations risk. Strong results may no longer be sufficient to drive further appreciation as companies must continue exceeding

already elevated forecasts. Even if AI-related semiconductor revenue grows rapidly, valuation multiples could contract if growth merely meets expectations, hyperscaler capital expenditure moderates or investors demand higher risk premiums.

VVSM's recent performance illustrates this risk. The ETF has materially outperformed the broader technology-fund category, reflecting both stronger semiconductor fundamentals and significant investor enthusiasm for AI infrastructure. (Morningstar) The investment thesis should therefore distinguish between: industry growth, which remains structurally attractive. and expected investment returns, which depend on how much of that growth is already embedded in valuations. A company can deliver exceptional operating performance while its shares underperform if earnings growth falls short of what the market has priced in.

Dependence on Hyperscaler Capital Expenditure

The current semiconductor cycle is increasingly tied to spending by a small number of hyperscale cloud platforms and technology companies. Demand for GPUs, custom accelerators, networking equipment and advanced-node manufacturing ultimately depends on these companies continuing to expand AI infrastructure. Current spending plans are exceptionally large, but they also raise questions regarding returns on invested capital. AI infrastructure investment must eventually translate into sufficient cloud revenue, software monetization, productivity gains or cost savings. If the commercial returns from AI deployment are weaker or slower than expected, hyperscalers could reduce the rate of capacity additions.

Such a slowdown would affect the semiconductor value chain sequentially. Lower AI-capex growth leads to fewer accelerator orders which results to weaker chips and networking demand. Weaker demand lowers foundry utilization and reduces semiconductor-equipment investment. The sector is therefore diversified across companies, but less diversified across its underlying economic driver than the number of ETF holdings initially suggests.

Semiconductor and Memory Cyclicality

Semiconductors remain cyclical despite the structural AI growth thesis. The industry has historically alternated between periods of shortages and excess capacity because semiconductor factories require large upfront investments and several years to construct. Producers often expand capacity simultaneously during periods of strong pricing, causing supply to arrive after demand growth has begun to moderate. This risk is especially relevant for the proposed additional holdings in the Memory sector. DRAM and NAND earnings are highly sensitive to average selling prices, inventory levels, utilization and industry capital

expenditure. Small changes in supply-demand conditions can produce disproportionately large changes in margins and cash flow.

Current shortages and strong memory pricing support exceptional profitability. If production expands faster than AI demand, today's scarcity premiums could decline. The portfolio's separate memory positions would consequently increase operating leverage, but also deepen exposure to the same memory cycle.

Technology Substitution and Competitive Disruption

The semiconductor industry is characterized by rapid innovation and short technological cycles. Current market leaders must continually invest to maintain performance advantages in processor architecture, fabrication, packaging and memory bandwidth. Several forms of substitution could affect the investment thesis:

- Hyperscalers may increasingly develop custom AI accelerators, reducing their dependence on merchant GPU suppliers.
- More efficient AI models could lower the amount of compute required for a given workload.
- Improvements in inference optimization, quantization and software architecture could reduce incremental hardware demand.
- Competing memory manufacturers could narrow the technological gap in high-bandwidth memory (HBM) .
- Alternative chip architectures or packaging methods could shift profit pools within the value chain.

Efficiency improvements do not necessarily reduce total semiconductor demand because lower computing costs may stimulate greater AI usage. Nevertheless, they could change which companies capture the value. VVSM reduces individual-company risk, but it cannot eliminate the risk that profitability shifts from existing leaders toward customers, custom-chip designers or new architectures.

Manufacturing Concentration and Geopolitical Risk

Advanced semiconductor manufacturing remains geographically concentrated, particularly in Taiwan and South Korea. TSMC is central to the production of many of the world's most advanced processors, while Samsung and SK Hynix are critical to advanced-memory supply. TSMC itself identifies geopolitical tensions, supply-chain disruptions, natural disasters, utility availability and geographic manufacturing concentration among the material risks to its operations. (TSMC)

Any military escalation in the Taiwan Strait, trade blockade, earthquake, energy disruption or production interruption could materially affect global semiconductor availability. The consequences would extend beyond TSMC to fabless designers and equipment suppliers whose earnings depend on continued production at advanced foundries.

Government initiatives to expand manufacturing in the US, Europe and Japan improve long-term resilience, but geographic diversification is expensive. New facilities may operate with higher labor, construction and utility costs, potentially reducing margins or requiring continued government support.

Export Controls and US–China Fragmentation

Semiconductors have become strategic instruments of economic and national-security policy. US restrictions on exports of advanced processors and semiconductor-manufacturing equipment to China can reduce the addressable market for selected companies. China may respond through domestic substitution, restrictions on critical materials, procurement preferences or regulatory action against foreign suppliers.

Export controls also create uncertainty because rules can change faster than companies can redesign products or supply chains. Companies may develop lower-performance chips specifically for restricted markets, but these products could subsequently face tighter regulations.

The geopolitical fragmentation of the semiconductor ecosystem could reduce global economies of scale, require duplicated supply chains and increase compliance costs. Furthermore, this might limit access to major end markets and accelerate the development of Chinese competitors.

Capital Intensity and Execution Risk

Semiconductor manufacturing and memory production require exceptionally high capital expenditure. Advanced fabrication facilities can cost tens of billions of euros and must be continuously upgraded as process technology develops. This creates substantial execution risk.

If demand forecasts prove too optimistic, companies may be left with underutilized capacity and high depreciation expenses. Conversely, underinvestment can cause capacity constraints, lost market share and delays in customer qualification.

The memory companies in the proposed portfolio are particularly exposed because cash flow must fund both current production and the transition toward new generations of memory chips. Strong operating cash flow during an upcycle can therefore overstate

sustainable free-cash-flow generation if significant reinvestment is required to protect future competitiveness.

ETF and Portfolio Concentration Risk

VVSM provides company diversification but remains concentrated by sector, factor and underlying demand driver. Top 10 holdings account for 86% of the ETF.

The portfolio is likely to have significant common exposure to:

- AI infrastructure expenditure
- Technology-sector valuations
- Global industrial production
- Interest rates and discount rates
- Advanced semiconductor manufacturing
- US equity-market sentiment.

Adding SK Hynix, Samsung would improve geographic and business-model representation, but would simultaneously create a substantial memory overweight. The proposed structure should therefore be considered a core semiconductor allocation plus an active memory bet, not a fully diversified technology portfolio.

Investment Conclusion

The semiconductor industry has entered a structural growth phase driven by artificial intelligence, cloud computing and the increasing compute intensity of the global economy. Unlike previous semiconductor cycles, demand is no longer solely dependent on consumer electronics but is increasingly supported by enterprise AI infrastructure, hyperscale data centers and government-led industrial policies. These long-term trends suggest that semiconductors will remain one of the primary beneficiaries of the AI revolution over the coming decade.

Despite this attractive outlook, investors should recognize that much of the near-term optimism has already been reflected in valuations. The sector currently trades at historically elevated multiples, and future returns will depend less on multiple expansion and more on companies consistently delivering earnings above already ambitious market expectations. Furthermore, the semiconductor industry remains highly cyclical, capital intensive and exposed to geopolitical risks, particularly within advanced manufacturing and memory production.

For most long-term investors, a diversified approach is therefore preferable to concentrated stock selection. The VanEck Semiconductor ETF (VVSM) offers broad exposure across the semiconductor value chain including chip designers, foundries, equipment manufacturers and analog semiconductor companies, while reducing company-specific execution risk. However, because the ETF has relatively limited exposure to the global memory market, selectively complementing it with dedicated memory holdings provides additional exposure to one of the fastest-growing segments of AI infrastructure.

Suggested Portfolio Positioning

Investment	Allocation	Rationale
VVSM ETF	80%	Diversified Exposure
Memory (SK Hynix & Samsung)	20%	Targeted Exposure

Table 3: Portfolio Positioning

This allocation maintains diversification while expressing a high-conviction view that memory semiconductors will be among the largest beneficiaries of AI infrastructure investment. An 80/20 core-satellite structure captures the industry's structural growth potential without relying excessively on the success of any single company or technology.

Over a long investment horizon, this balanced approach offers an attractive combination of growth, diversification and thematic exposure, while acknowledging that elevated valuations and industry cyclicality may lead to periods of significant short-term volatility. The investment thesis therefore remains strongest for investors with a 5–10 year investment horizon who can tolerate above-average volatility in exchange for participation in one of the most important structural technology trends of the coming decade.

Scenario Analysis

The investment outlook for the semiconductor sector ultimately depends on the pace of artificial intelligence adoption and the sustainability of hyperscaler capital expenditure.

Moderate Scenario

Under the base-case scenario, AI infrastructure spending remains robust while memory prices stabilize at elevated levels. In this environment, the proposed portfolio allocation of 80% VVSM and 20% memory manufacturers is expected to deliver attractive long-term returns, benefiting from both diversified semiconductor exposure and continued strength in the Memory theme.

Optimistic Scenario

In a bull-case scenario, enterprise AI adoption accelerates faster than expected, leading to another wave of investment in data centers and computing infrastructure. Demand for advanced processors and memory chips continues to outpace supply, supporting higher memory prices, expanding operating margins and stronger earnings growth for companies such as SK Hynix and Samsung. Under these conditions, the memory allocation would likely outperform the broader semiconductor ETF and contribute positively to overall portfolio returns.

Conservative Scenario

Conversely, the bear-case scenario assumes that hyperscaler capital expenditure moderates, AI adoption progresses more slowly than expected, or memory supply expands faster than demand. As memory prices normalize, profitability for memory manufacturers would likely decline more rapidly than for the broader semiconductor industry. Although the proposed memory overweight would underperform in this environment, the diversified exposure provided by VVSM should help mitigate downside risk through holdings across semiconductor designers, foundries and equipment manufacturers.

Appendix

Chart 4: Operating margins for the largest memory makers (J.P Morgan)

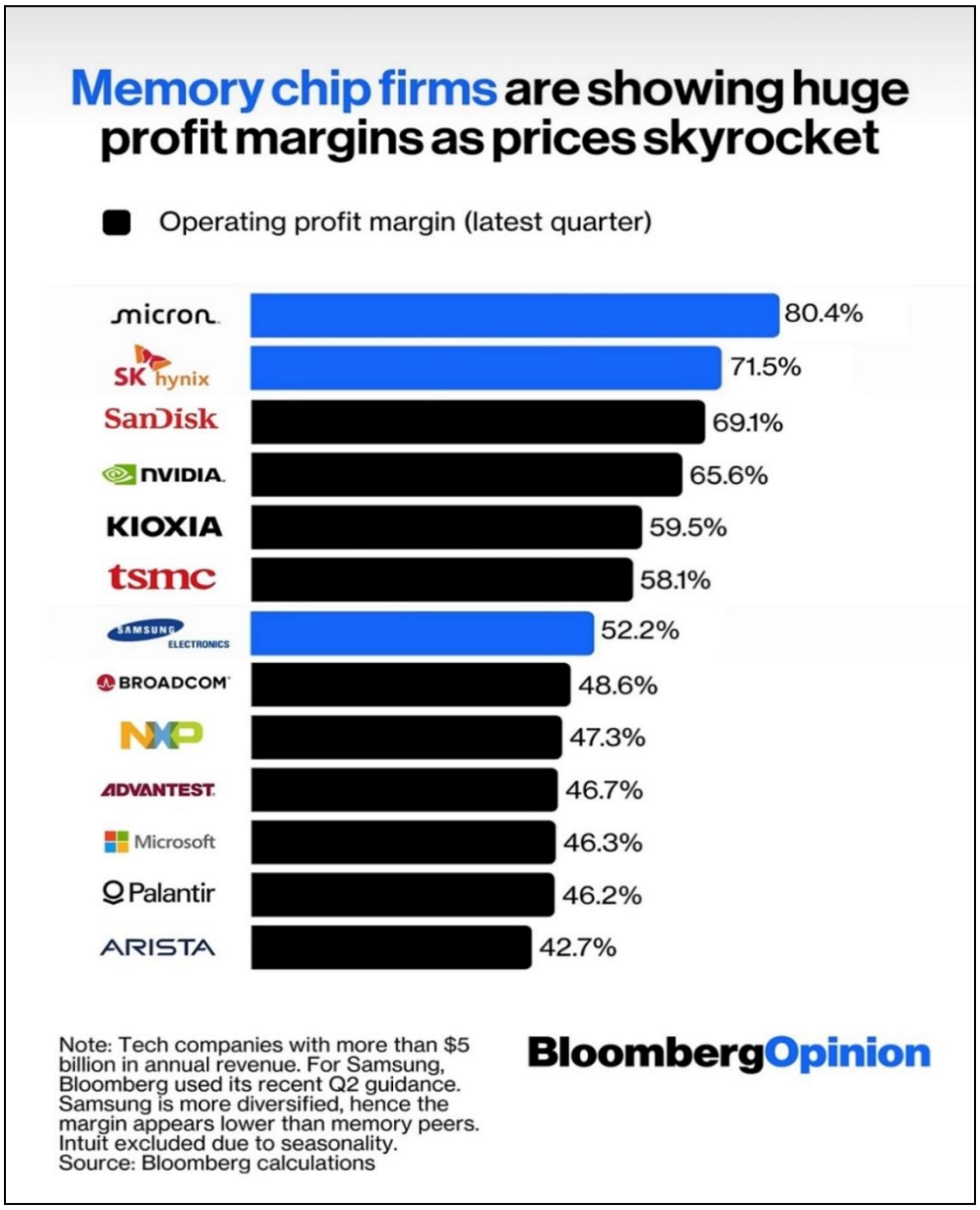

Chart 5: Memory Chips Profit Margins (Bloomberg)