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US Semiconductor Equipment

2024 Playbook: In Like a Lion, Out Like a Lamb; Staying Long

CITI'S TAKE

We believe the semi cap group bottomed in October 2022 and the cycle remains in “Phase 2”, where our stock-picking framework prefers equipment makers to wafer starts driven stocks. We expect the group to grind higher on positive capex revisions, particularly DRAM memory, and drive upside to Street 2024 (down 2% vs Citi +5%) and 2025 wafer fab equipment (up 10% vs Citi +30%) revenue estimates. Our 2025 peak earnings sensitivity analysis shows Buy rated LRCX/AMAT/KLAC have ~30% further upside using peak multiples which remain 20% below prior peak average.

Move LRCX to #1 Pick — We move LRCX to #1 pick up from prior #2 on memory cycle recovery in 2024. We believe the stock is not pricing-in a recovery in NAND spend which we expect to pick up late this year into 2025. We move AMAT down to #2 pick as mature logic sales aka ICAPS is expected to be down Y/Y in 2024. Both stocks remain best positioned to benefit from the rise in deposition/etch spend intensity from gate all around (GAA), backside power, and advanced packaging including HBM DRAM megatrends.

WOLF Least Preferred Pick — We see risk to SiC opportunity due to competition and a slowdown in auto demand in 2024.

Key Investor Debates — **a) WFE outlook** - We assume 2023/24/25 WFE model to reach \$81B/\$85B/\$110B sales; **b) China Domestic Spend Sustainability** - Looking forward into 2024/25, we expect China domestic WFE spend to stabilize at a roughly \$20B annual run rate and the proportion of domestic China WFE spend to decline to 18% in 2025. We assume China will remain an important contributor to global WFE on the mature nodes and expect spending in other regions like US and Japan to pick up, and **c) Valuations** – Group trades on average at 20x P/E above 5-year average of 16x but 20% below peak 24x P/E.

Downside Risk — A prolonged period of macro weakness poses the biggest risk to our 2024/25 WFE assumptions.

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See Appendix A-1 for Analyst Certification, Important Disclosures and Research Analyst Affiliations.

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Semiconductor Capital Equipment

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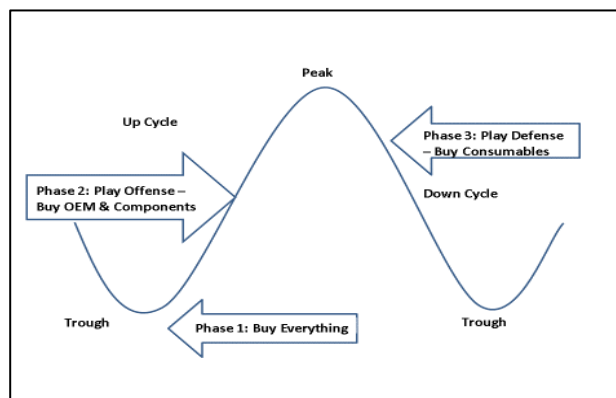
1. Coverage Picks

Figure 1. Top & Bottom Coverage Picks

	Ticker	Rating	Price (1/8/24)	Target Price	Yield (%)	ETR (%)
Most Preferred						
Lam Research	LRCX	Buy	\$752.0	\$800	1.06%	7%
<i>Memory derivative play on 2024 recovery and GAA inflection in 2025+</i>						
Applied Materials	AMAT	Buy	\$151.0	\$170	0.84%	13%
<i>Best play on DRAM recovery in 2024 & GAA inflection in 2025+</i>						
KLA	KLAC	Buy	\$556.3	\$570	1.03%	3%
<i>Defensive pick w/outsized auto SiC exposure</i>						
Least Preferred						
Wolfspeed	WOLF	Neutral	\$40.0	\$35	0.00%	-13%
<i>Risk to SiC opportunity due to competition and slower than expected MV fab ramp/auto demand</i>						
FormFactor	FORM	Neutral	\$38.8	\$37	0.00%	-5%
<i>Valuation and China memory dislocation</i>						
Entegris	ENTG	Neutral	\$112.6	\$94	0.35%	-16%
<i>Gross margins reset due to company & industry specific issues</i>						

Source: Citi Research, FactSet

Figure 2. Sector Stock Picking Framework – We are still in Phase 2



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Source: Citi Research

2. WFE Model

Figure 3. WFE Model

Citi Top Spender Model					
(US\$ millions)	21	22	23E	2023/24 CAPEX Outlook/WFE GUIDE	24E
Global Foundries	\$1,800	\$3,100	\$2,000	CY23 \$2B; CY24 material Y/Y reduction	\$1,300
Intel	\$20,329	\$24,844	\$24,717	CY23 no guide but at mid 30% net capital intensity across 2023 and 2024 in aggregate; capital offsets towards the higher end of 20-30% and land mostly in 2024	\$27,000
Micron Technology	\$10,557	\$11,251	\$7,023	FY23 (ends Aug) \$7.7B; FY24 \$7.5-8B and WFE down Y/Y	\$9,832
Nanya Technology	\$355	\$587	\$425	CY23 NT \$15B (WFE less than 50% of total)	\$553
WDC Alliance	\$3,000	\$2,700	\$2,200	FY23 (ends Jun) gross capex \$2.2B; FY24 significantly lower than FY23	\$1,200
Samsung	\$38,045	\$41,798	\$42,000	CY23 no guide	\$43,260
TSMC	\$30,040	\$36,300	\$30,855	CY23 \$32B	\$30,000
UMC	\$1,800	\$2,700	\$3,000	CY23 capex \$3B	\$2,500
China (domestic)	\$15,000	\$15,250	\$20,000	Hua Hong CY23/24 \$1.1B/\$2B	\$20,000
Top Spender Capex \$MM	\$132,619	\$155,109	\$138,328		\$144,380
Y/Y %	35%	17%	-11%		4%
Total Semi Capex \$MM	\$149,010	\$174,279	\$155,425		\$162,224
Wafer Fab Equipment \$MM	\$85,215	\$95,854	\$80,627	LRCX: \$80B range in CY23; KLAC: ~\$80B; TEL \$85-\$90B	\$85,029
Y/Y %	46%	12%	-16%		5%
Segment WFE Breakdown \$MM					
Logic (Foundry + IDM)	\$56,697	\$63,337	\$62,439		\$63,430
Y/Y %	52%	12%	-1%		2%
Memory	\$28,607	\$32,937	\$18,110		\$21,543
Y/Y %	35%	15%	-45%		19%
DRAM	\$12,767	\$14,144	\$9,848		\$12,821
Y/Y %	59%	11%	-30%		30%
NAND	\$15,840	\$18,793	\$8,263		\$8,721
Y/Y %	21%	19%	-56%		6%

Semiconductor Consumables:

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023E	2024E
Area Shipments (MSI)	9,043	9,031	9,067	10,098	10,435	10,738	11,810	12,732	11,810	12,407	14,165	14,713	12,614	13,119
Y/Y	-2%	0%	0%	11%	3%	3%	10%	8%	-7%	5%	14%	4%	-14%	4%

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023E	2024E
Fabrication Materials (\$M)	24,219	23,464	22,975	24,250	23,972	24,841	28,187	33,009	32,758	35,002	40,424	44,667	40,450	43,068
Y/Y	5%	-3%	-2%	6%	-1%	4%	13%	17%	-1%	7%	15%	10%	-9%	6%

Source: Citi Research, Company Reports

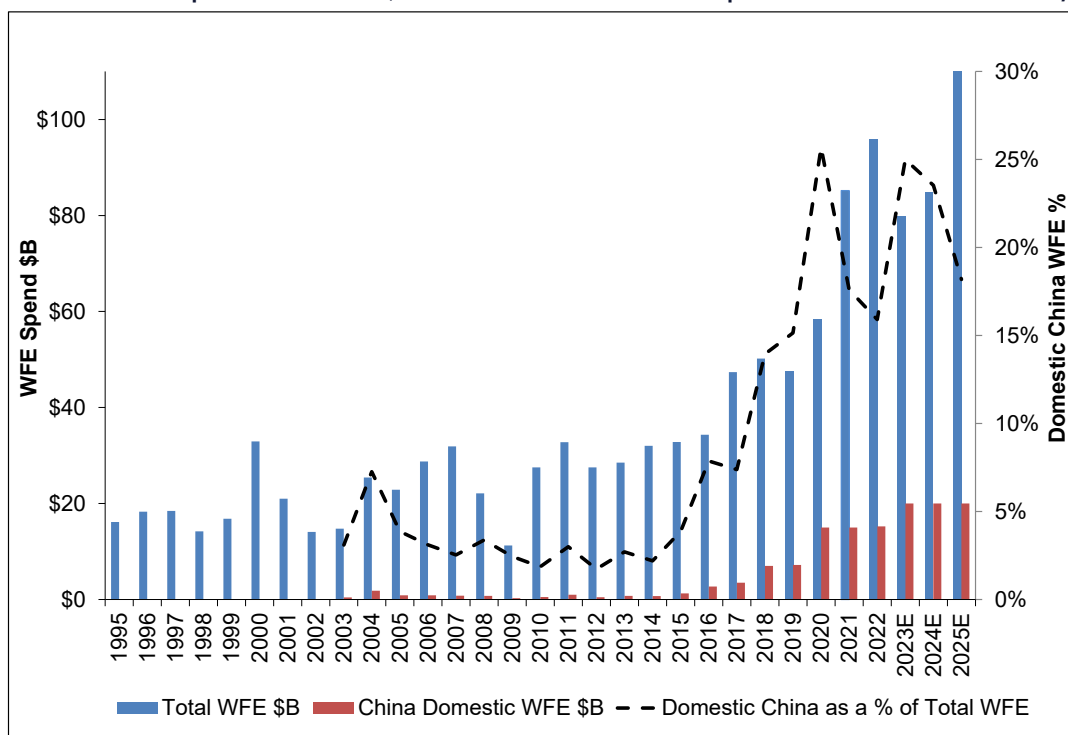
3. Key Investor Debate

Figure 4. Street expects WFE down 2% vs Citi +5% Y/Y in 2024 (Citi assumes 2023 WFE @ 43% Big 3 WFE share ~\$81B)

Revenues (Cons)	2022	2023E	2024E	2025E
AMAT (Silicon System Group)	\$19,392	\$19,578	\$19,295	\$20,692
Y/Y %	12%	1%	-1%	7%
LRCX (Systems)	\$12,387	\$9,518	\$9,211	\$10,682
Y/Y %	13%	-23%	-3%	16%
KLAC (Products)	\$7,845	\$7,893	\$7,642	\$8,280
Y/Y %	25%	1%	-3%	8%
Big Three (\$M)	\$39,624	\$36,989	\$36,148	\$39,654
Y/Y %	15%	-7%	-2%	10%

Revenues (Citi)	2022	2023E	2024E	2025E
AMAT (Silicon System Group)	\$19,392	\$19,285	\$19,800	\$21,300
Y/Y %	12%	-1%	3%	8%
LRCX (Systems)	\$12,387	\$8,265	\$9,630	\$11,399
Y/Y %	13%	-33%	17%	18%
KLAC (SPC)	\$7,079	\$6,311	\$6,644	\$7,725
Y/Y %	36%	-11%	5%	16%
Big Three (\$M)	\$38,858	\$33,861	\$36,073	\$40,423
Y/Y %	16%	-13%	7%	12%

Citi expects China domestic spend to sustain ~\$20B in 2024 and China WFE spend % mix to decline in 2024/25



Source: Citi Research, Company Reports, FactSet

- China's march towards its "[Made in China 2025](#)" initiative increased domestic wafer fabrication equipment (WFE) spend to a 38% CAGR over the last ten years—to roughly \$20 billion in 2023, or about 25% of the total global WFE, compared to the non-China WFE CAGR of 8%. However, China domestic spend has slowed to a 23% CAGR in the last five years (vs. non-China at about 7%) as

the US government put restrictions on leading-edge semiconductor manufacturing in China due to military end-use reasons.

- Although US semi equipment companies are not able to ship certain advanced equipment to China following the US export control in October 2022, mature-node demand in China soared in 2023 as domestic companies built fabs and ramped up production, particularly for silicon carbide (SiC) or EV-related projects where China aspires to be a market leader. We don't expect the updated restrictions in October 2023 will have a material incremental impact on semi equipment companies, as most of the export control impact already took place in 2022. We believe China domestic WFE spend was split at one-third each across new fabs, established foundries, and domestic memory makers in 2023. We estimate that China is ramping up about 30 new projects on the mature nodes, with 50% of them SiC or EV related.
- Looking forward into 2024/25, we expect China domestic WFE spend to stabilize at a roughly \$20 billion annual run rate and the proportion of domestic China WFE spend to decline to 18% in 2025. We assume China will remain an important contributor to global WFE on the mature nodes and expect spending in other regions like US and Japan to pick up. We forecast total WFE spend to be \$81 billion in 2023 and \$85 billion in 2024, before moving higher to \$110 billion in 2025, driven by higher Japan/US spending and a stable capital intensity of about 15% due to growing complexity in semiconductor devices (see report [The US-China Chip Rivalry: A Playbook for Who Wins and Who Loses](#)).

4. Where are we in the Cycle?

Figure 5. Cyclical Growth Mistaken for a Mature Cyclical...

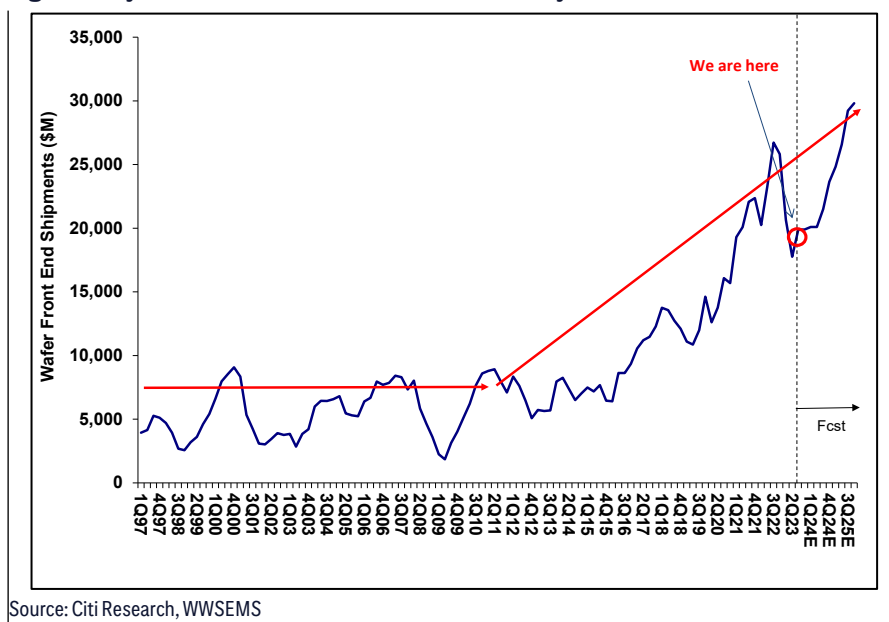
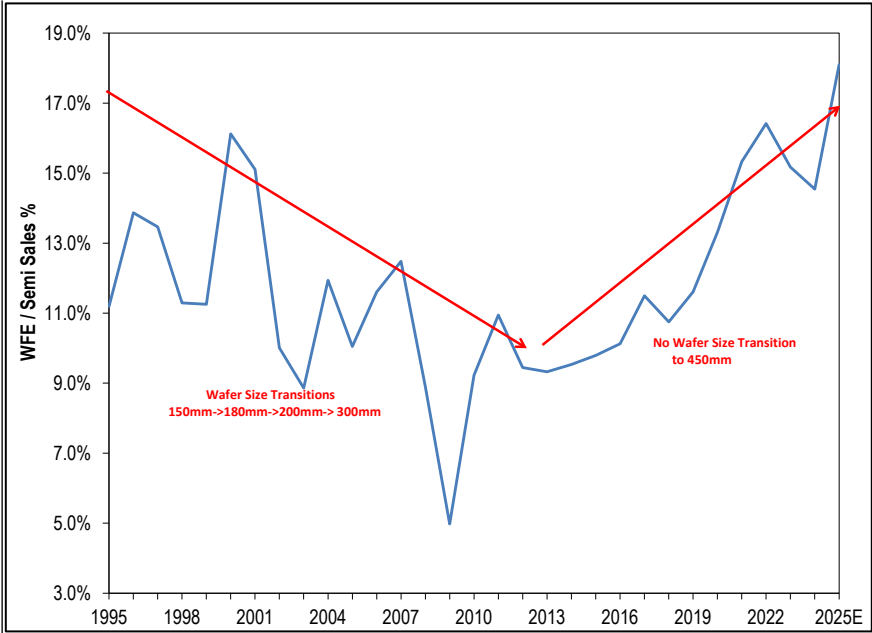
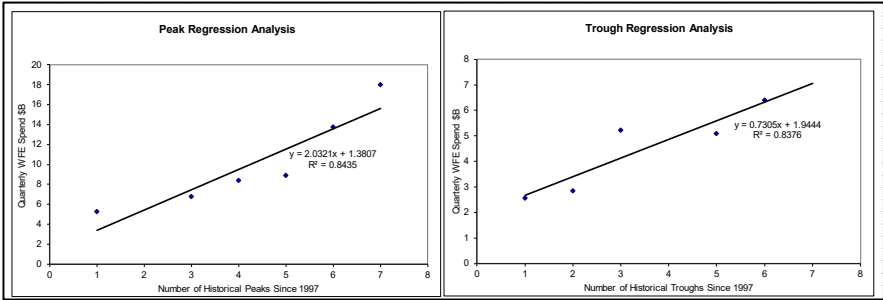


Figure 6. ...Underpinned by Rising L/T WFE Capital Intensity



Source: Citi Research, WWSEMS

Figure 7. Historical WFE Peak Regression Analysis Points to \$100B+ Peak WFE in 2025



Source: Citi Research, WWSEMS

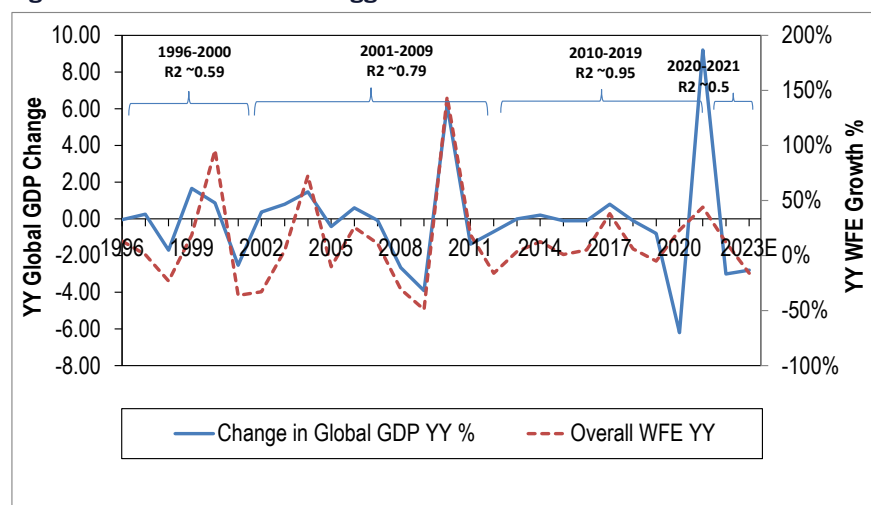
5. Peak Earnings Analysis

Figure 8. 2025 Peak Earnings Scenario Analysis

	2025 WFE Share %	2025 Bear/Base/Bull Peak WFE			2023E
		\$90	\$110	\$120	
AMAT	21.0%				
Silicon Revs (\$M)		\$18,900	\$23,100	\$25,200	\$19,285
Services Revs (\$M)		\$7,708	\$7,708	\$7,708	\$5,828
Display Revs (\$M)		\$936	\$936	\$936	\$936
Total Revs (\$M)		\$27,544	\$31,744	\$33,844	\$26,227
EPS \$		\$8.08	\$8.59	\$8.85	\$7.92
Peak Value					Upside %
P/E - 5 year avg	15x	\$121	\$129	\$133	
P/E - 3 year avg	16x	\$129	\$137	\$142	
P/E - prior peak	22x	\$178	\$189	\$195	25%
KLAC	5.5%				
System Revs (\$M)		\$4,950	\$6,050	\$6,600	\$6,311
Services Revs (\$M)		\$2,755	\$2,755	\$2,755	\$2,276
EPC Revs (\$M)		\$1,051	\$1,051	\$1,051	\$1,051
Total Revs (\$M)		\$8,755	\$9,855	\$10,405	\$9,638
EPS \$		\$29.89	\$30.96	\$31.50	\$30.75
Peak Value					Upside %
P/E - 5 year avg	17x	\$508	\$526	\$535	
P/E - 3 year avg	19x	\$568	\$588	\$598	
P/E - prior peak	24x	\$717	\$743	\$756	32%
LRCX	17.0%				
System Revs (\$M)		\$15,300	\$18,700	\$20,400	\$8,265
Services Revs (\$M)		\$7,936	\$7,936	\$7,936	\$6,001
Total Revs (\$M)		\$23,236	\$26,636	\$28,336	\$14,269
EPS \$		\$36.87	\$40.69	\$42.59	\$26.82
Peak Value					Upside %
P/E - 5 year avg	16x	\$590	\$651	\$681	
P/E - 3 year avg	18x	\$664	\$732	\$767	
P/E - prior peak	25x	\$922	\$1,017	\$1,065	34%

Source: Citi Research, Gartner

Figure 9. Macro Remains the Biggest Risk to Peak WFE in 2025



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Source: Citi Research, WWSEMS

6. Stock Performance

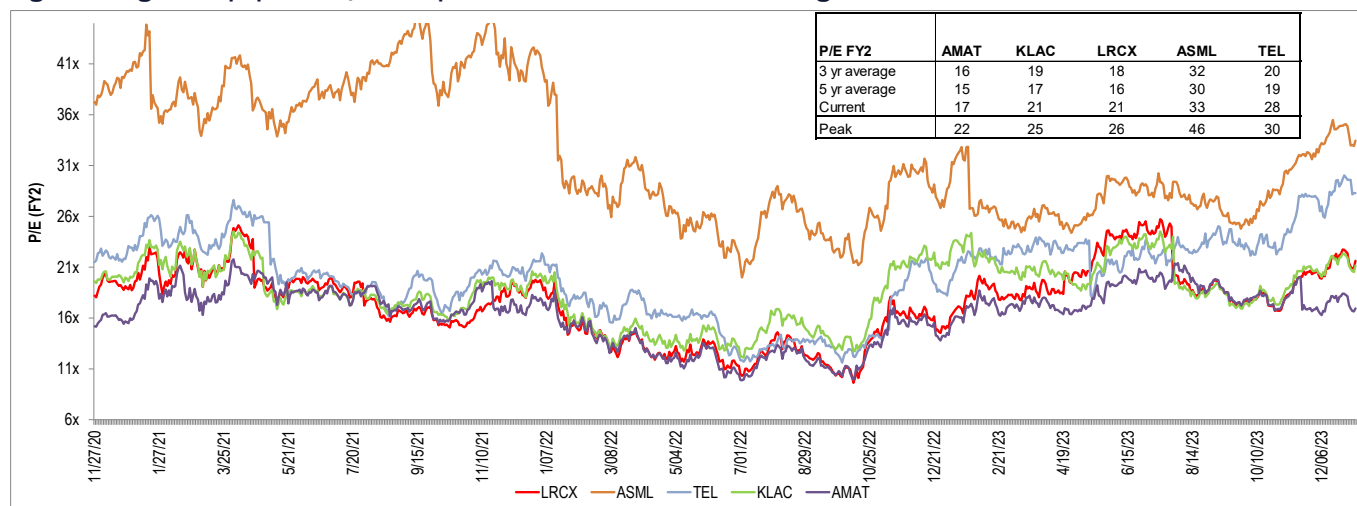
Figure 10. Annual Price Performance

Qtrly & Annual Price Performance	1Q23	2Q23	3Q23	4Q23	1Q24E	2021	2022	2023	2024YTD
AEIS	14%	14%	-7%	6%	-5%	-6%	-6%	20%	-5%
AMAT	26%	18%	-4%	17%	-7%	82%	-38%	55%	-7%
ASML	25%	6%	-19%	29%	-5%	63%	-31%	31%	-5%
COHU	20%	8%	-17%	3%	-5%	0%	-16%	4%	-5%
WOLF	-6%	-14%	-31%	14%	-8%	6%	-38%	-42%	-8%
ENTG	25%	35%	-15%	28%	-6%	44%	-53%	72%	-6%
FORM	43%	7%	2%	19%	-7%	6%	-51%	74%	-7%
COHR	8%	34%	-36%	33%	-3%	-10%	-49%	21%	-3%
KLAC	6%	22%	-5%	27%	-4%	66%	-12%	48%	-4%
LRCX	26%	21%	-3%	25%	-4%	52%	-42%	79%	-4%
MKSI	5%	22%	-20%	19%	0%	16%	-51%	22%	0%
NVMI	28%	12%	-4%	22%	-5%	108%	-44%	60%	-5%
VECO	14%	22%	9%	10%	-8%	64%	-35%	53%	-8%
TER	23%	4%	-10%	8%	-3%	36%	-47%	20%	-3%
Tokyo Electron	23%	18%	-4%	31%	-4%	55%	-49%	76%	-4%
SOXX	28%	14%	-7%	22%	-3%	43%	-36%	61%	-3%
SP50	7%	8%	-4%	11%	0%	27%	-19%	24%	0%
Sector Average	19%	15%	-10%	25%	-5%	50%	-37%	47%	-5%
US Front End Average	19%	20%	-4%	23%	-5%	67%	-31%	61%	-5%

Source: Citi Research, FactSet

7. Valuation

Figure 11. Big Five Equipment P/E Multiples ~20% below Prior Peak Average



Source: Citi Research, FactSet

Companies Mentioned:

ASML Holding NV (ASML.AS; €654.5; 1; 09 Jan 24; 16:30)

Samsung Electronics (005930.KS; ₩73600.0; 1; 10 Jan 24; 15:45)

MKS Instruments, Inc. (MKSI.O; US\$103.16; 1; 09 Jan 24; 16:00)

Cohu Inc (COHU.O; US\$33.46; 1H; 09 Jan 24; 16:00)

Wolfspeed, Inc. (WOLF.N; US\$40.03; 2; 09 Jan 24; 16:00)

Entegris Inc (ENTG.O; US\$112.61; 2; 09 Jan 24; 16:00)

Coherent Corp (COHR.K; US\$42.37; 1; 09 Jan 24; 16:00)

Intel Corp (INTC.O; US\$48.05; 2; 09 Jan 24; 16:00)

KLA Corp (KLAC.O; US\$556.34; 1; 09 Jan 24; 16:00)

Lam Research Corp (LRCX.O; US\$752.02; 1; 09 Jan 24; 16:00)

Nova Ltd (NVMI.O; US\$130.95; 1; 09 Jan 24; 16:00)

Veeco Instruments (VECO.O; US\$28.42; 1; 09 Jan 24; 16:00)

Advanced Energy Industries, Inc (AEIS.O; US\$103.03; 1; 09 Jan 24; 16:00)

Applied Materials Inc (AMAT.O; US\$151.03; 1; 09 Jan 24; 16:00)

Tokyo Electron (8035.T; ¥25385.0; 1; 10 Jan 24; 15:00)

Micron Technology Inc (MU.O; US\$83.33; 1; 09 Jan 24; 16:00)

UMC (2303.TW; NT\$50.1; 1; 10 Jan 24; 13:30)

TSMC (2330.TW; NT\$584.0; 1; 10 Jan 24; 13:30)

Nanya Technology (2408.TW; NT\$71.5; 1; 10 Jan 24; 13:30)

FormFactor Inc (FORM.O; US\$38.77; 2; 09 Jan 24; 16:00)

Teradyne Inc (TER.O; US\$105.24; 1; 09 Jan 24; 16:00)

TE Connectivity Ltd. (TEL.N; US\$133.16; 2; 09 Jan 24; 16:00)

Hua Hong Semiconductor Ltd (1347.HK; HK\$18.22; 3; 09 Jan 24; 16:10)

Global Foundries (GFS.O; US\$58.42; 1; 09 Jan 24; 16:00)

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Appendix A-1

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