US Semiconductors

State of the union: 180 or 360 degree rotation?

Industry Overview

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Equity
United States
Semiconductors

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More of the same, or rotation into laggards?

After a solid 65% run in the SOX index in 2023 (fourth best in last three decades), the key investor question is whether 2024 will bring: 1) *More of the same*? Inevitable strength in growthier/secular albeit crowded cloud/AI, memory, semicap, EDA stocks, OR 2) *Rotation into last year's laggards* in cyclical/"value" groups inc. industrial/autos, small-caps, smartphone, foundry. The arbiter could be macro: if interest rate cuts prove to be proactive/stimulate the global cyclical economy (esp. China), it supports the laggard rotation scenario. However, if the global economy remains tepid despite rate cuts, investors are likely to rotate back into tried and tested secular growth stocks. Our approach is to be consistently exposed to durable growth themes across **Cloud** (NVDA, AVGO, AMD, MRVL), **Cars** (NXPI, ON) and **Complexity** (KLAC, SNPS, ARM, CDNS).

Risks to owning chip stocks in 2024?

1) *Premium valuation*: SOX at 25x NTM PE vs SPX at 20x or 5-trun premium vs 1.2x historically (though partly due to higher multiples of cyclically depressed auto/industrial and memory stocks); 2) *Market rotation*: away from beta tech. Early days but this rotation abundantly clear in today's trading when SOX index declined -3.6% well below broader SPX down -57bps; 3) *Enhanced volatility*: influenced by unpredictable events including geopolitics, trade conflicts and upcoming elections in US and Taiwan.

But also potential rewards, we are bullish on the sector

1) *New Upcycle*: As outlined in our Year-Ahead 2024 report (see report), we could be at start of upcycle from -11% YoY sales decline in CY23 to 15%/14% industry sales growth in CY24/25E. Upcycles last 2-2.5years, with last three driving 67% average SOX returns; 2) *Generative AI in early stages*: we are only in Year 2 of what is normally a 3+ year upfront hardware deployment cycle and 10+ year success-driven cycles in new technologies (similar to 3G/4G rollouts), so too early to predict a peak; 3) *Reshoring additive to demand*: funding from global CHIPS Acts across US, Europe, Japan, China, Korea etc. could continue to provide new sources of funding for semi manufacturing.

Top 5 items on our radar

1) *Generative AI monetization*: we see solid hardware deployment and supply constrains through CY24, but AI chip stock sentiment will be driven by end-user (cloud customer, enterprise) monetization, key to NVDA, AVGO, AMD, MRVL, MU, CAMT; 2) *US CHIPS Act Grants*: start within Q1, part of reshoring thesis, most benefit to INTC, TXN, MU, semicap eqp. stocks also exposed to sustainability of China fab builds; 3) *Industrial chip inventory correction*: could last through Q1 and any recovery will require sustained global demand/ stimulus, but key to recovery in TXN, ADI, MCHP; related we also monitor any slowdown in auto/EV demand that has kept a lid on auto chip stocks ON, NXPI, WOLF and their European peers; 4) *Potential EDA industry consolidation*: see comments published in related note published on Jan 2, 2024; and 5) *Bottoming in telco demand*: likely more 2H weighted, but any troughing signs could raise interest in small-caps LITE, COHR. Telco upside could also further benefit MTSI (remains key beneficiary of strong defense exposure).

Bullish on SOX despite strong run in 2023

The SOX (semiconductor index) surged 65% in 2023, well-ahead of the 24% gain in the broader SPX index, following depressed performance in 2022 impacted by concerns around rising rates/inflation, heightened geopolitical tensions between US/China, and semi supply/demand imbalance. While these concerns persist, substantial early tailwinds from AI combined with several end markets progressing through inventory corrections drove upside during the year. We see potential for higher volatility and intra-sector rotations following the strong run in semiconductors but note secular tailwinds for the industry remain in place: 1) Continued adoption/investment in AI infrastructure, 2) Growing chip design complexity, 3) Automotive semiconductor content proliferation, and 4) Government focus on silicon independence (public investment). We continue to prefer our favored areas of Cloud, Cars, and Complexity.

Exhibit 1: Expect semi industry sales to flip from -11% YoY in CY23E to +15%/+14% YoY in CY24/25E, marking new upcycle
Semi industry model with total; and core (ex memory) semis

Revenue ($mn)	2016	2017	2018	2019	2020	2021	2022	2023E	2024E	2025E	2026E	CAGR '23-26E	CAGR '18-23	CAGR '13-23
Total Semis	$338,931	$412,221	$468,778	$412,307	$440,389	$555,607	$573,683	$511,532	$589,157	$670,768	$691,588	5.3%	1.8%	5.3%
YoY%	1.1%	21.6%	13.7%	(12.0%)	6.8%	26.2%	3.3%	(10.8%)	15.2%	13.9%	3.1%			
Memory	$76,767	$123,974	$157,967	$106,440	$117,482	$153,838	$129,801	$89,274	$131,965	$166,152	$152,403	8.6%	(10.8%)	2.9%
YoY%	(0.6%)	61.5%	27.4%	(32.6%)	10.4%	30.9%	(15.6%)	(31.2%)	47.8%	25.9%	(8.3%)			
Core Semis (ex-memory)	$262,164	$288,247	$310,812	$305,867	$322,907	$401,769	$443,882	$422,258	$457,191	$504,615	$539,185	8.5%	6.3%	5.9%
YoY%	1.6%	9.9%	7.8%	(1.6%)	5.6%	24.4%	10.5%	(4.9%)	8.3%	10.4%	6.9%			

Source: SIA, Gartner, Omdia, BofA Global Research forecasts

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With '24 on the horizon, we model semis sales up 15% YoY driven by 1) A rebound in memory (+48% YoY), 2) Continued investment in AI, and 3) Improved consumer market performance with market corrections largely finished. We expect areas of strength to offset potential weakness seen in 1H24 as corrections persist in the communications and industrial markets (and possibly have modest impacts in autos). Ex-memory, we forecast '24E semiconductor sales to grow +8% YoY. We see growth into CY25E with total semi industry sales projected to grow around 14% YoY including 10% YoY in core.

Fab equipment muted, though China, CHIPS Act drivers

Despite initial expectations for WFE spend to decline to $70bn, down more than 20% YoY in '23, clarity around restrictions in China, relative resilience in trailing edge investment (auto/industrial centric markets), and investment to support AI demand (high-bandwidth memory) supported upside from initial expectations. Indeed, we expect '23E WFE to finish around ~$87bn, down just 9% YoY. Heading into '24E, we model continued growth of +2.5% YoY, supported by continued trailing edge capacity build outs and memory spending recovery. We expect growth to accelerate in CY25E, up 9% YoY.

Exhibit 2: Wafer fab equipment (WFE) demand muted in CY24E, but could accelerate into CY25E
Wafer fab equipment demand and implied WFE intensity

	2016	2017	2018	2019	2020	2021	2022	2023E	2024E	2025E	2026E	CAGR '23-'26E	CAGR '17-'22
Wafer Fab Equipment (WFE) ($bn)	$34.5	$47.7	$55.2	$52.2	$61.1	$87.8	$95.2	$86.6	$88.8	$97.1	$105.0	6.6%	14.8%
YoY	12.6%	38.2%	15.8%	(5.4%)	17.1%	43.6%	8.4%	(9.0%)	2.5%	9.4%	8.2%		
Semiconductor sales ($bn)	$338.9	$412.2	$468.8	$412.3	$440.4	$555.6	$573.7	$511.5	$589.2	$670.8	$691.6	10.6%	6.8%
YoY	1.1%	21.6%	13.7%	(12.0%)	6.8%	26.2%	3.3%	(10.8%)	15.2%	13.9%	3.1%		
Semiconductor WFE capital intensity (% of sales)	10.2%	11.6%	11.8%	12.7%	13.9%	15.8%	16.6%	16.9%	15.1%	14.5%	15.2%		
YoY	104 bps	139 bps	21 bps	89 bps	122 bps	192 bps	78 bps	35 bps	-187 bps	-59 bps	71 bps		
Semiconductor capex ($bn)	$70.4	$93.3	$103.1	$99.4	$110.2	$152.7	$175.4	$176.8	$174.8	$185.8	$192.3	2.9%	13.5%
YoY	9.4%	32.6%	10.4%	(3.6%)	10.9%	38.5%	14.9%	0.8%	(1.1%)	6.2%	3.5%		

Source: SIA, Gartner, Omdia, BofA Global Research forecasts

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SOX tends to continue to outperform after strong year

While there are fundamental and market rotation risks, history shows the SOX index has tended to continue to outperform even after strong annual gains. For instance, prior to the 2023 surge, the SOX index exceeded 35% annual gain 10 times since 1995 and delivered double digit gains (plus outperformed SPX) in the following year 6 of those 10 times. The trend is even more favorable if one were to exclude the CY20 market crash.

Exhibit 3: SOX has appreciated 18% on average with 11 instances of 35%+ annual gains since 1995
Annual performance of the SOX and S&P 500 Indexes

	SOX	SPX	SOX Out (Under) Performance
1995	43%	34%	9%
1996	20%	20%	-1%
1997	10%	31%	-21%
1998	33%	27%	6%
1999	101%	20%	81%
2000	-18%	-10%	-8%
2001	-9%	-13%	4%
2002	-45%	-23%	-21%
2003	76%	26%	49%
2004	-15%	9%	-24%
2005	11%	3%	8%
2006	-2%	14%	-16%
2007	-13%	4%	-16%
2008	-48%	-38%	-10%
2009	70%	23%	46%
2010	14%	13%	2%
2011	-12%	0%	-12%
2012	5%	13%	-8%
2013	39%	30%	10%
2014	28%	11%	17%
2015	-3%	-1%	-3%
2016	37%	10%	27%
2017	38%	19%	19%
2018	-8%	-6%	-2%
2019	60%	29%	31%
2020	51%	16%	35%
2021	41%	27%	14%
2022	-36%	-19%	-16%
2023	65%	24%	41%

Source: Bloomberg, BofA Global Research

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Upcycles have lasted 2.4yrs and produced solid returns

Exhibit 4: Upcycles (start of YoY semis sales growth) have produced strong returns
SOX returns measured from start to end of YoY semi industry sales

	Start Date	End Date	Duration (Yrs)	SOX Return	SPX Return	Delta
UPCYCLE	May'2013	May'2015	2	68%	32%	36%
DOWNCYCLE	Jun'2015	Jun'2016	1	5%	5%	0%
UPCYCLE	Jul'2016	Nov'2018	2.4	81%	31%	50%
DOWNCYCLE	Dec'2018	Nov'2019	0.9	3%	-3%	6%
UPCYCLE	Dec'2019	Jun'2022	2.7	51%	22%	29%
DOWNCYCLE	Jul'2022	Aug'2023	1.1	49%	18%	31%
UPCYCLE AVG.			2.4	67%	28%	38%
DOWNCYCLE Avg			1.0	19%	7%	12%

Source: SIA, Bloomberg, BofA Global Research Estimates

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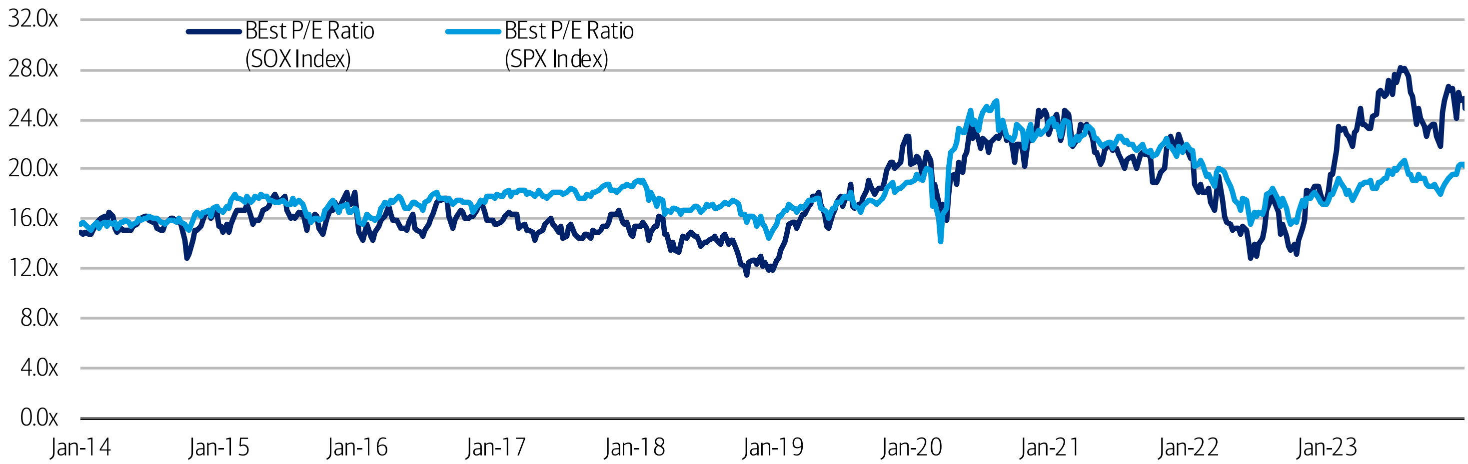
Semis at premium PE, but due to depressed cyclicals

The SOX index is currently trading at a 24.8x NTM PE, well above the broader SPX at 20.3x. The ~5x turn delta is well above the 1.2x turn delta historically (SOX at 17.7x median vs SPX at 16.5x). However, we believe the elevated premium or SOX is partly due to cyclically depressed stocks such as INTC, MU, TXN and others. The forward PE for the highest market cap chip stock and industry growth leader NVDA is a very compelling 25x NTM PE vs 32x median. In other words, we expect the PE premium to be less of a headwind as the cycle potentially improves. For instance, based on consensus estimates, the SOX and SPX are trading at a similar ~27.7x PE on ~2-year (24 month blended forward) earnings estimates.

Exhibit 5: SOX premium valuation due to depressed cyclical components, should reverse in CY25E
NTM PE multiple for SOX and SPX indexes



Source: Bloomberg

Exhibit 6: Tickers, prices and PO of key stocks highlighted in this report
iQ ratings of key stocks referenced in this report

	Rating	QRQ	Price	PO	Upside
NVDA	BUY	C-1-7	$481.68	$700.00	45.3%
AVGO	BUY	B-1-7	$1,085.38	$1,250.00	15.2%
AMD	BUY	C-1-9	$138.58	$165.00	19.1%
MRVL	BUY	C-1-7	$58.17	$68.00	16.9%
MU	BUY	B-1-7	$82.34	$100.00	21.4%
CAMT	BUY	C-1-9	$67.46	$75.00	11.2%
INTC	NEUTRAL	B-2-8	$47.80	$50.00	4.6%
TXN	NEUTRAL	B-2-7	$169.26	$175.00	3.4%
ADI	BUY	B-1-7	$193.58	$225.00	16.2%
MCHP	BUY	B-1-7	$86.56	$105.00	21.3%
ON	BUY	C-1-9	$81.45	$100.00	22.8%
NXPI	BUY	B-1-7	$221.18	$280.00	26.6%
WOLF	UNDERPERFORM	C-3-9	$43.24	$40.00	-7.5%
LITE	UNDERPERFORM	B-3-9	$52.04	$45.00	-13.5%
COHR	NEUTRAL	C-2-9	$42.12	$48.00	14.0%
MTSI	BUY	C-1-9	$90.28	$105.00	16.3%
ARM	BUY	C-1-9	$68.92	$80.00	16.1%
CDNS	BUY	B-1-9	$262.9	$315.00	19.8%
KLAC	BUY	B-1-9	$560.39	$700.00	25.8%
SNPS	BUY	B-1-9	$498.97	$650.00	30.3%

Source: Bloomberg, BofA Global Research

Glossary

ADAS: advanced driver assist system
ADI: Analog Devices
AI: Artificial Intelligence

AMD: Advanced Micro Devices
ASP: Average Selling Price
AV: Autonomous Vehicle
AVGO: Broadcom
BEV: Battery Electric Vehicle
CAMT: Camtek
CDNS: Cadence
CPU: Central Processing Unit

DRAM: Dynamic Random Access Memory
EDA: Electronic design automation
EV: Electric Vehicle

GPU Graphics Processing Unit
HF : hedge fund
IC: Integrated Circuit
IDM: Integrated Device Manufacturer
INTC: Intel
KLAC: KLA
LITE: Lumentum

MCHP: Microchip
MCU: Microcontroller
MPU: Microprocessor
MRVL: Marvell
MTSI: M/A-com
MU: Micron
NVDA: Nvidia

NXPI: NXP Semiconductor
OEM: Original Equipment Manufacturer
ON: onsemi
PC: Personal Computer

RF: Radio Frequency
SiC: Silicon Carbide
SNPS: Synopsys
SSD: Solid State Drive

TAM: Total Addressable Market

TXN: Texas Instruments

WFE: Wafer Fab Equipment
WOLF: Wolfspeed

Price objective basis & risk

Advanced Micro Devices, Inc (AMD)

Our $165 PO is based on 32x our 2025E non-GAAP EPS, which is towards the middle of AMD's historical 17x-64x range, justified by AI upside offset by slowdown in cyclical embedded/console markets.

Downside risks: 1) M&A integration risks, 2) Strong competition from larger names, 3) Lumpy nature of consumer and enterprise spending that could create delays in acceptance and success of new products, 4) High reliance on one outsourced manufacturing partner, 5) Maturity of current game console cycle.

Analog Devices Inc. (ADI)

Our $225 PO is based on 34x CY2025E EV/FCF, within its historical 15x-33x range, and justified based on ADI's best in class profitability and differentiated/secular comms exposure.

Downside risks to our price objective: 1) Economic downturn, which could reduce demand for automotive, industrial products, impacting gross margins, especially given recent capital expenditures and higher fixed cost footprint. 2) Inability to realize the planned cost synergies from the Maxim combination. 3) Competition from larger vendors, such as TXN, which have lower-cost production facilities.

Arm Holdings (ARM)

We assign a $80 PO, which is based on 44x our CY25E non-GAAP EPS. This is at the high end of peers trading at 30x-36x and is justified, in our view, given Arm's superior growth profile.

Downside risks: 1) historically cyclical nature of semiconductor units, 2) high exposure to mature smartphone market, 3) competition against established x86 in the data center, 4) emerging competition from RISC-V in low-end consumer markets, 5) rising geopolitical tensions and deterioration of Arm China relationship, 6) ongoing Qualcomm/Nuvia litigation, 7) small trading float

Broadcom Inc (AVGO)

Our $1250 price objective for Broadcom is based on 22x CY25E P/E, the upper end of its 8x-23x historical range, though justified given double-digit EPS growth and best-in-semis profitability, FCF generation, and returns.

Downside risks to our price objective are 1) semiconductor cycle risks, including sensitivity to US/China trade relations, 2) high exposure to Apple and Google with potential design out risks, 3) competitive risks in networking, smartphone, storage, enterprise software markets, 4) frequent acquirer of assets, which increases financial and integration risks, and 5) recent strategy towards moving into non-core software businesses creates execution risks.

Cadence (CDNS)

Our $315 PO is based on 46x FY25E P/E, at upper end historical 22x-52x trading range and justified in our view given the strategic importance of EDA in an increasingly fragmented global electronics supply chain.

Downside risks are: (1) Share loss in existing markets to primary competitors, (2) a broader economic downturn dampens semis R&D spending and corresponding spend on EDA tools and services, (3) escalation of US-China trade war limits CDNS' ability to sell to key customers, (4) semiconductor industry consolidation accelerates which could diminish customer spending power, (5) venture into adjacent system analysis market fails to meaningfully accelerate revenue growth and incremental investments suppress margin expansion.

Camtek (CAMT)
We assign a $75 PO which is based on 26x our non-GAAP CY25E EPS adjusted for net cash. This is well within Camtek's long-term 8x-40x range and in-line with other semicap peers which we think is fair given similar growth prospects.

Upside risks: (1) accelerated share gains vs. key competitor, Onto Innovations. (2) stronger than expected electronics demand that would tighten up semiconductor capacity further, driving increased semiconductor equipment sales. (3) potential as a target of industry consolidation.

Downside risks: (1) Slower than expected capital spending cycle. (2) heightened competition with larger players like KLA Corp. (3) historically cyclical nature of semiconductor capital spending, particularly on packaging equipment. (4) further restrictions on companies in China/Asia given high relative exposure, 5) Geopolitics conflicts.

Coherent Corp (COHR)
We assign a $48 PO based on 14x CY25E P/E, in the middle of historical 7x-26x range, given potential sales upside from hyperscaler upgrades, but partially offset by lower margin profile (versus industry).

Upside risks to our PO are 1) better than expected telco capex trends, 2) more resilient iPhone sales trends as well as continued share growth in 3D sensing, 3) quick rebound in cloud activity

Downside risks to our PO are 1) lumpy telecom/hyperscaler capex trends, 2) frequent M&A activity increasing leverage limiting valuation multiples, 3) persistent supply constraints impacting topline growth, 4) heightened trade tensions impacting opportunities in growing Asia markets.

Intel (INTC)
Our $50 price objective is based on 25x our 2025E pf-EPS ex-stock comp expense, in the middle of compute peers (15x-40x), which we view as appropriate given manufacturing uncertainties and risks of new foundry strategy.

Upside risks to our price objective are 1) clarity or breakthrough on yields for 7nm process technology, 2) new products allowing Intel to limit share loss, 3) improving product mix which can drive upside to gross margins, 4) manufacturing slip up at key foundry competitors.

Downside risks to our price objective are 1) weaker-than-expected trends in a mature PC market, which is largest revenue generator for Intel, 2) further delays in 7nm process technology and roadmap, 3) accelerated share loss to AMD, 4) more competition in profitable data center market.

KLA Corporation (KLAC)
We assign a $600 PO based on 25x CY24E P/E, at higher end KLAC's historical range of 10x-26x. KLAC's leading profit margin and less cyclical topline supports a slightly higher multiple vs. semicap peers, in our view.

Downside risks to our PO are the cyclical nature of the semiconductor capital spending and its impact on earnings, competitive price and market share issues, particularly against Applied Materials, ability to get new products and technologies into the market in a timely manner.

Lumentum Holdings (LITE)
We assign LITE a $45 PO based on 11x CY25E P/E, at the upper end of its 9x-18x historical range, justified given opportunities from potential catalysts (merger with NeoPhotonics, AI/datacom, macro rebound) that could drive sales/EPS acceleration from trough levels in the longer-term.

Downside risks are 1) continued 3D sensing share loss at large customer Apple, 2) delayed upgrades made by hyperscaler/telecom network slowing rollout of emerging high speed optical equipment, 3) competitive pressures in optical communications market weighing on price/margin, 4) consistent M&A weighing on long-term multiple.

Upside risks are 1) quick rebound in cloud activity, 2) more resilient iPhone sales trends as well as limited share loss, 3) gross margin resilience if demand comes in better than expected.

M/A-Com (MTSI)
Our $105 PO is based on a 29x CY25E P/E, within historical 14x-37x trading range and justified, in our view, as opportunities in the data center are offset by telecom weakness.

Downside risks to our price objective are: (1) Semiconductor cyclicality driven by weak macroeconomic conditions, demand or inventory corrections, (2) Large private ownership with limited public float could add volatility to the stock price, (3) Demand fluctuations in optical, aerospace and defense markets, and (4) High degree of leverage could limit M/A-Com's flexibility and ability to engage in buybacks/dividends.

Marvell Technology Group Ltd. (MRVL)
Our $68 PO is based on a 27x FY26E/CY25E pf-EPS, which is well-supported by the 20%-30%+ longer-term compounded annual EPS growth potential, and within the normal 1x-2x range for high growth semi peers.

Downside risks: 1) Integration risks in recent deals, 2) Financial risks related to going to net debt from net cash position, and in achieving expected cost synergies in a timely manner, and 3) Cyclical industry risks including potential slowdown in legacy hard disk drive, infrastructure spending, and storage assets, 4) Competitive risks against larger well resourced rivals.

Microchip (MCHP)
We assign a $105 PO based on 24x our 2025E EV/FCF. This is in line with the comparable peers trading at 16x-27x range and justified due to MCHP's mix of growth, execution, profitability, and leverage, which is in line with/quickly approaching analog peers.

Upside risks to our PO: FCF returns that are the upper end of the peer group, but not fully reflected in the company's multiple which trades at a discount to peers, inflecting/greater FCF growth going forward as MCHP deleverages its balance sheet and accelerates returns to shareholders. Downside risks to our PO: macro headwinds related to trade/COVID-19, increased competition capping any market share gains, tougher compares, GMs approaching the upper end of historical range and long term model

Micron Technology, Inc (MU)
Our $100 PO is based on 2.1x our CY25E P/B, which is within MU's long term range 0.8x-3.0x as we potentially enter the next memory upcycle.

Downside risks: (1) larger than expected memory ASP decline, (2) greater competition from China newcomers, (3) share loss to other large competitors like Samsung or SK Hynix, (4) softening of demand across major end markets such as data center, smartphones, or PCs.

NVIDIA Corporation (NVDA)
Our $700 PO is based on 27x CY25E PE ex cash, within NVDA's historical 26x-69x forward year PE range, justified given stronger growth opportunities ahead as gaming cycle troughs and data center demand potentially faces strong, long-term demand dynamics.

Downside risks to our price objective are: 1) weakness in consumer driven gaming market, 2) Competition with major public firms, internal cloud projects and other private companies in accelerated computing markets, 3) Larger than expected impact from restrictions on compute shipments to China, or additional restrictions placed on activity in the region, 4) Lumpy and unpredictable sales in new enterprise, data center, and autos markets, 5) Potential for decelerating capital returns.

NXP Semiconductors NV (NXPI)
Our PO of $280 is based on 19x 2025E EV/FCF, in line with median diversified auto/industrial compares which trade in a range of 16x-32x CY24E EV/FCF.

Downside risks: 1) Semiconductor cycle risks, 2) Lumpy nature of projects in key identification segment, 3) Some exposure to and growth driven by Apple, which could add volatility, 4) Execution risk surrounding management's capability to reengage following two-year hiatus, 5) Macroeconomic supply/demand disruption.

onsemi (ON)
Our PO of $100 PO is based on 17x 2025E P/E, in line with ON's 7x-27x trading range, in our view justified given improving profitability, though partially offset by the heavier capex required for SiC ramp.

Downside risks to our PO are: 1) Macro/cyclical risks, given high exposure to automotive and industrial markets, make ON susceptible to any potential global trade tensions/tariffs, 2) Prolonged COVID-19 headwinds limiting pace of automotive/industrial recovery, impacting utilization levels, 3) Difficulty in ramping 300mm fabrication facility limiting gross margin improvement, 4) sustained elevated capex levels relative to peers.

Synopsys (SNPS)
Our $650 PO is based on 40x 2025E P/E, at upper end of company's historical trading range (19x-49x), justified in our view as EDA investment accelerates as chip complexity rises.

Downside risks are: (1) Variability in IP/hardware sales creates issues in timing of revenue recognition, (2) competitors develop unique software capabilities displacing SNPS at core customers, (3) heightened geopolitical tensions lead to further restrictions on supplying firms in China with EDA technology.

Upside risks are: (1) Share gains in existing markets vs primary competitors, (2) increased government investment in semiconductor R&D and development as nations develop internal ecosystems, (3) material M&A that enables consistent margin expansion or further accelerates sales CAGR, (4) faster than expected cost improvements driving higher operating margin.

Texas Instruments Inc. (TXN)
Our $175 PO is based on 34x CY25E EV/FCF. In-line with historical 15x-42x range, which we believe is warranted based on TXN's best in class FCF generation and returns, and based on incremental cash flow from US CHIPS Act grants.

Risks to our price objective: 1) Macro/cyclical risks given high exposure to automotive, industrial, and telco capex markets, also makes TXN susceptible to any potential global trade tensions/tariffs, 2) Increasing capex intensity and higher depreciation burden could be a headwind to gross margins, 3) Increased R&D spending pressure to maintain an edge versus the competition, 4) Inventory cycles and potential double ordering by customers that can often create mismatches between real supply and demand, 5) Exposure to several mature markets such as PC and other consumer.

Wolfspeed Inc (WOLF)
We assign a $40 PO on 4x CY25E EV/S, in line auto tech peers, justified given the leverage to high growth prospects in automotive and communication markets, partially offset by near term profitability headwinds.

Upside risks to our PO are: (1) Faster than anticipated EV adoption with higher SiC penetration, (2) Accelerated ramp of Mohawk Valley driving stronger than expected cost improvements, (3) Slowdown in competitor investment in SiC technology, (4) Market share gains in autos or telecom.

Downside risks to our PO are: (1) lumpy 5G telecom capex and rollout of next generation base stations, (2) long-term impacts of COVID-19 reducing automotive demand, (3) higher than expected investment to sustain SiC factory production.

Analyst Certification

We, Vivek Arya, Blake Friedman and Duksan Jang, hereby certify that the views each of us has expressed in this research report accurately reflect each of our respective personal views about the subject securities and issuers. We also certify that no part of our respective compensation was, is, or will be, directly or indirectly, related to the specific recommendations or view expressed in this research report.

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US - Semiconductors and Semiconductor Capital Equipment Coverage Cluster

Investment rating	Company	BofA Ticker	Bloomberg symbol	Analyst
BUY				
	Advanced Micro Devices, Inc	AMD	AMD US	Vivek Arya
	Analog Devices Inc.	ADI	ADI US	Vivek Arya
	Applied Materials, Inc.	AMAT	AMAT US	Vivek Arya
	Arm Holdings	ARM	ARM US	Vivek Arya
	Broadcom Inc	AVGO	AVGO US	Vivek Arya
	Cadence	CDNS	CDNS US	Vivek Arya
	Camtek	CAMT	CAMT US	Vivek Arya
	KLA Corporation	KLAC	KLAC US	Vivek Arya
	Lam Research Corp.	LRCX	LRCX US	Vivek Arya
	M/A-Com	MTSI	MTSI US	Vivek Arya
	Marvell Technology Group Ltd.	MRVL	MRVL US	Vivek Arya
	Microchip	MCHP	MCHP US	Vivek Arya
	Micron Technology, Inc	MU	MU US	Vivek Arya
	Nova	NVMI	NVMI US	Vivek Arya
	NVIDIA Corporation	NVDA	NVDA US	Vivek Arya
	NXP Semiconductors NV	NXPI	NXPI US	Vivek Arya
	onsemi	ON	ON US	Vivek Arya
	Synopsys	SNPS	SNPS US	Vivek Arya
NEUTRAL				
	Advanced Energy Industries	AEIS	AEIS US	Duksan Jang
	Allegro MicroSystems	ALGM	ALGM US	Blake Friedman
	Axcelis Technologies	ACLS	ACLS US	Duksan Jang
	Coherent Corp	COHR	COHR US	Vivek Arya
	GlobalFoundries	GFS	GFS US	Vivek Arya
	Intel	INTC	INTC US	Vivek Arya
	Lattice Semiconductor	LSCC	LSCC US	Blake Friedman
	Texas Instruments Inc.	TXN	TXN US	Vivek Arya
UNDERPERFORM				
	Ambarella	AMBA	AMBA US	Vivek Arya
	Credo Technology	CRDO	CRDO US	Vivek Arya
	Lumentum Holdings	LITE	LITE US	Vivek Arya
	Qorvo Inc.	QRVO	QRVO US	Vivek Arya
	Skyworks Solutions, Inc.	SWKS	SWKS US	Vivek Arya
	Teradyne	TER	TER US	Vivek Arya
	Wolfspeed Inc	WOLF	WOLF US	Vivek Arya

Disclosures

Important Disclosures

Equity Investment Rating Distribution: Electronics Group (as of 31 Dec 2023)

Coverage Universe	Count	Percent	Inv. Banking Relationships [R1]	Count	Percent
Buy	32	54.24%	Buy	13	40.63%
Hold	11	18.64%	Hold	3	27.27%
Sell	16	27.12%	Sell	4	25.00%

Equity Investment Rating Distribution: Technology Group (as of 31 Dec 2023)

Coverage Universe	Count	Percent	Inv. Banking Relationships [R1]	Count	Percent
Buy	215	53.09%	Buy	111	51.63%
Hold	97	23.95%	Hold	45	46.39%
Sell	93	22.96%	Sell	24	25.81%

Equity Investment Rating Distribution: Global Group (as of 31 Dec 2023)

Coverage Universe	Count	Percent	Inv. Banking Relationships [R1]	Count	Percent
Buy	1895	53.62%	Buy	1083	57.15%
Hold	832	23.54%	Hold	454	54.57%
Sell	807	22.84%	Sell	383	47.46%

[R1] Issuers that were investment banking clients of BofA Securities or one of its affiliates within the past 12 months. For purposes of this Investment Rating Distribution, the coverage universe includes only stocks. A stock rated Neutral is included as a Hold, and a stock rated Underperform is included as a Sell.

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Investment rating	**Total return expectation (within 12-month period of date of initial rating)**	**Ratings dispersion guidelines for coverage cluster**[R2]
Buy	≥ 10%	≤ 70%
Neutral	≥ 0%	≤ 30%
Underperform	N/A	≥ 20%

[R2] Ratings dispersions may vary from time to time where BofA Global Research believes it better reflects the investment prospects of stocks in a Coverage Cluster.

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