

US Semiconductors

Cloud Capex Preview: Investment cycle to remain strong through the year and beyond

Industry Overview

'24 cloud capex on track to grow 20% YoY

Data center a key theme in Week 2 of semis earnings, with four major US hyperscalers (Microsoft, Alphabet, Amazon, and Meta) set to report this week. Main points heading into earnings: 1) After 3 qtrs of annual declines, consensus expects Q4 US hyperscaler capex to reach ~\$45bn, up +7% YoY, led by Google/Microsoft (up 30%/65% YoY); 2) Q1 US capex expectations of \$44bn down slightly QoQ, but up >20% YoY, again driven by Google/Microsoft (+38%/63% YoY); and 3) CY24 capex outlook on global basis (major US + China hyperscalers) projected to reach record \$196bn – up roughly 20% YoY, with all US hyperscalers up at least 10% YoY (Oracle at +40% YoY). Growth is expected to be strong across both US (+18% YoY, growth across all hyperscalers) and China (+64% YoY, rebounding to CY21 levels). With CY23 cloud capex down 1%-2% YoY, we believe we are in the early stages of the next capex upcycle – typically supporting 3 years of capex growth >15% YoY (seen following 2015/19 downcycles). We remain confident in AI supporting multiple years of investment. AI infrastructure cycle is only at the start of year 2, and pivotal to support the foundation of the emerging AI apps/software. NVDA remains top pick, but highlight other top beneficiaries including AMD, MRVL, and AVGO.

AI demand expands well beyond the Tier-1 hyperscalers

While much focus is on large hyperscalers, AI support broad-based. Enterprises holding large amounts of data (healthcare, finance, etc.) are actively looking to deploy AI models to increase operational efficiency/assist in developing new insights. We highlight an important partnership between Nvidia and Equinix, enabling enterprises to buy NVDA DGX systems and have Equinix install/operate these systems inside International Business Exchange (IBX) data centers around the world. ServiceNow's recent earnings saw important boost from AI Pro Plus offerings (see Brad Sills' [takeaways report](#)), and Equinix' ability to support AI infrastructure should only help in allowing more enterprises access to AI. We also highlight Apple as a potential key enterprise driver, which we expect could require billions in investment to support AI edge/smartphone initiatives (see Wamsi Mohan's [upgrade report](#)). Separately, several mid/small-sized cloud/data vendors making substantial investments in AI over the past few months, including Yotta (Indian data center operator which purchased additional \$500mn GPUs from NVDA, adding to 16k+ GPU delivery expected by mid-2024) and CoreWeave (recently announced its purchase of "thousands" of Dell PowerEdge servers, with several incorporating H100 GPUs).

Main AI data points remain solid indicating n-t momentum

Recent data points from critical industry participants also remain positive: 1) Meta CEO mentioned his company targeting to have 350k NVDA H100s, or roughly 600k H100 equivalents of compute, 2) Better than expected results from SuperMicro (DecQ revenue ~30% above initial expectations, MarQ beat by >25%, AI/GPU and rack-scale solutions >50% of total revenue), 3) Tesla CEO stating the company will spend \$500mn more on Nvidia products this year, and 4) TSMC increasing its long-term AI target as percent of sales from low-teens to high-teens by 2027 (and indicating even further upside). While industry capacity constraints are easing as supply of AI chips become more available, we see healthy demand from hyperscalers, looking to expand their infrastructure and maintain a competitive advantage.

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Equity
United States
Semiconductors

Vivek Arya
Research Analyst
BofAS
+1 646 855 1755
vivek.arya@bofa.com

Blake Friedman
Research Analyst
BofAS
+1 646 556 1850
blake.friedman@bofa.com

Duksan Jang
Research Analyst
BofAS
+1 646 556 4825
duksan.jang@bofa.com

Lauren Guy
Research Analyst
BofAS
+1 646 855 4273
lauren.guy2@bofa.com

Glossary

AI: Artificial Intelligence

AMD: Advanced Micro Devices

AVGO: Broadcom

GPU: Graphics Processor

MRVL: Marvell

NVDA: Nvidia

n-t: near-term

TSMC: Taiwan Semi

Cloud Capex Overview

Exhibit 1: Summary of Cloud Capex Outlook

Consensus aggregate projections suggests capex across major cloud vendors can grow >20% YoY

CapEx (\$mn)	C1Q23	C2Q23	C3Q23	C4Q23E	C1Q24E	C2Q24E	C3Q24E	C4Q24E	C1Q25E	C2Q25E	C3Q25E	C4Q25E	2022	2023E	2024E	2025E
Total US	36,573	35,415	38,308	44,872	44,142	44,923	45,137	48,931	48,175	48,055	49,479	56,387	157,932	155,168	183,132	202,095
Google	6,289	6,888	8,055	9,880	8,702	8,859	9,114	9,666	9,497	9,486	9,905	10,821	31,485	31,112	36,340	39,708
Microsoft	6,607	8,943	9,917	10,341	10,739	11,341	11,099	11,317	11,419	12,036	12,126	12,457	24,768	35,808	44,495	48,038
Amazon	14,207	11,455	12,479	15,050	14,269	13,767	14,523	16,671	16,404	15,290	16,293	20,698	63,645	53,191	59,231	68,685
Meta	6,842	6,216	6,543	8,520	7,862	8,082	8,289	9,133	8,592	8,793	8,984	10,189	31,356	28,121	33,365	36,558
Oracle	2,628	1,913	1,314	1,080	2,571	2,874	2,112	2,144	2,263	2,450	2,172	2,222	6,678	6,935	9,701	9,107
Total China	1,197	1,746	2,145	3,031	2,743	3,324	3,624	3,616	2,889	3,604	3,756	4,012	9,410	8,119	13,307	14,261
Alibaba	366	828	564	1,106	1,198	1,972	2,037	1,459	1,267	2,142	2,084	1,609	5,490	2,864	6,665	7,102
Tencent	642	545	1,097	1,516	1,195	991	1,170	1,682	1,345	1,087	1,218	1,861	2,703	3,800	5,038	5,511
Baidu	189	373	484	409	350	361	418	475	277	375	454	542	1,217	1,455	1,604	1,649
Total	37,770	37,161	40,453	47,903	46,885	48,247	48,761	52,547	51,064	51,659	53,236	60,399	167,342	163,286	196,439	216,357
YoY %																
Total US	(0.1%)	(7.8%)	(6.6%)	7.1%	20.7%	26.8%	17.8%	9.0%	9.1%	7.0%	9.6%	15.2%	20.9%	(1.8%)	18.0%	10.4%
Google	(35.7%)	0.9%	10.7%	30.1%	38.4%	28.6%	13.1%	(2.2%)	9.1%	7.1%	8.7%	11.9%	27.8%	(1.2%)	16.8%	9.3%
Microsoft	23.7%	30.2%	57.8%	64.8%	62.5%	26.8%	11.9%	9.4%	6.3%	6.1%	9.3%	10.1%	6.7%	44.6%	24.3%	8.0%
Amazon	(5.0%)	(27.1%)	(23.8%)	(9.3%)	0.4%	20.2%	16.4%	10.8%	15.0%	11.1%	12.2%	24.2%	4.2%	(16.4%)	11.4%	16.0%
Meta	25.7%	(17.9%)	(30.1%)	(5.2%)	14.9%	30.0%	26.7%	7.2%	9.3%	8.8%	8.4%	11.6%	68.3%	(10.3%)	18.6%	9.6%
Oracle	138.7%	34.4%	(23.6%)	(55.6%)	(2.2%)	50.2%	60.8%	98.5%	(12.0%)	(14.8%)	2.8%	3.7%	114.2%	3.8%	39.9%	(6.1%)
Total China	(58.2%)	(28.0%)	(1.7%)	56.4%	129.3%	90.4%	68.9%	19.3%	5.3%	8.4%	3.7%	11.0%	(27.2%)	(13.7%)	63.9%	7.2%
Alibaba	(74.8%)	(50.1%)	(63.4%)	31.7%	227.3%	138.2%	261.0%	31.9%	5.8%	8.6%	2.3%	10.3%	(9.0%)	(47.8%)	132.8%	6.6%
Tencent	(41.6%)	21.1%	228.4%	85.1%	86.1%	81.9%	6.6%	10.9%	12.5%	9.6%	4.1%	10.7%	(48.0%)	40.6%	32.6%	9.4%
Baidu	(39.6%)	17.7%	57.1%	46.3%	85.8%	(3.3%)	(13.7%)	16.1%	(20.8%)	3.9%	8.8%	14.0%	(28.1%)	19.6%	10.3%	2.8%
Total	(4.3%)	(9.0%)	(6.3%)	9.3%	24.1%	29.8%	20.5%	9.7%	8.9%	7.1%	9.2%	14.9%	16.6%	(2.4%)	20.3%	10.1%
Cap. intensity (%)																
Total US	12.6%	11.4%	11.9%	12.8%	14.0%	13.4%	13.0%	12.5%	13.7%	12.9%	12.8%	13.0%	13.6%	12.2%	13.2%	13.1%
Google	9.0%	9.2%	10.5%	13.9%	13.3%	12.8%	12.8%	12.3%	13.1%	12.3%	12.4%	12.3%	11.1%	10.7%	12.8%	12.5%
Microsoft	12.5%	15.9%	17.5%	16.9%	17.6%	17.5%	17.1%	16.5%	16.7%	16.5%	16.5%	16.1%	12.1%	15.8%	17.2%	16.4%
Amazon	11.2%	8.5%	8.7%	9.1%	10.0%	9.2%	9.1%	9.0%	10.4%	9.2%	9.2%	10.1%	12.4%	9.3%	9.3%	9.7%
Meta	23.9%	19.4%	19.2%	21.8%	23.4%	22.2%	21.8%	21.0%	22.5%	21.5%	21.0%	21.1%	26.9%	21.0%	22.0%	21.5%
Oracle	21.2%	13.8%	10.6%	8.3%	19.4%	19.5%	15.7%	15.3%	15.7%	15.4%	14.7%	14.5%	14.5%	13.4%	17.5%	15.1%
Total China	2.1%	2.9%	3.8%	4.8%	4.7%	5.3%	5.8%	5.2%	4.5%	5.2%	5.3%	5.3%	4.2%	3.4%	5.3%	5.1%
Alibaba	1.2%	2.5%	1.8%	3.0%	3.9%	5.7%	6.0%	3.7%	3.8%	5.7%	5.6%	3.8%	4.4%	2.2%	4.8%	4.7%
Tencent	2.9%	2.6%	5.1%	6.9%	5.3%	4.4%	5.0%	7.0%	5.2%	4.2%	4.5%	6.8%	3.3%	4.4%	5.4%	5.2%
Baidu	4.2%	7.7%	10.2%	8.3%	7.6%	7.1%	8.0%	8.7%	5.5%	6.6%	7.7%	8.9%	6.9%	7.6%	7.9%	7.3%
Total	10.9%	10.0%	10.6%	11.6%	12.6%	12.1%	11.9%	11.4%	12.3%	11.7%	11.6%	11.8%	12.1%	10.8%	12.0%	11.8%

Source: BofA Global Research estimates, Bloomberg

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Stocks mentioned

Prices and ratings for stocks mentioned in this report

BofA Ticker	Bloomberg ticker	Company name	Price	Rating
AMD	AMD US	Advanced Micro	US\$ 177.83	C-1-9
AVGO	AVGO US	Broadcom	US\$ 1217.77	B-1-7
MRVL	MRVL US	Marvell	US\$ 70.14	C-1-7
NVDA	NVDA US	NVIDIA	US\$ 624.65	C-1-7

Source: BofA Global Research



Price objective basis & risk

Advanced Micro Devices, Inc (AMD)

Our \$195 PO is based on 38x 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.

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.

Marvell Technology Group Ltd. (MRVL)

Our \$80 PO is based on a 32x 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.

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.

Analyst Certification

I, Vivek Arya, hereby certify that the views expressed in this research report accurately reflect my personal views about the subject securities and issuers. I also certify that no part of my compensation was, is, or will be, directly or indirectly, related to the specific recommendations or view expressed in this research report.

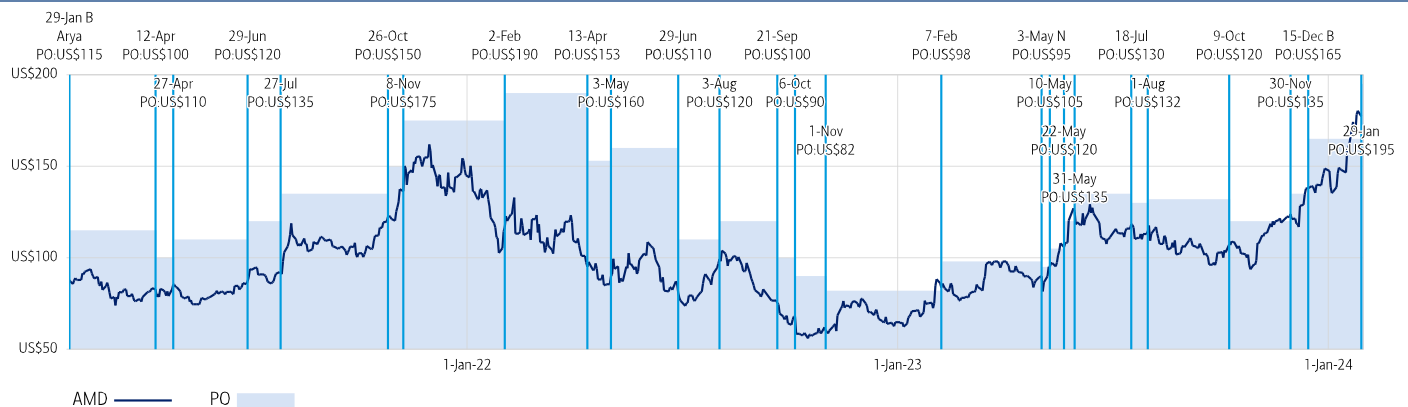
US - Semiconductors and Semiconductor Capital Equipment Coverage Cluster

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

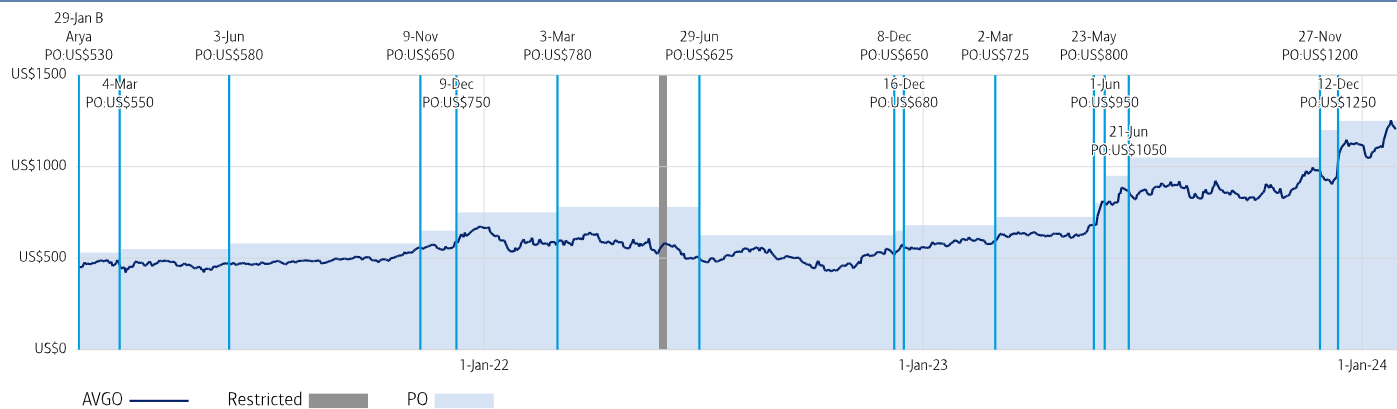
Disclosures

Important Disclosures

Advanced Micro (AMD) Price Chart

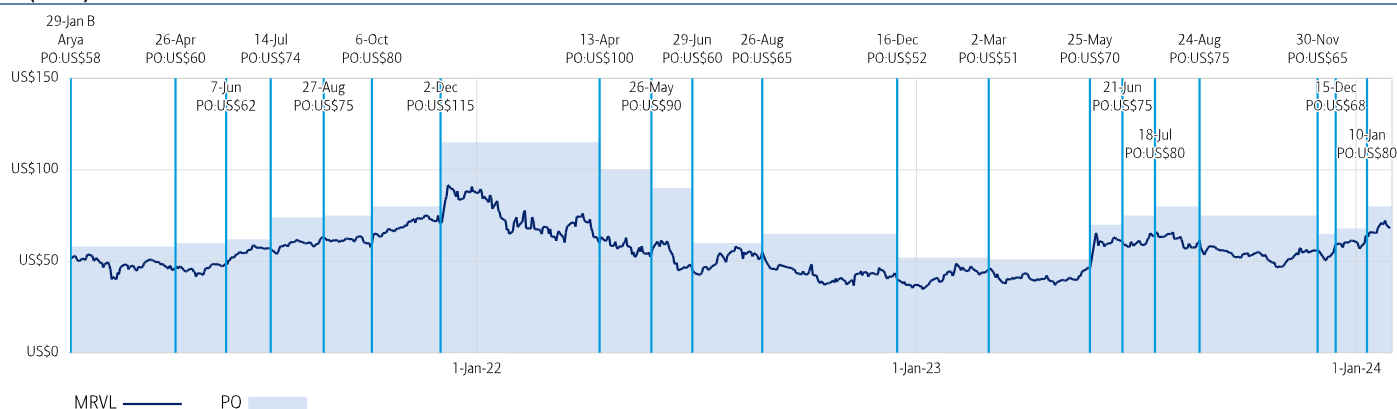


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Broadcom (AVGO) Price Chart

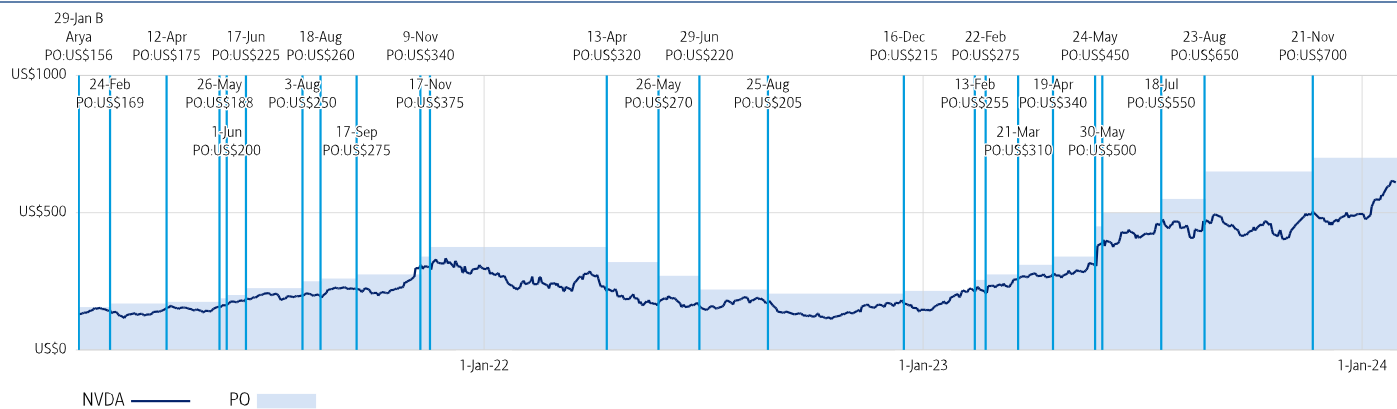
B: Buy, N: Neutral, U: Underperform, PO: Price Objective, NA: No longer valid, NR: No Rating

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Marvell (MRVL) Price Chart

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NVIDIA (NVDA) Price Chart

B: Buy, N: Neutral, U: Underperform, PO: Price Objective, NA: No longer valid, NR: No Rating

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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%

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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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