

Semiconductor sector

2027 AI chip outlook

Key message

1. More upside for TSMC's CoWoS capacity expansion, but it will remain in short supply.
2. Component supply might be another constraint.
3. Major upside from TPU & CPU.

Event

We've updated our 2027 CoWoS capacity, shipment, and AI chip forecasts.

Impact

More upside for TSMC's CoWoS capacity expansion, but it will remain in short supply. We revise up our forecast for TSMC's (2330 TT, NT\$2,385, OP) CoWoS monthly capacity from 170-175kwpm to 185-190kwpm by end-2027 due to easing expansion bottlenecks. However, our observations of equipment vendors suggest another 10% upside to our current estimates, so we don't rule out the possibility of further upward revisions. With upside potential for capacity expansion, we believe TSMC will likely reduce the supply shortage gap from 30-35% to 15-20%. Spillover demand will largely benefit OSAT vendors, particularly ASE Technology Holding (ASEH; 3711 TT, NT\$592, OP), which is why demand for equipment from OSAT vendors has been much stronger YTD.

Component supply might be another constraint. Assuming no production yield issues, we believe TSMC and OSAT capacity expansion will be able to meet strong demand for AI chips in 2027, but component supply might be constraints. We forecast overall CoWoS capacity will grow 70.9% YoY in 2027 (TSMC up 55-60% YoY, ASEH up 125% YoY, and Amkor Technology (US) up 66% YoY). However, we estimate the increase in component supply will fall short of CoWoS capacity growth (i.e. ABF up 25-30% YoY, HBM up 45-50% YoY, with potential loss from HBM4e migration). We foresee the potential risk of a component supply gap in 2027.

Major upside from TPU & CPU. In 2027, we expect AI ASIC shipments to surpass GPU shipments, particularly those from Nvidia (US), for the first time. That said, Nvidia's revenue from AI chips still accounts for 70% of the industry total due to higher ASP. Among AI ASIC, we estimate Google's (US) TPU and Amazon Web Services (AWS; US) Trainium will account for 80% of shipments in 2027. Guidance from these two companies is actually higher than our forecasts, but supply constraints will be the swing factor due to shortages of both CoWoS-S and CoWoS-R capacity. In addition, demand for CPUs will also see strong growth due to the requirements of agentic AI, and both Nvidia and AMD's (US) latest CPUs will adopt CoWoS, which will cause supply to be even tighter. We expect 50% of Vera CPU and the majority of Venice CPU to go to ASEH, making the firm a proxy CPU play within the semiconductor space. Amkor will likely benefit from both Vera CPU and Broadcom's (US) connectively chips due to 2.5D packaging demand.

Stocks for Action

Strong GPU demand remains intact, but we believe that potential upside might be less than that for AI ASICs and CPUs. Therefore, we prefer AI ASIC and CPU plays over GPU plays for the next few quarters. Our preferred AI ASIC and CPU plays are TSMC, MediaTek (2454 TT, NT\$4,430, OP), ASEH, Chunghwa Precision Test Tech (CHPT; 6510 TT, NT\$3,255, OP), Global Unichip (GUC; 3443 TT, NT\$6,035, OP), Alchip Technologies (3661 TT, NT\$3,355, OP), MPI (6223 TT, NT\$5,440, OP), and WinWay Technology (6515 TT, NT\$6,310, OP).

Risks

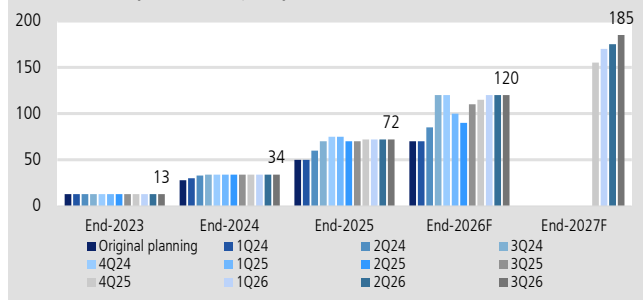
Over expansion of AI facilities and demand; economic recession.

TSMC

TSMC is the key beneficiary of all AI mega deals and continues to revise up CoWoS capacity expansion plan. We forecast TSMC will expand CoWoS capacity from 120kwpm by end-2026 to 185-190kwpm by end-2027, with an additional 40-50kwpm of capacity in 2028 (pending upside from AP7 and how much pull-in demand there is in 2027). However, even with the upside, we still estimate a 15-20% capacity shortage gap to meet revised client demand. The spillover demand will likely benefit TSMC's OSAT partners ASEH and Amkor in 2027. TSMC will ramp-up its chip-on-panel-on-substrate (CoPoS), panel-level 2.5D packaging, from 2028F, with meaningful contribution delayed one year to 2029F.

Figure 1: TSMC CoWoS capacity forecasts

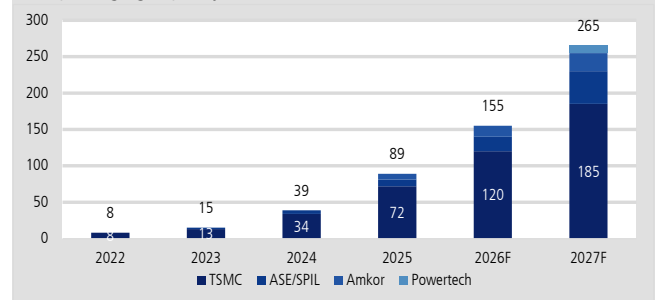
TSMC's monthly CoWoS capacity forecasts, '000 units



Source: KGI Research estimates

Figure 2: 2.5D packaging capacity forecasts (TSMC + OSAT)

2.5D packaging capacity forecasts, '000 units



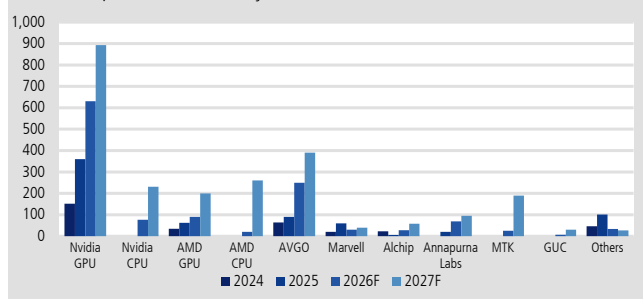
Source: KGI Research estimates

ASEH & Amkor

We forecast Amkor's monthly 2.5D capacity is around 15kwpm and will likely expand to 25kwpm (mainly CoWoS-S/R), with key products being Nvidia's CPU and Broadcom's switch ASIC. We forecast ASEH full-process CoWoS capacity will expand from 20kwpm by end-2026 to 45kwpm by end-2027, up 125% YoY. We expect about 50% of Nvidia's CPU and the majority of AMD's Venice CPU will go to ASEH, whereas TSMC will focus on AI accelerators.

Figure 3: CoWoS shipment forecasts, including OSAT

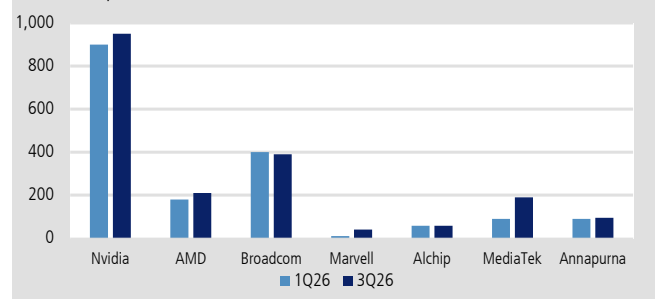
CoWoS shipment forecasts by client, '000 units



Source: KGI Research estimates

Figure 4: CoWoS 2027 shipment forecast revisions vs. 1Q26

CoWoS shipment forecasts, '000 units



Source: KGI Research estimates

Intel

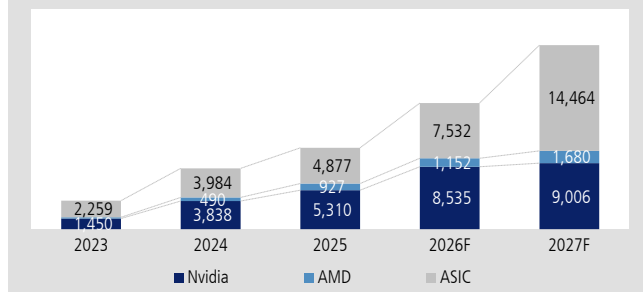
Our 2.5D packaging capacity estimates exclude Intel's EMIB-T as: (1) EMIB-T is expected to ramp-up in late 2027; and (2) they are different technology and units, therefore it is hard to convert to the CoWoS equivalent. Due to the US localization policy and requirements for larger reticle size (9x), as well as TSMC's capacity shortage, Google will adopt EMIB-T for its TPU v9 Humufish (MediaTek is key ASIC partner for I/O). However, noteworthy contribution won't begin until 2Q28F, and substrate supply and production yield during ramp-up are key concerns regarding further expansion.

Nvidia

On strong TPU growth in 2027F, we expect AI ASIC shipments to surpass those of GPU, particularly from Nvidia, for the first time in 2027. However, as Nvidia's GPU specs and ASP are still much higher than those of ASIC, we expect Nvidia to continue to account for 70% of AI chip revenue, including CPU, in 2027. Meanwhile, GPU is no longer the only source of Nvidia's data center revenue as it has expanded its AI solutions from one to seven chips in the new Rubin structure (Rubin GPU, Vera CPU, CX9, BF4, NVLink Switch, Spectrum CPO, and Groq LPU). Nvidia has further raised FY28 (FY ends January) sales growth guidance to 70% YoY, with a 15% price hike to pass through inflated component costs, far above consensus of 40-45% YoY. We believe upsides will come from: (1) price hikes; (2) downgrading HBM specs to maximize shipment volume; and (3) CPU and networking chip contribution. We forecast Vera CPU shipments will grow 200% from 2.0mn units in 2026 to 6.0mn units in 2027, with 60% going to TSMC and ASEH, and remainder packaged by Amkor.

Figure 5: Nvidia GPU, AMD GPU, & ASIC shipment forecasts

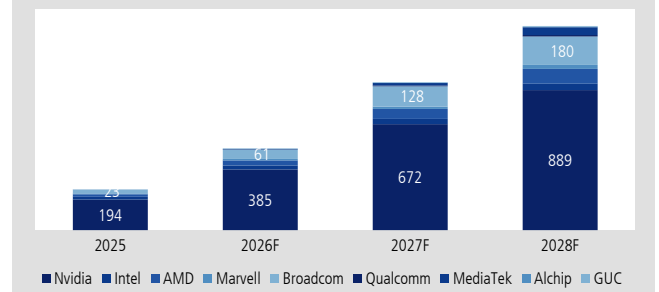
Shipment forecasts, '000 units



Source: KGI Research estimates

Figure 6: AI revenue forecasts

Revenue, US\$bn



Source: KGI Research estimates

Figure 7: Nvidia AI accelerator roadmap

Platform	Blackwell	Blackwell Ultra	Blackwell Ultra	Vera Rubin	Rubin Ultra	Feynman
NVL	NVL72	NVL72	NVL16 (HGX)	NVL144	NVL576	
Product code	B200/GB200	B300/GB300	B300A	VR200	VR300	RF200
Process node	N4	N4P	N4P	N3P	N3P	A16
# of Chip packages	72	72	16	72	72	n.a.
# of GPU (die)	144	144	16	144	144	
CPU	Grace	Grace	x86	Vera	Vera	Rosa
LPU				LP30	LP35	LP40
NVLink	NVLink5	NVLink5	NVLink6	NVLink6 Switch	NVLink7 Switch	NVLink8 CPO
HBM type	HBM3e 8H	HBM3e 12H	HBM3e 12H	HBM4	HBM4e	Custom HBM5
HBM capacity	13.8TB	20.7TB	2.3TB	20.7TB	18.4TB	
Time	2H24	2H25	2H25	2H26	2H27	2H28

Source: KGI Research

Broadcom

Broadcom is the leader in the AI ASIC space and continues to widen the gap with second-tier players. Broadcom has surpassed AMD to become TSMC's second largest CoWoS client as it landed major CSPs' AI ASIC projects, expect Microsoft (US) and AWS. Broadcom and Nvidia are driving the majority of CoWoS demand revisions in 2026-27F. Broadcom's 2027 demand guidance is 500k wafers, but we project only 380-390k at TSMC due to limited CoWoS-S capacity, and MediaTek continues to revise up its shipment guidance, so we only slightly trim our forecast. The main upside at Broadcom comes from Google's TPU v8i Sunfish, with 80-90% designated for Google's TPU, with the balance supporting other CSPs and LLM providers, including Meta (US) and OpenAI (US).

Figure 8: Google TPU roadmap at Broadcom

	2026	2027	2028	2029
Google	v7	v8i	v8px	v10
Code name	Ironwood	Sunfish	Whalefish (Upgraded Sunfish)	Merope
ASIC partner	Broadcom	Broadcom	Broadcom	Broadcom
Process node	TSMC N3	TSMC N3	TSMC N3	TSMC N2
Memory	HBM3E	HBM3E	HBM4E	HBM4E/HBM5?
Memory capacity	192GB	288GB	576GB?	?
2.5D packaging	CoWoS-S	CoWoS-S	CoWoS-S	CoWoS-L
Hybrid bonding/SolC	No	No	No	Yes?

Source: Digitimes, KGI Research

MediaTek

Investors do have high expectations for MediaTek as it has landed both Google's 8t (a.k.a. Zebrafish) and v9 (a.k.a. Humufish) TPU. In addition, we expect v10 Icefish to also go to MediaTek. With MediaTek's new guidance for AI ASIC TAM of US\$80bn and market share of 15-20%, we forecast AI ASIC revenue will jump from US\$2.4bn in 2026 to US\$15.6bn in 2027. As the silicon content and ASP of Humufish will be at least three times higher than Zebrafish, we forecast MediaTek AI ASIC revenue will reach US\$50bn in 2028, which would account for over 60% of our 2028 sales estimates.

Figure 9: Google TPU roadmap at MediaTek

	2026	2027	2028	2029
Google		v8t	v9	v10
Code name		Zebrafish (A5921)	Humufish/Triggerfish (A5922)	Icefish
ASIC partner		MediaTek	MediaTek	MediaTek
Process node		TSMC N3	TSMC N3/N2	TSMC N2
Memory		HBM3E	HBM4E	HBM4E/HBM5?
Memory capacity		216GB	288GB	768GB?
2.5D packaging		CoWoS-S	EMIB-T	EMIB-T
Hybrid bonding/SolC		No	No	?

Source: Digitimes, KGI Research

Google

Google has long history of AI development (Deepmind and Alphago) and has developed its own AI ASIC and architecture. Historically, it partnered with Broadcom for chip design. While TPU were previously exclusive to internal workloads and cloud leasing, Google has significantly shifted its strategy to be open to select third parties, either via selling or leasing. Now that Anthropic (US) dominates the AI agent space, it is boosting TPU demand further as it is the first outside user of Google's TPU. On the other hand, Google is also a major investor in Anthropic.

In addition, despite strong ties with Broadcom, we believe Google is still trying to develop its own chip in order to: (1) adopt new technology (i.e. burn-in for Zebrafish) or suppliers (EMIB-T for Humufish); and (2) take more control and ownership of key component

procurement, such as HBM and CoWoS. We believe MediaTek will benefit from this move via market share expansion.

AWS (Annapurna + Alchip)

AWS prioritizes cost sensitivity in its ASIC strategy. Its supply chain is anchored by its subsidiary Annapurna Labs (US), partnered with Alchip for back-end design services. In 2027, we forecast demand for Trainium3 will reach 3.5mn units, but currently we only estimate about 3.0mn units due to supply constraints. Trainium3 is produced via CoWoS-R, but capacity is largely occupied for Vera CPU.

AMD

We forecast strong demand for both GPU (MI450/455) and CPU (Venice) at AMD. AMD also guides it will ship 6.0mn Venice CPU units, the same as for Vera, but we only forecast 4.5-5.0mn units due to: (1) the learning curve for ASEH's fast ramp-up of the full CoWoS process, so there are concerns about initial production yield; and (2) capacity expansion will be unable to meet strong demand in time.

Figure 10: AI accelerator forecasts

Shipments (k units)	2023	2024	2025	2026F	2027F
GPU	1,645	4,730	6,753	10,237	11,286
YoY (%)	N.M.	187.5	42.8	51.6	10.3
Nvidia	1,450	3,838	5,310	8,535	9,006
- A100	1,450	88	-	-	-
- H100	-	3,218	522	943	-
- B200	-	532	2,873	1,128	-
- B300	-	-	1,915	4,514	266
- Rubin	-	-	-	1,950	5,890
- Rubin Ultra	-	-	-	-	2,850
AMD	168	490	927	1,152	1,680
Intel	27	202	16	-	-
Others	-	200	500	550	600
GPU (GPU die equiv.)	1,645	5,262	11,541	17,829	25,992
		219.9%	119.3%	54.5%	45.8%
ASIC	2,259	3,984	4,877	7,532	14,464
YoY (%)	N.M.	76.4	22.4	54.4	92.0
Amazon/AWS (Trainium)	495	1,225	1,600	2,428	3,060
Google (TPU)	1,464	2,099	2,527	4,020	9,104
Meta (MTIA)	-	300	350	209	400
MSFT (Maia)	-	60	100	350	1,000
Open AI	-	-	-	25	400
Others	300	300	300	500	500
AI Accelerator	3,904	8,714	11,630	17,769	25,750
YoY (%)	N.M.	123.2	33.5	52.8	44.9
YoY (%)					
Amazon/AWS (Trainium)	-	147	31	52	26
Google (TPU)	-	43	20	59	126

Source: KGI Research estimates

Figure 11: Valuation tables

Company	Code	Market cap (US\$ mn)	Share price (LCY)	EPS (LCY)		EPS CAGR (%) (2025-2027F)	PER (x)		PBR (x)		ROE (%)		Dividend yield (%)	
				2026F	2027F		2026F	2027F	2026F	2027F	2026F	2027F	2026F	2027F
TSMC	2330 TT	1,955,196	2,385.0	108.25	139.22	45.0	22.0	17.1	8.1	5.9	43.0	39.9	1.2	1.4
MediaTek	2454 TT	224,763	4,430.0	71.34	123.26	36.5	62.1	35.9	18.2	15.5	28.7	46.3	1.5	1.6
UMC	2303 TT	55,036	138.5	7.86	7.33	48.1	17.6	18.9	3.9	3.4	23.5	19.0	2.1	2.1
Hon Precision	7769 TT	34,896	6,135.0	129.97	226.71	73.1	47.2	27.1	15.8	11.7	36.6	49.7	1.5	2.6
KYEC	2449 TT	10,431	257.0	8.96	14.07	25.0	28.7	18.3	5.6	4.7	20.5	27.8	2.1	3.3
Vanguard	5347 TT	9,086	153.0	5.91	7.86	35.2	25.9	19.5	3.6	3.2	17.0	20.4	2.9	2.9
ASEH	3711 TT	83,665	592.0	19.11	30.25	79.7	31.0	19.6	6.5	5.5	22.2	30.0	0.9	2.2
Kinik	1560 TT	3,492	735.0	16.28	23.17	58.0	45.2	31.7	11.0	8.6	27.0	30.9	1.4	1.9
C Sun	2467 TT	2,559	516.0	16.23	22.78	103.5	31.8	22.7	7.9	6.3	30.8	31.5	1.4	1.7
Nvidia	NVDA US	5,084,136	211.0	9.33	15.72	83.2	22.6	13.4	33.7	16.1	91.9	97.8	0.0	0.4
Intel	INTC US	513,656	97.2	1.66	2.81	N.M.	58.5	34.6	4.5	4.0	5.2	8.7	0.0	0.0
Realtek	2379 TT	11,457	703.0	30.15	35.72	11.4	23.3	19.7	8.3	7.4	32.3	39.9	3.7	4.4
V5 Technologies	7822 TT	1,152	800.0	24.62	39.55	67.8	32.5	20.2	5.2	4.4	29.8	25.7	1.7	2.7
Novatek	3034 TT	10,407	541.0	34.64	31.32	8.0	15.6	17.3	4.4	4.3	29.5	25.2	5.5	5.0
Faraday	3035 TT	1,400	170.0	3.78	6.60	53.3	45.0	25.8	3.1	3.0	7.3	11.8	1.8	2.9
Aspeed	5274 TT	23,031	17,520.0	186.54	317.44	74.8	93.9	55.2	71.4	38.7	92.1	100.0	0.8	1.4
GUC	3443 TT	25,567	6,035.0	50.99	130.40	115.3	118.3	46.3	40.9	25.0	41.8	67.0	0.6	1.5
Alchip	3661 TT	9,154	3,355.0	130.60	171.62	57.5	25.7	19.5	5.5	4.7	23.5	25.9	1.9	2.6
Parade	4966 TT	1,305	523.0	32.84	37.95	4.9	15.9	13.8	1.8	1.7	11.4	12.4	3.2	3.0
Chipbond	6147 TT	4,708	200.0	5.46	8.54	51.1	36.6	23.4	2.7	2.5	8.2	11.7	2.1	2.8
Airoha	6526 TT	3,299	623.0	20.22	25.24	20.7	30.8	24.7	5.7	5.2	18.0	22.1	1.4	1.8
Zilltek	6679 TT	337	194.0	12.42	13.70	41.8	15.6	14.2	1.7	1.7	11.5	11.5	5.1	5.7
WT Microelectronics	3036 TT	7,732	192.5	23.86	28.14	55.7	8.1	6.8	1.7	1.3	23.2	21.1	6.2	7.3
Silegy	6415 TT	4,999	406.0	11.59	17.73	66.5	35.0	22.9	0.9	0.8	11.3	14.9	1.2	1.8
Innostar Service	7828 TT	2,362	1,845.0	17.88	39.61	150.2	103.2	46.6	45.7	27.0	49.1	72.9	0.3	0.6
Yield Microelectronics	6423 TT	78	79.7	1.83	2.55	85.9	43.4	31.3	5.1	4.4	11.7	15.0	2.1	2.9
uPI	6719 TT	597	179.0	8.34	9.63	21.0	21.5	18.6	1.3	1.2	6.2	7.0	3.2	3.7
Global Mixed-Mode	8081 TT	670	246.0	18.52	19.65	5.2	13.3	12.5	3.0	2.8	21.0	23.3	6.9	7.3
MPI	6223 TT	16,850	5,440.0	76.08	137.53	102.6	71.5	39.6	31.4	25.0	47.3	70.3	0.8	1.5
WinWay Technology	6515 TT	7,270	6,310.0	92.10	184.01	98.0	68.5	34.3	30.9	21.8	47.6	73.8	1.1	2.1
CHPT	6510 TT	3,388	3,255.0	63.22	120.23	98.8	51.5	27.1	10.3	7.5	21.8	32.1	1.0	1.8
Winbond Electronics	2344 TT	22,690	159.5	29.03	69.97	791.4	5.5	2.3	3.2	1.4	78.6	86.8	5.5	13.2
Macronix International	2337 TT	7,174	114.5	21.84	67.00	N.M.	5.2	1.7	2.2	1.0	60.8	84.5	5.7	17.6
Nanya Technology	2408 TT	50,772	465.5	75.16	130.67	682.3	6.2	3.6	3.4	1.8	86.9	74.3	4.8	8.4
Innodisk Corp	5289 TT	3,964	1,275.0	52.38	n.a.	N.M.	24.3	N.M.	9.4	N.M.	47.0	N.M.	2.1	N.M.
Advantech	2395 TT	18,819	685.0	21.08	27.59	50.1	32.5	24.8	9.2	8.1	30.6	34.9	2.7	3.6
Phison Electronics	8299 TT	13,424	1,920.0	388.99	298.61	166.7	4.9	6.4	3.1	2.2	88.8	41.2	6.1	4.7
GlobalWafers	6488 TT	13,815	914.0	26.85	74.98	121.4	34.0	12.2	4.5	3.6	13.4	32.8	1.5	4.1
Flytech Technology	6206 TT	620	137.0	11.21	12.03	32.1	12.2	11.4	3.2	2.9	28.5	26.9	6.5	7.0
Marvell Technology	MRVL US	191,883	218.8	3.67	5.22	35.6	59.6	41.9	13.1	10.7	2.8	17.6	0.1	0.1
Broadcom	AVGO US	1,645,566	344.7	11.55	17.03	86.2	29.8	20.2	14.6	9.0	56.0	59.3	0.8	0.9
Astera Labs	ALAB US	44,593	257.0	3.00	4.45	83.6	85.7	57.8	21.3	14.4	35.7	35.7	0.0	0.0
ARM Holding	ARM US	255,263	239.0	1.75	2.12	68.1	136.6	112.7	30.8	24.7	18.6	19.4	0.0	0.0
Advanced Micro Devices	AMD US	805,480	493.4	7.08	14.00	129.0	69.7	35.2	11.1	8.5	15.5	25.7	0.0	0.0
Qualcomm	QCOM US	189,158	180.2	10.74	9.90	40.0	16.8	18.2	7.1	7.5	46.9	35.2	2.0	2.1
Analog Devices	ADI US	174,938	361.0	11.59	13.21	69.6	31.1	27.3	5.2	4.7	17.1	21.0	1.2	1.3
NXP Semiconductors	NXPI US	56,612	224.2	14.60	17.00	45.8	15.4	13.2	4.8	3.9	33.5	34.7	1.9	2.0
On Semiconductor	ON US	27,894	71.7	3.15	4.16	278.7	22.7	17.2	3.8	3.5	15.8	23.2	0.0	0.0
Texas Instruments	TXN US	240,568	263.4	7.64	9.50	31.8	34.5	27.7	12.6	10.5	42.0	43.5	2.2	2.3
Applied Materials	AMAT US	336,652	424.2	11.25	14.25	27.9	37.7	29.8	12.9	10.2	43.0	50.2	0.4	0.5
ASML Holding	ASML NA	626,435	1,387.8	32.83	42.16	30.6	42.3	32.9	20.4	14.8	62.1	61.9	0.7	0.9
Lam Research	LRCX US	342,224	273.5	5.69	7.71	36.0	48.1	35.5	29.2	17.1	66.5	78.8	0.4	0.4
KLA Corporation	KLAC US	220,924	169.1	36.49	47.93	296.2	4.6	3.5	36.4	21.0	90.9	87.0	0.5	0.5
Synopsys	SNPS us	73,096	381.4	14.37	17.12	45.1	26.5	22.3	2.2	2.1	7.6	8.4	0.0	0.0
Cadence	CDNS us	76,852	279.1	8.00	9.55	52.8	34.9	29.2	10.8	9.4	32.8	32.4	0.0	0.0
Peer Average							36.7	24.1	12.6	8.8	32.5	37.9	6.8	8.9

Source: KGI Research

KGI Locations

China Shanghai	Room 1507, Park Place, 1601 Nanjing West Road, Jingan District, Shanghai, PRC 200040
Taiwan Taipei	700 Mingshui Road, Taipei, Taiwan Telephone 886.2.2181.8888 • Facsimile 886.2.8501.1691
Hong Kong	41/F Central Plaza, 18 Harbour Road, Wanchai, Hong Kong Telephone 852.2878.6888 Facsimile 852.2878.6800
Thailand Bangkok	8th - 11th floors, Asia Centre Building 173 South Sathorn Road, Bangkok 10120, Thailand Telephone 66.2658.8888 Facsimile 66.2658.8014
Singapore	4 Shenton Way #13-01 SGX Centre 2 Singapore 068807 Telephone 65.6202.1188 Facsimile 65.6534.4826
Indonesia	Sona Topas Tower Fl.11 Jl. Jend. Sudirman kav.26 Jakarta Selatan 12920 Indonesia Telephone 62 21 250 6337

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Outperform (OP)	We take a positive view on the stock. The stock is expected to outperform the expected total return* of the KGI coverage universe in the related market over a 12-month investment horizon.
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Restricted (R)	KGI policy and/or applicable law regulations preclude certain types of communications, including an investment recommendation, during the course of KGI's engagement in an investment banking transaction and in certain other circumstances.
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