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Greater China Semiconductors | Asia Pacific

TSMC preview and CoWoS update – CPU, GPU, ASIC, and Optical

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GREATER CHINA TECHNOLOGY SEMICONDUCTORS
Asia Pacific
Industry View **Attractive**

investors should be aware that the firm may have a conflict of

Research as only a single factor in making their investment decision.

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Strong AI Semi Outlook

- Top ideas:
  - **OW:**
    - **AI:** MediaTek(Top Pick), TSMC, SMIC, Aspeed, Alchip, KYEC, ASE, FOCI, ASMPT, AllRing, GUC
    - **Memory:** Macronix (Top Pick), AP Memory, Nanya Tech, Winbond, GigaDevice
    - **China AI/ Semis/WFE**: Iluvatar, Cambricon, NAURA Tech, AMEC, USI
    - **Testing Equipment and Consumables:** Winway, MPI, Hon Precision, Gudeng
    - **Mature nodes:** UMC
  - **EW:** OmniVision, Phison, MetaX, Realtek, GlobalWafers
  - **UW:**, WIN Semi, Silergy, ASMedia

Long-term demand drivers:

- **Chip inflation:** We expect “price elasticity” to affect demand for tech products. Rising wafer, OSAT, and memory costs create more margin headwinds for chip designers in 2026.
- **AI cannibalization:** Besides demand weakness (AI to replace some human jobs), we see the semi supply chain also prioritizing AI semis over non-AI semis, e.g., T-Glass and memory shortage.
- **China AI: DeepSeek is triggering inferencing AI demand:** DeepSeek has demonstrated cheaper inferencing. Local foundry supply chain also getting more capable for AI GPU production.

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Valuation Comparison: Foundry, Back-end, Memory, IDM and Semi Cap

Ticker	Company	Price 6/29/2026	Currency	Price Target	Upside/ Downside	Rating	Dividend Yield (%)	FCF Yield (%)	Market Cap (US$M)	3M Avg. Daily Trading (US$M)	P/E Ratio (x) 2026e	P/E Ratio (x) 2027e	P/E Ratio (x) 2028e	EPS Growth 2026e	EPS Growth 2027e	EPS Growth 2028e	ROAE 2026e	ROAE 2027e	ROAE 2028e	P/B Ratio (x) 2026e	P/B Ratio (x) 2027e	P/B Ratio (x) 2028e
Foundry																						
2330.TW	TSMC	2,370.0	TWD	2,888.0	22%	O	1.4%	1.8%	1,940,327	2,964.2	22.9	18.4	15.0	56%	25%	23%	41%	38%	35%	8.2	6.1	4.6
2303.TW	UMC	164.0	TWD	138.0	-16%	O	5.1%	5.3%	65,376	876.7	36.5	28.9	23.7	35%	26%	22%	14%	17%	19%	5.0	4.7	4.3
0981.HK	SMIC	84.8	HKD	85.0	0%	O	0.0%	-5.0%	76,261	1,069.6	NM	NM	NM	142%	45%	20%	7%	10%	11%	NM	NM	NM
5347.TWO	Vanguard	208.5	TWD	180.0	-14%	E	4.9%	3.1%	12,235	180.2	38.2	30.9	25.1	31%	24%	23%	12%	14%	17%	4.5	4.3	4.0
1347.HK	Hua Hong	204.2	HKD	118.0	-42%	E	0.1%	-4.6%	45,373	556.3	NM	NM	NM	584%	55%	27%	5%	7%	8%	NM	NM	NM
6770.TW	PSMC	78.9	TWD	111.0	41%	O	0.0%	5.6%	10,523	424.7	NM	NM	NM	-136%	259%	18%	3%	8%	7%	1.7	1.4	1.2
3105.TWO	WIN Semi	412.0	TWD	300.0	-27%	U	0.5%	-3.8%	2,264	510.2	NM	46.3	32.0	59%	40%	45%	6%	9%	12%	4.1	4.0	3.9
8086.TWO	AWSC	142.0	TWD	130.0	-8%	U	1.1%	-3.9%	881	37.1	22.4	19.9	16.1	89%	13%	24%	14%	14%	16%	3.0	2.7	2.3
Mean:							**1.6%**	**-0.2%**			**30.3**	**32.4**	**24.4**	**108%**	**61%**	**25%**	**13%**	**14%**	**16%**	**4.4**	**3.9**	**3.4**
Median:							**0.8%**	**-1.0%**			**29.7**	**28.9**	**23.7**	**58%**	**33%**	**23%**	**10%**	**12%**	**14%**	**4.3**	**4.1**	**3.9**
Memory																						
603986.SS	Giga Device	840.0	CNY	888.0	6%	O	0.3%	4.1%	77,936	2,836.4	65.6	40.6	36.4	417%	62%	11%	37%	42%	35%	20.5	14.5	11.2
2408.TW	Nanya Tech	453.0	TWD	550.0	21%	O	0.0%	13.6%	44,087	1,239.3	7.4	5.6	10.1	NM	NM	NM	74%	53%	21%	3.8	2.2	1.8
2344.TW	Winbond	203.0	TWD	288.0	42%	O	0.0%	16.6%	28,845	918.5	10.0	6.2	5.8	NM	NM	NM	64%	59%	46%	5.2	2.8	2.5
8299.TWO	Phison	2,340.0	TWD	2,248.0	-4%	E	1.5%	1.6%	16,105	552.5	11.7	20.0	45.3	402%	-41%	-56%	55%	25%	11%	5.1	5.0	5.0
SIMO.O	Silicon Motion	305.3	USD	155.0	-49%	O	1.1%	2.1%	10,257	219.9	46.7	28.1	NM	106%	66%	NA	24%	32%	NA	10.1	8.0	NA
2337.TW	Macronix	158.5	TWD	220.0	39%	O	4.6%	17.2%	9,286	658.7	NM	NM	NM	-513%	183%	3%	28%	53%	35%	5.2	3.0	2.1
Mean:							**1.3%**	**9.2%**			**28.3**	**20.1**	**24.4**	**103%**	**67%**	**-14%**	**47%**	**44%**	**30%**	**8.3**	**5.9**	**4.5**
Median:							**0.7%**	**8.8%**			**11.7**	**20.0**	**23.3**	**254%**	**64%**	**3%**	**46%**	**47%**	**35%**	**5.2**	**4.0**	**2.5**
Backend																						
3711.TW	ASEH	627.0	TWD	558.0	-11%	O	2.2%	6.0%	86,385	424.3	37.2	23.3	15.4	83%	60%	52%	19%	26%	33%	6.5	5.5	4.5
600584.SS	JCET	103.3	CNY	50.0	-52%	E	0.3%	5.7%	25,667	1,464.3	71.5	51.6	43.3	65%	38%	19%	8%	11%	11%	5.8	5.2	4.7
601231.SS	USI	30.8	CNY	45.4	47%	O	1.4%	-7.4%	9,756	302.0	26.0	17.5	15.0	42%	48%	17%	13%	17%	17%	3.1	2.8	2.4
2449.TW	KYEC	308.5	TWD	388.0	26%	O	1.8%	1.6%	11,911	350.7	31.0	20.5	15.4	11%	51%	33%	23%	29%	32%	6.6	5.4	4.4
3363.TWO	FOCI	567.0	TWD	708.0	25%	O	0.2%	4.8%	1,883	74.0	NM	NM	NM	NM	NM	NM	3%	56%	78%	NM	NM	NM
Mean:							**1.4%**	**1.5%**			**28.5**	**19.0**	**15.2**	**50%**	**49%**	**30%**	**16%**	**21%**	**23%**	**5.5**	**4.7**	**4.0**
Median:							**1.6%**	**3.7%**			**28.5**	**19.0**	**15.2**	**54%**	**50%**	**26%**	**16%**	**21%**	**25%**	**6.1**	**5.3**	**4.5**
Power Semis/ IDM																						
688396.SS	CR Micro	92.5	CNY	51.6	-44%	U	0.2%	1.6%	16,855	310.5	77.6	52.0	37.5	138%	49%	39%	6%	9%	11%	4.6	4.2	3.8
600460.SS	Silan Micro	52.6	CNY	26.9	-49%	U	0.5%	2.1%	12,158	379.6	63.8	42.8	33.5	244%	49%	28%	10%	14%	15%	6.2	5.5	4.9
603290.SS	StarPower	139.0	CNY	120.0	-14%	E	1.0%	0.0%	4,626	172.6	88.8	52.2	34.8	-7%	70%	50%	5%	8%	12%	4.6	4.2	3.8
300373.SZ	Yangjie	150.0	CNY	136.0	-9%	O	1.4%	-2.8%	11,248	327.3	51.1	36.5	27.2	27%	40%	34%	15%	18%	21%	7.2	6.2	5.2
Mean:							**0.8%**	**0.2%**			**70.3**	**45.9**	**33.3**	**100%**	**52%**	**38%**	**9%**	**12%**	**15%**	**5.7**	**5.0**	**4.4**
Median:							**0.7%**	**0.8%**			**70.7**	**47.4**	**34.2**	**82%**	**49%**	**36%**	**8%**	**11%**	**14%**	**5.4**	**4.9**	**4.3**
Semicap / Equipment/ Materials/ Supply Chain																						
002371.SZ	NAURA	860.2	CNY	818.0	-5%	O	0.6%	-0.9%	86,592	1,033.4	67.7	46.2	36.3	45%	46%	27%	19%	24%	25%	12.1	10.0	8.3
688012.SS	AMEC	456.7	CNY	550.0	20%	O	0.0%	17.6%	39,849	1,101.7	74.8	54.8	40.0	90%	37%	37%	16%	18%	20%	10.8	9.0	7.3
7769.TW	Hon Precision	6,395.0	TWD	10,008.0	56%	O	2.5%	NA	36,328	196.6	49.5	28.7	17.2	69%	72%	67%	37%	53%	65%	NM	13.3	9.6
6223.TWO	MPI	6,060.0	TWD	7,500.0	24%	O	0.0%	-5.4%	18,749	213.3	88.4	42.3	21.0	109%	109%	101%	38%	54%	69%	NM	NM	NM
6515.TW	Winway	8,015.0	TWD	15,000.0	87%	O	0.9%	1.3%	9,048	109.9	NM	39.1	18.3	104%	116%	113%	45%	67%	84%	NM	NM	NM
6488.TWO	GlobalWafers	915.0	TWD	750.0	-18%	E	2.7%	1.7%	13,814	159.5	41.0	27.4	21.5	46%	50%	27%	11%	15%	18%	4.4	4.0	3.6
0522.HK	ASM Pacific	217.0	HKD	188.0	-13%	O	1.8%	6.5%	11,033	88.8	59.1	35.4	25.3	69%	67%	40%	9%	14%	18%	4.8	4.4	4.0
688234.SS	SICC	175.3	CNY	112.1	-36%	O	0.6%	NA	11,801	327.1	NM	NM	NM	NM	NM	NM	1%	3%	3%	11.7	11.4	11.0
ACMR.O	ACM Research	104.5	USD	130.0	24%	O	1.1%	-0.7%	6,856	104.7	36.0	23.1	18.2	109%	56%	27%	10%	14%	16%	3.3	2.9	2.6
3680.TWO	Gudeng Precision	489.0	TWD	648.0	33%	O	0.0%	-6.1%	1,483	46.3	25.2	17.8	12.9	106%	42%	38%	15%	19%	22%	3.6	3.1	2.6
6187.TWO	AllRing Tech	980.0	TWD	1,580.0	61%	O	2.8%	1.1%	2,978	104.4	44.5	25.0	21.8	42%	78%	15%	27%	39%	36%	NM	NM	NM
Mean:							**1.2%**	**1.7%**			**54.0**	**34.0**	**23.3**	**79%**	**67%**	**49%**	**21%**	**29%**	**34%**	**7.2**	**7.3**	**6.1**
Median:							**0.9%**	**1.1%**			**49.5**	**32.0**	**21.3**	**80%**	**61%**	**38%**	**16%**	**19%**	**22%**	**4.8**	**6.7**	**5.7**

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Valuation Comparison: Fabless, Power Semis, FPGA and Analog

Ticker	Company	Price 6/29/2026	Curr ency	Price Target	Upside/ Downside	Rating	Dividend Yield (%)	FCF Yield (%)	Market Cap (US$M)	3M Avg. Daily Trading (US$M)	P/E Ratio (x)			EPS Growth			ROAE			P/B Ratio (x)		
											2026e	2027e	2028e	2026e	2027e	2028e	2026e	2027e	2028e	2026e	2027e	2028e
Fabless																						
AI accelerators																						
688256.SS	Cambricon	1,482.0	RMB	1,528.0	3%	O	0.0%	-2.2%	129,350	2,397.2	117.2	76.2	55.7	160%	54%	37%	48%	51%	46%	49.9	31.6	21.3
9903.HK	Iluvatar	695.0	HKD	688.0	-1%	O	NA	NA	22,602	81.4	NM	107.9	60.5	-83%	-805%	78%	-6%	26%	34%	32.4	24.9	17.6
688802.SS	MetaX	793.6	RMB	758.0	-4%	E	0.0%	NA	44,109	262.2	NM	572.0	318.4	-103%	2214%	80%	0%	4%	7%	24.1	23.1	21.5
Smartphone/Wireless Semis																						
2454.TW	MediaTek	3,910.0	TWD	5,588.0	43%	O	17.3%	0.9%	193,245	1,430.6	55.9	26.8	12.7	12%	109%	111%	25%	40%	55%	12.8	8.8	5.7
603501.SS	OmniVision	88.3	CNY	111.0	26%	E	0.5%	2.1%	14,792	386.8	26.5	18.2	14.8	0%	45%	23%	14%	18%	19%	3.4	2.9	2.5
300782.SZ	Maxscend	100.8	CNY	48.00	-52%	U	0.1%	-2.2%	7,475	453.2	NM	53.1	NM	-485%	85%	NA	5%	9%	NA	5.1	4.7	NA
603160.SS	Goodix	58.2	CNY	58.0	0%	U	0.7%	-1.4%	3,722	64.3	48.8	43.1	39.0	-35%	13%	11%	6%	6%	7%	2.8	2.6	2.5
6462.TWO	Egis	113.5	TWD	105.0	-7%	E	1.0%	-16.3%	327	10.4	NM	21.2	NM	-88%	-462%	NA	-1%	5%	NA	1.2	1.1	NA
IP/Design Service																						
3661.TW	Alchip	3,985.0	TWD	5,088.0	28%	O	1.0%	5.1%	10,260	299.8	26.3	22.1	18.3	124%	19%	21%	28%	28%	30%	NM	NM	NM
301269.SZ	Empyrean Technology	114.3	CNY	95.0	-17%	E	0.1%	NA	8,658	197.0	NM	NM	NM	283%	136%	70%	4%	10%	15%	NM	NM	NM
3443.TW	GUC	4,420.0	TWD	5,688.0	29%	O	0.8%	4.7%	18,704	330.9	100.4	35.5	23.3	58%	182%	52%	40%	71%	66%	NM	NM	NM
6531.TW	AP Memory	980.0	TWD	1,555.0	59%	O	1.2%	4.1%	5,008	182.5	55.5	28.5	16.1	128%	95%	77%	22%	35%	47%	11.1	8.8	6.6
PC/Cloud/Display Semis																						
3034.TW	Novatek	523.0	TWD	414.0	-21%	U	6.1%	14.3%	10,049	88.2	15.1	14.8	17.3	29%	2%	-15%	30%	28%	23%	4.3	4.1	4.1
2379.TW	Realtek	783.0	TWD	570.0	-27%	E	4.8%	5.0%	12,615	95.1	22.1	24.0	23.0	23%	-8%	5%	33%	28%	28%	6.9	6.6	6.2
5269.TW	ASMedia	1,475.0	TWD	1,482.0	0%	U	4.1%	0.9%	3,477	75.8	16.1	16.5	15.5	25%	-3%	6%	18%	16%	15%	2.7	2.4	2.2
5274.TWO	Aspeed	15,210.0	TWD	23,456.0	54%	O	1.2%	1.3%	18,156	148.5	65.5	46.4	32.9	123%	41%	41%	85%	79%	81%	NM	NM	NM
4966.TWO	Parade	631.0	TWD	1,000.0	58%	O	2.9%	1.6%	1,551	56.8	20.7	12.5	10.8	-11%	66%	16%	11%	16%	17%	2.1	1.9	1.7
2458.TW	Elan Micro	180.0	TWD	180.0	0%	O	4.8%	9.6%	1,627	21.7	18.9	17.3	17.2	13%	9%	0%	25%	25%	23%	4.5	4.1	3.8
HIMX.O	Himax	14.4	TWD	17.4	21%	E	2.7%	8.3%	2,454	64.8	36.2	19.9	9.8	65%	82%	102%	8%	14%	26%	2.9	2.7	2.3
Analog IC																						
6415.TW	Silergy	598.0	TWD	388.0	-35%	U	1.4%	4.8%	7,328	104.8	59.0	36.3	28.2	59%	62%	29%	10%	15%	17%	5.7	5.1	4.5
300661.SZ	SG Micro	133.6	CNY	82.0	-39%	E	0.3%	1.1%	11,510	411.1	98.0	68.6	55.0	49%	43%	25%	15%	18%	20%	NM	NM	NM
MCU																						
4919.TW	Nuvoton	170.5	TWD	98.0	-43%	U	0.8%	14.5%	2,260	102.3	NM	38.7	21.6	-69%	-457%	79%	-4%	14%	21%	5.7	4.9	4.0
688018.SS	Espressif	115.9	CNY	125.0	8%	O	NA	NA	3,749	127.4	NM	NM	NM	NA	NA	NA	12%	14%	15%	NM	NM	NM
FPGA																						
002049.SZ	Unigroup Guoxin	85.4	CNY	57.0	-33%	U	0.4%	1.5%	10,074	358.1	35.1	27.0	23.1	44%	30%	17%	14%	16%	16%	4.7	4.0	3.5
1385.HK	Shanghai Fudan	30.2	HKD	47.3	57%	O	0.1%	0.1%	6,905	28.0	23.4	19.3	17.2	353%	22%	12%	16%	16%	16%	3.4	2.9	2.5
IC distributor																						
3702.TW	WPG	104.5	TWD	160.0	53%	O	7.2%	-27.2%	5,540	50.1	8.2	8.4	7.9	115%	-2%	5%	24%	21%	20%	1.7	1.6	1.5
3036.TW	WT Micro	209.0	TWD	349.0	67%	O	4.4%	-21.4%	8,351	91.8	8.4	7.4	6.6	107%	13%	13%	25%	25%	24%	2.0	1.7	1.5

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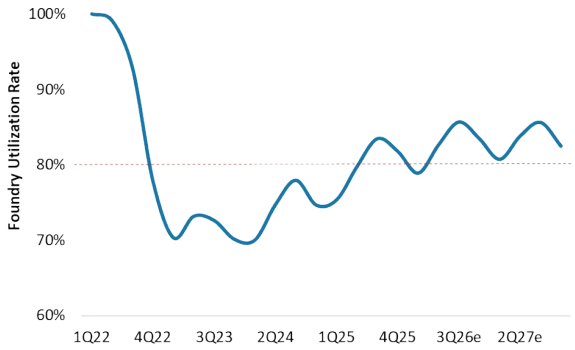
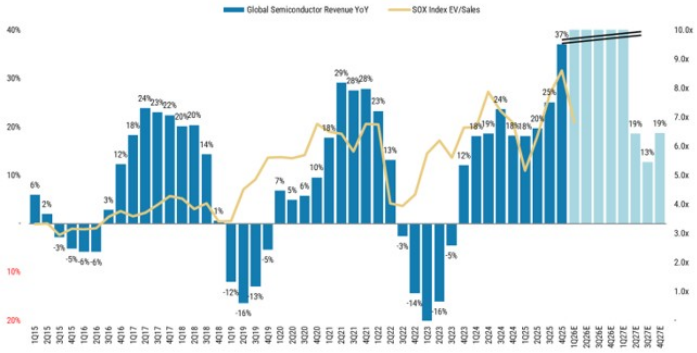
Broader Semiconductor Cycle

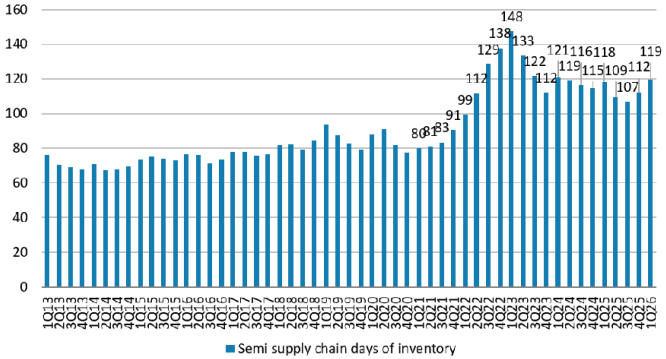
Logic semi foundry utilization could reach 80% in 2H26



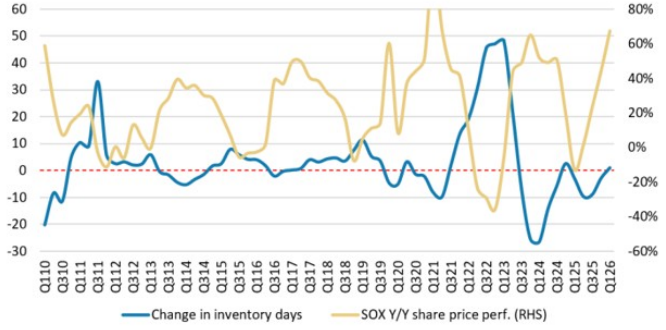
Excluding memory and NVIDIA's AI GPU revenue, non-AI semi growth is expected to decline in 2026



Semi supply chain days of inventory as of 1Q26



Historically, when inventory days went down, semi stock index went up



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TSMC 2Q26 Earnings Preview

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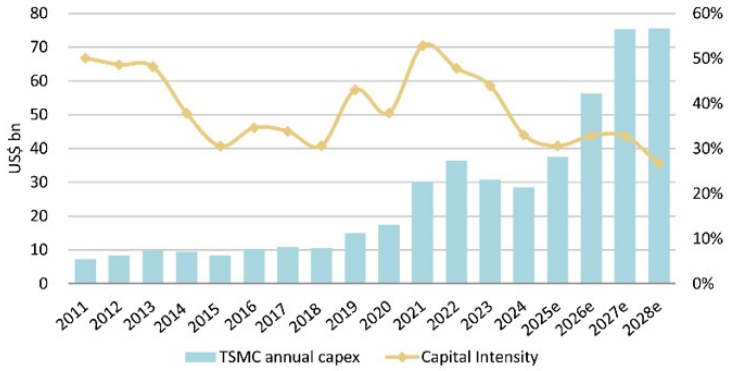
TSMC 2Q26 earnings preview and 3Q26 guidance

2Q26 earnings preview and 3Q26 guidance

	2Q26				3Q26		
(NT$ bn)	Guidance	Preliminary	MS Est.	Consensus	Guidance	MS Est.	Consensus
Revenue	US$39.0 - 40.2bn		1,266,623	1,263		1,435,872	1,364
Q/Q	*+10% at mid-point in USD*			*11.4%*			*8.0%*
Y/Y				*35.3%*			*37.8%*
GM (%)	65.5% - 67.5%		67.4%	66.9%		67.5%	65.6%
OpM (%)	56.0% - 58.0%		59.8%	58.3%		60.3%	57.1%
EPS (NT$)			**25.08**	**23.89**		**29.21**	**26.14**

We raise TSMC 2026/27e capex to US$56bn and US$75bn



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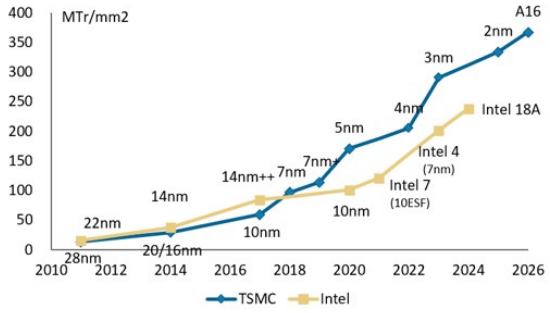
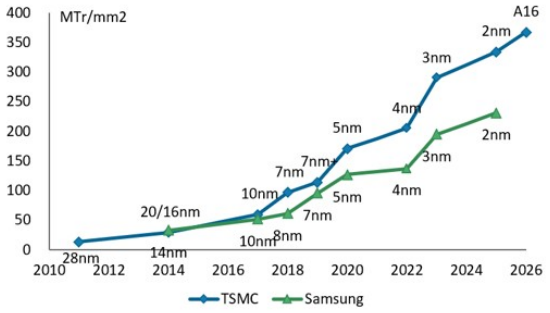
TSMC remains the only game in town given technology leadership and tight EUV supply

TSMC still leads in technology roadmap as well as the logic density

CY	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025e	2026e
Intel		22nm FinFET		14nm FinFET						10nm FinFET		Intel 7 FinFET	Intel 4 (EUV)	Intel 3	Intel 20A GAA	Intel 18A GAA
										10nm			7nm		5nm	
TSMC	28nm			20nm	16nm FinFET		10nm FinFET	7nm	7nm Pro	5nm	5nm Pro		3nm FinFET		2nm GAA	1.6nm GAA
					16nm+ FinFET			12nm	7nm+ (EUV)			4nm	N3e			
								22nm								
Samsung	32nm	28nm			14nm FinFET		10nm FinFET	8nm	7nm (EUV)	5nm			3nm GAA		2nm GAA	
								14nm LPU				4nm				
						28FDS		28FDS-RF	28FDS-eMRAM	18FDS						

Logic density comparison between TSMC, Intel, and Samsung foundry





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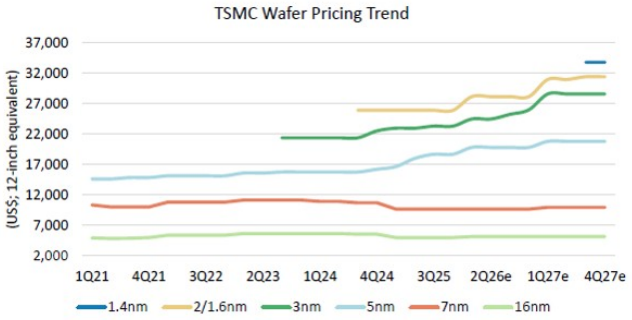
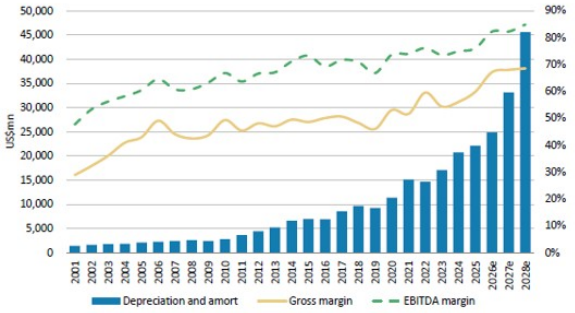
TSMC should be able to hike its leading-edge price by 5%-10% in 2027, to reflect its value to customers

TSMC wafer pricing trend



TSMC's GM and depreciation trends – 60% should be the floor



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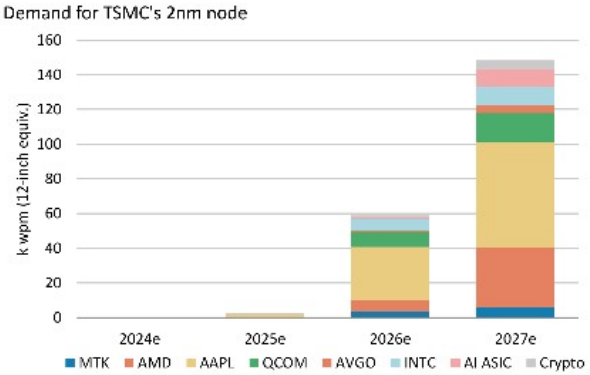
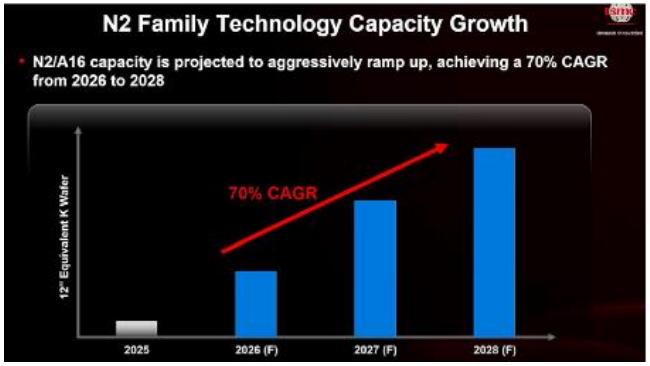
TSMC 2nm demand remains very strong

TSMC – MSe 2nm customer demand breakdown



TSMC suggests N2 capacity to achieve 70% CAGR from 2026-2028e



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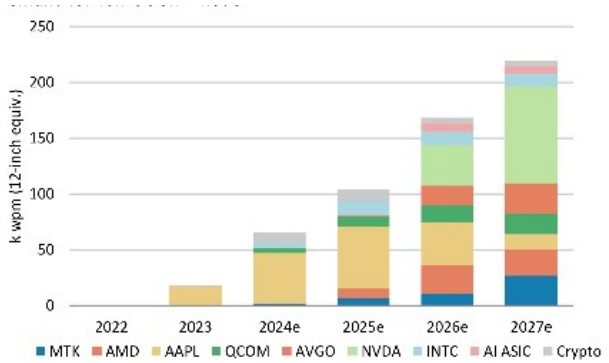
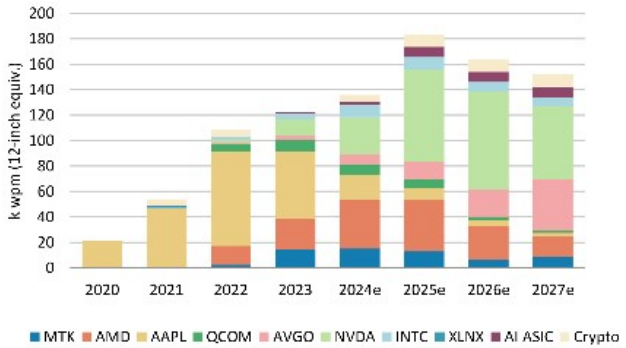
TSMC N5 capacity to drop in 2027 while N3 should keep increasing, similar to our demand forecast

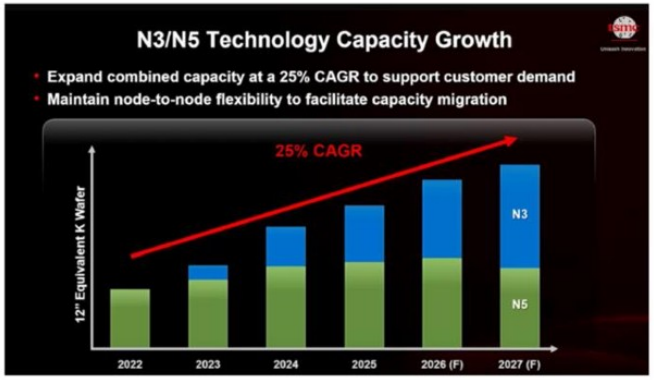
TSMC – MSe 3nm customer demand breakdown



TSMC – MSe 4/5nm customer demand breakdown



TSMC indicates N5 capacity to drop in 2027 while N3 capacity should keep increasing, similar to our demand forecast



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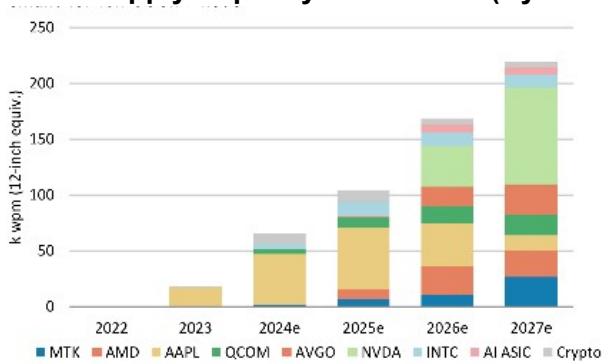
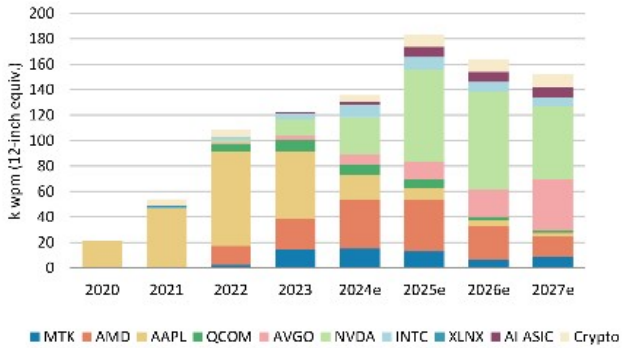
TSMC advanced packaging capacity expansion should also be the key focus in 2026/27

MSe CoWoS Supply Capacity Breakdown (By Year End)



MSe TSMC SoIC Supply Capacity Breakdown (By Year End)



TSMC also address strong advanced packaging capacity build

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TSMC is tracking to spend US$75bn capex in 2027

TSMC fab roadmap

Node	Location	Fab	Capacity				
			2025	2026	2027	2028	2029
N3	Tainan	F18 - P4/P5/P6/P8/P9	110k	160-170k			
	Arizona	F21 - P2		20k			
	Japan	F23 - P2				15k	
Total			110k	180-190k	190k	200-205k	
N2/A16	HsinChu	F20 - P1/P2	20k	30k			
	Tainan	F22 - P7/P8/P9			40-50k	60k	
	KaoHsiung	F22 - P1/P2/P3/P4/P5/P6	25k	60k	80-90k	100k	
	Arizona	F21 - P3/P4/P5/P6				20k	
Total			45k	90-100k	150-170k	210k	
A14	HsinChu	F20 - P3/P4			10-20k	30-40k	40k
A14/A13/A12	Taichung	F25 - P1/P2/P3/P4			10-20k	30-40k	80k
Total					20-40k	60-80k	120k
A10	Tainan	F26 - P1/P2/P3/P4					5k
N40/28/22/12	Japan	F23 - P1	25k				
N28/16	Germany	F24			5k	40k	

TSMC Fab details

Front-end Plant	Location	Focused Technology
F18 - P4/P5/P6/P8/P9	Tainan	N3
F20 - P1/P2/P3/P4	HsinChu	N2/A14
F21 - P2	Arizona	N3
F22 - P1/P2/P3/P5/P6	KaoHsiung	N2
F22 - P7/P8/P9	Tainan	N2
F22 - P4	KaoHsiung	A16
F23 - P2	Kumamoto	N3
F25 - P1/P2/P3/P4	Taichung	A14
F26 - P1/P2/P3/P4	Tainan	A10

TSMC shares its Arizona Fab P2 tool move-in in 2H26, in-line with our 20kwpm capacity addition for 3nm

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AI Semi Supply Chain and Niche Memory

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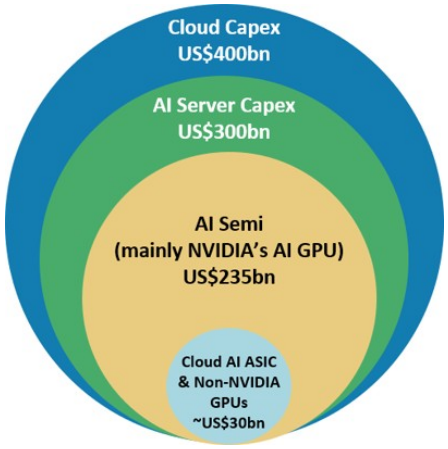
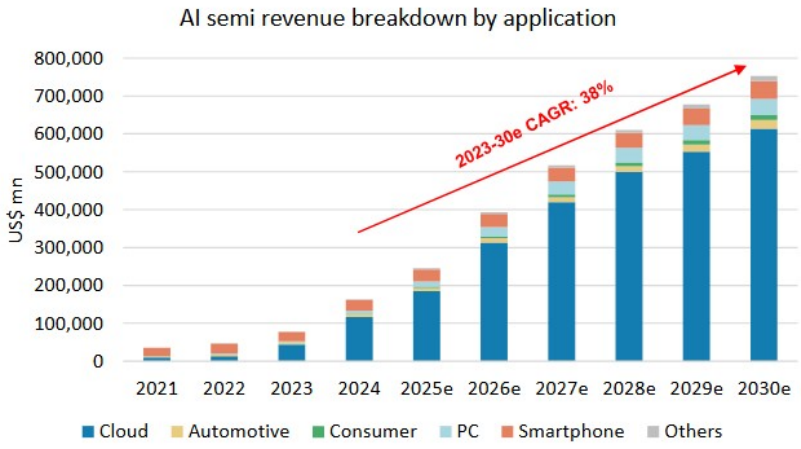
The Global Semi Industry Market Size May Reach US$1.5 trillion in 2030, Half from AI Semis

Our supply chain data-driven bull case assumption is that cloud AI Semi TAM may have grown to US$235bn in 2025e



We expect the AI semi TAM to reach nearly US$753bn by 2030



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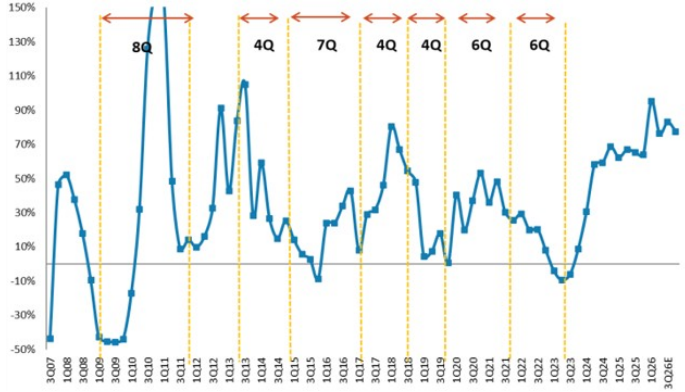
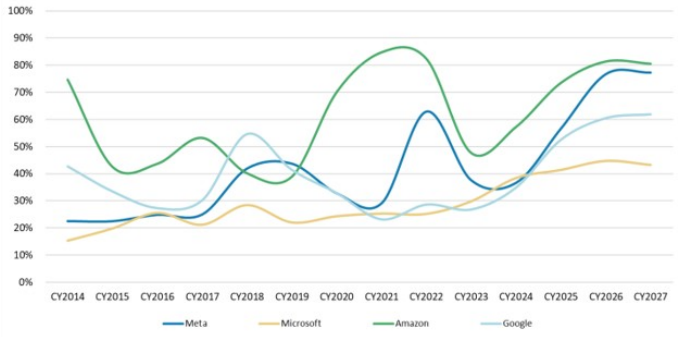
Cloud Semis: Brighter Outlook

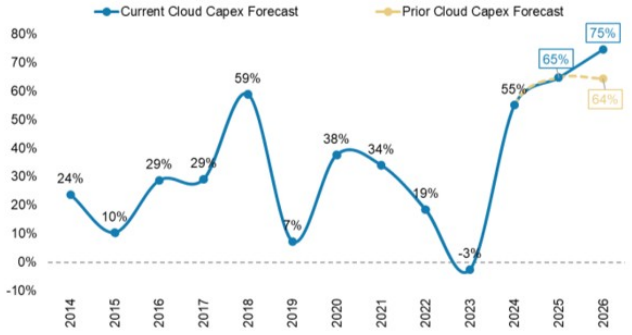
Top 4 CSPs (Amazon, Google, Microsoft and Meta) capex was up 95% Y/Y in 1Q26CY



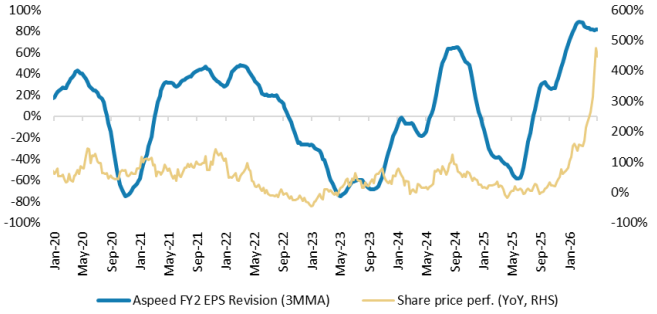
Capex-to-EBITDA ratio should remain stable at around 50%



Top 4 Cloud Providers: Cloud Capex Y/Y Growth



Aspeed earnings estimate revision breadth



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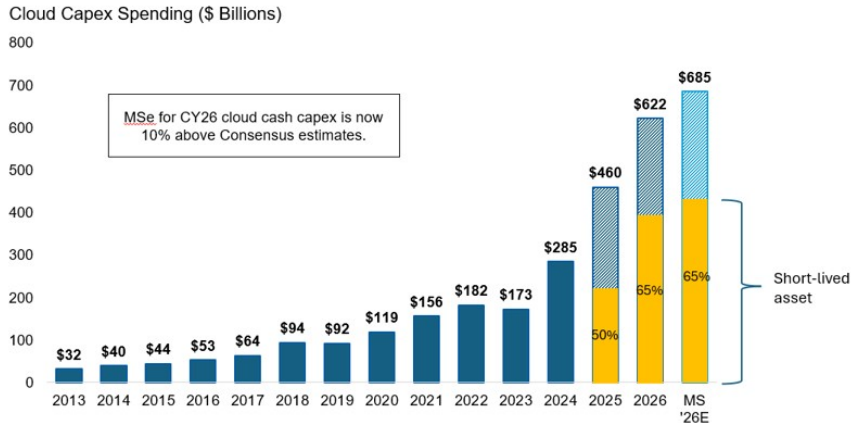
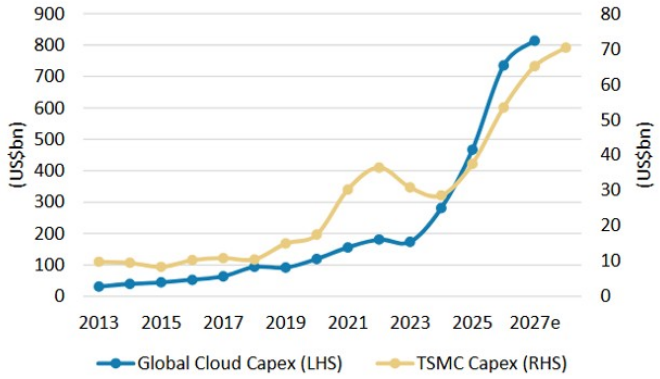
Cloud Capex Remains Robust From Major CSPs

Morgan Stanley cloud capex tracker estimates nearly US$685bn of cloud capex in 2026 (Purely Top 10 listed global CSPs; no sovereign AI)



Global Cloud Capex vs. TSMC Capex



Source: FactSet, company data,

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Announced Power Deployment Implications for TSMC

GPU/ASIC Vendor	Announced Power Deployment Implication for TSMC NVIDIA (Top US AI firm)	AMD (Top US AI firm)	Broadcom	AWS (Top US AI firm)
Power Deployed (GW)	10	6	3.5	2
Rack name	Vera Rubin NVL144	Helios	TPU	Trainium3 UltraServers
Power consumption per Rack (kW)	220	220	63	144
Rack Number (k units)	45	27	56	14
Chip Name	Rubin GPU	MI455 GPU	TPUv7 (Ironwood) TPUv8i (Sunfish)	Trainium3 (4)
Chip Volume (k units)	3,273	1,964	3,571	2,000
Life Cycle for the project	3	3	5	8
Implied life-cycle CoWoS Volume (k wafers)	409	166	260	118
Implied life-cycle 2/3nm wafer Volume (k wafers)	260	95	190	107
2027 annual CoWoS demand (k wafers)	136	55	52	15

v8i per chip TDP being ~980W.

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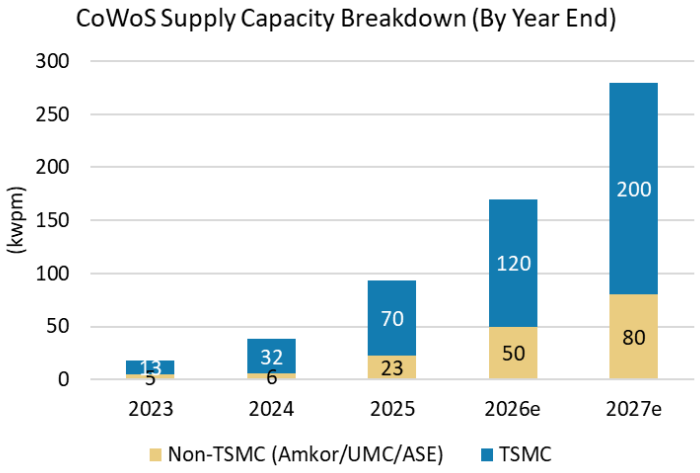
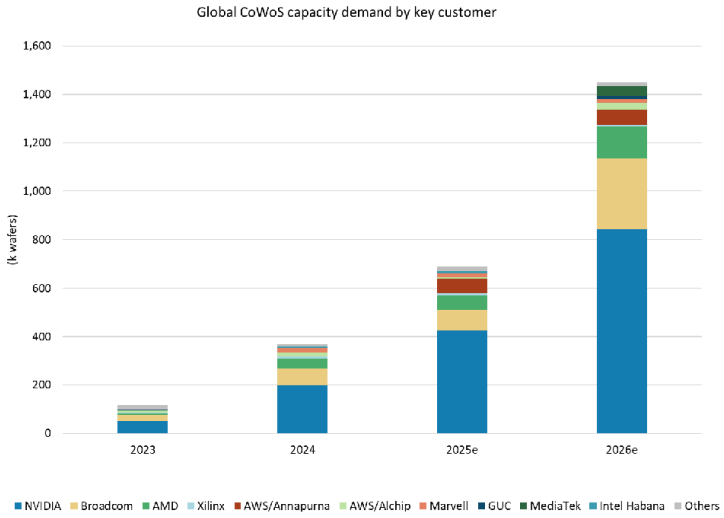
TSMC May Expand CoWoS Capacity to 200kwpm by 2027 Given Continual Strong AI Demand

Global CoWoS capacity expansion by year-end and by vendor



Global CoWoS consumption, by customer



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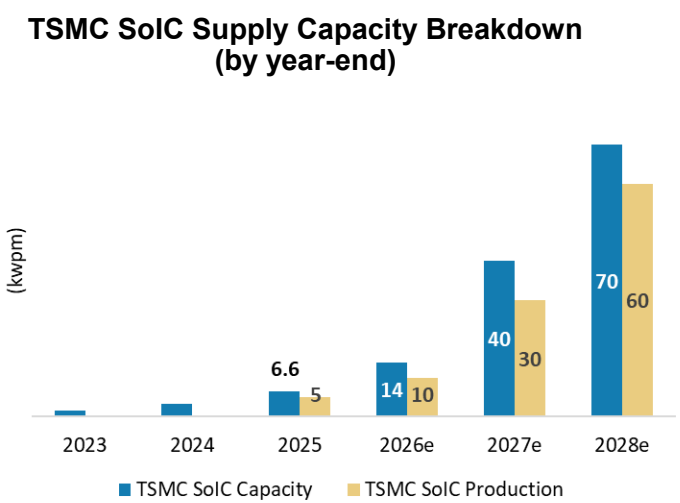
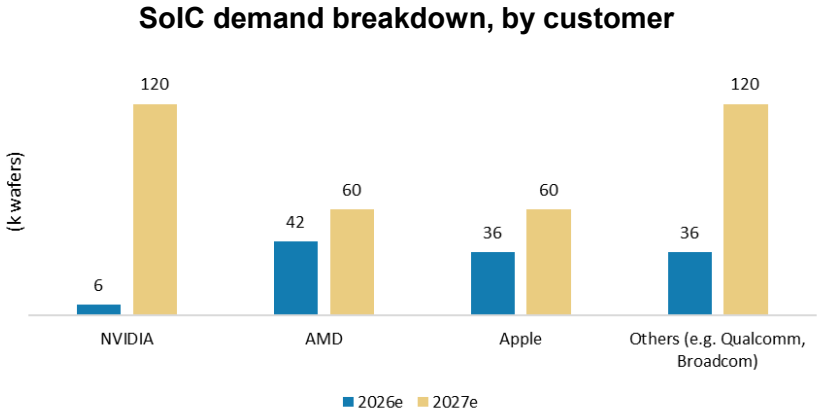
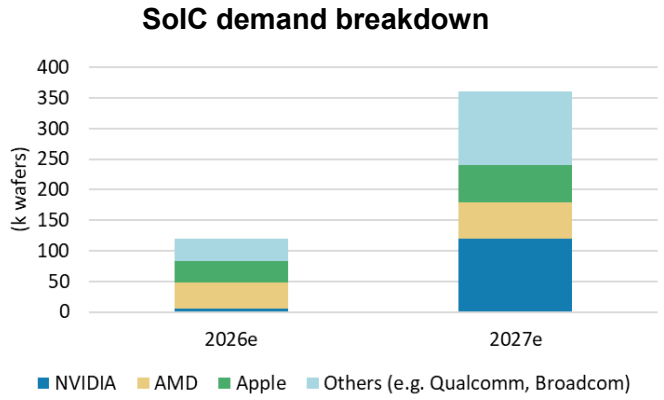
SoIC Expansion Expected to Be a Key Focus Area for TSMC in the Coming Years







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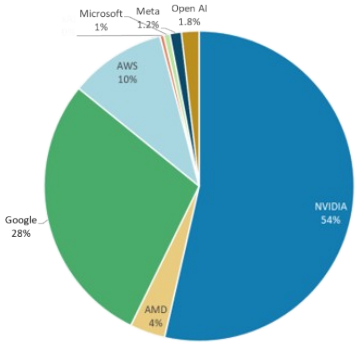
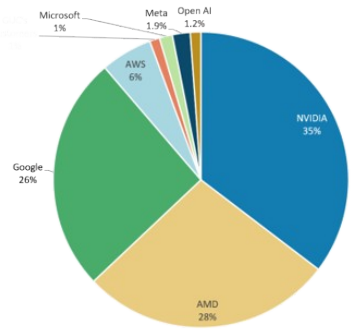
AI Computing Wafer Consumption Could Reach >US$46bn in 2027, with NVIDIA Accounting for the Majority

AI semi wafer consumption, by customer, 2026e



AI semi wafer consumption, by customer, 2027e



AI chip vendor	Product name	CoWoS capacity allocation (k wafers)	Chips per CoWoS wafer	Implied shipments (k)	Compute die size	Geometry	Compute die units	Wafer consumption (k wafers)	Wafer price (US$)	Wafer revenue TAM (US$ mn)
AI GPU (2027e)										
NVIDIA	B300	40	14	560	850	4nm	2	44	23,042	1,024
	Vera CPU	250	23	5,750	850	3nm	1	228	27,300	6,229
	Rubin R200	740	8	5,920	850	3nm	2	470	27,300	12,827
	Rubin Ultra	130	8	1,040	850	3nm	2	58	27,300	1,588
AMD	MI350 series	24	12	288	110	3nm	8	8	27,300	229
	MI400 series	192	10	1,920	850	2nm	2	23	30,000	698
	MI500 (Arcadia)	24	4	96		2nm			30,000	
	Venice CPU	270	25	6,750		2nm				
AI ASIC (2027e)										
Google	TPU v7p (Ironwood; AVGO)	13	16	208	700	3nm	2	14	27,300	371
	TPU v8i (Sunfish; AVGO)	330	12	3,960	800	3nm	2	296	27,300	8,075
	TPU v8t (Zebrafish; MediaTek)	180	20	3,600	800	3nm	2	269	27,300	7,341
	TPU v9 (Humufish; MediaTek)			400	850	2nm	2	32	27,300	867
AWS	Trainium 3	140	17	2,380	700	3nm	2	127	27,300	3,465
GUC's customers		60	20	1,200	645	4nm	1	29	23,042	674
Microsoft	Maia 300	50	11	550	850	2nm	1	29.1	30,000	873
Meta	MTIA 3 (Iris)	55	10	550	850	3nm	2	44	27,300	1,192
Others		18								
Total		**2,664**						**1,707**		**46,418**

Source: Company

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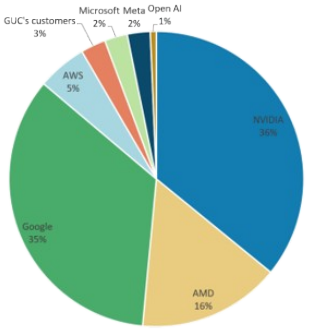
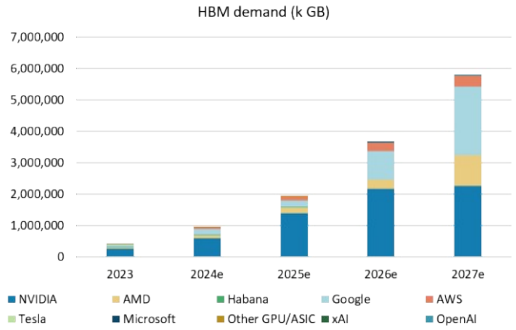
HBM Consumption in 2027e – Up to 50bn Gb

HBM consumption by customer in 2027e



NVIDIA still consumes most HBM supply in 2026e



AI chip vendor	Product name	CoWoS capacity allocation (k wafers)	Chips per CoWoS wafer	Implied shipments (k)	HBM chip density (GB)	HBM chip units	Total HBM size (GB)	HBM generation	HBM vendor	Total HBM demand (k GB)
AI GPU (2027e)										
NVIDIA	B300	40	14	560	36	8	288	HBM3e 12hi	Hynix/Micron	161,280
	Vera CPU	250	23	5,750						
	Rubin R200	740	8	5,920	36	8	288	HBM4 12hi	Hynix/Micron/Samsung	1,704,960
	Rubin Ultra	130	8	1,040	48	8	384	HBM4e 12hi	Hynix/Micron/Samsung	399,360
AMD	MI350 series	24	12	288	36	8	288	HBM3e 12hi	Samsung/Micron	82,944
	MI400 series	192	10	1,920	36	12	432	HBM4 12hi	Samsung/Micron	829,440
	MI500 (Arcadia)	24	4	96	48	16	768	HBM4e 12hi	Samsung/Micron	73,728
	Venice CPU	270	25	6,750						
AI ASIC (2027e)										
Google	TPU v7p (Ironwood; AVGO)	13	16	208	24	8	192	HBM3e 8hi	Hynix/Samsung	39,936
	TPU v8i (Sunfish; AVGO)	330	12	3,960	36	8	288	HBM3e 12hi	Samsung/Hynix/Micron	1,140,480
	TPU v8t (Zebrafish; MediaTek)	180	20	3,600	36	6	216	HBM3e 12hi	Samsung/Hynix/Micron	777,600
	TPU v9 (Humufish; MediaTek)			400	48	12	576	HBM4e 12hi	Samsung/Hynix/Micron	230,400
AWS	Trainium 3	140	17	2,380	36	4	144	HBM3e 12hi	Hynix/Samsung/Micron	342,720
GUC's customers		60	20	1,200	24	6	144	HBM3e 8hi	Samsung?	172,800
Microsoft	Maia 300	50	11	550	36	8	288	HBM4 12hi	Samsung	158,400
Meta	MTIA 3 (Iris)	55	10	550	36	8	288	HBM3e 12hi	Samsung/Hynix/Micron	158,400
Others		18								
Total		**2,664**								**6,326,088**
									Total HBM demand (mn Gb)	**50,609**

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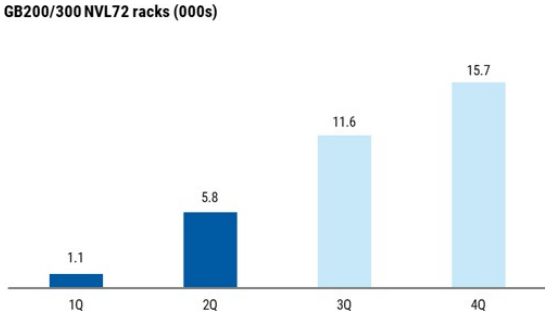
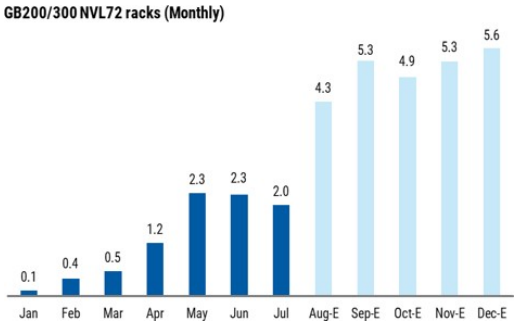
NVIDIA GB200/300 Rack Output Estimates

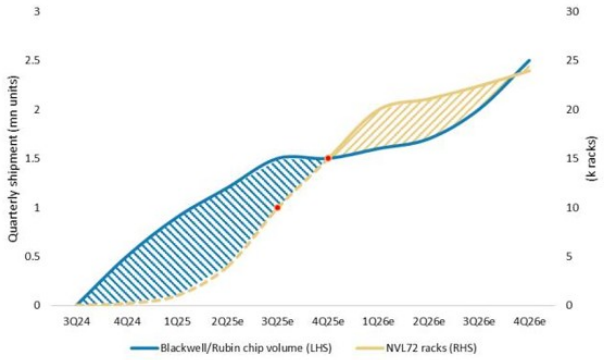
GB200/300 NVL72 Rack Ramp Quarterly Trajectory



Industry-wide GB200 NVL72 Rack Monthly Output



We estimate that TSMC produced 5.1mn chips in 2025, with full-year GB200 NVL72 shipments seen reaching 30k



we include Wistron's computing tray (L10) rack equivalent number (without accounting for rack assembly and test times for L11). Estimates are from our Asia Pacific tech team's downstream estimates.

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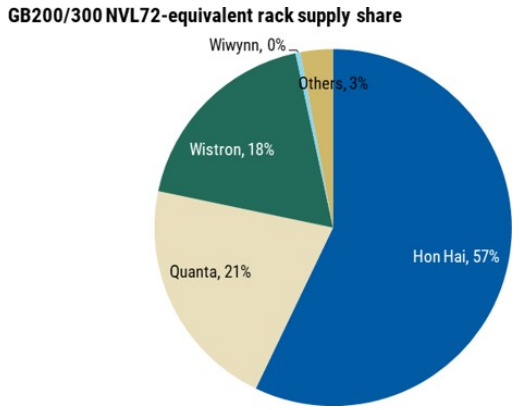
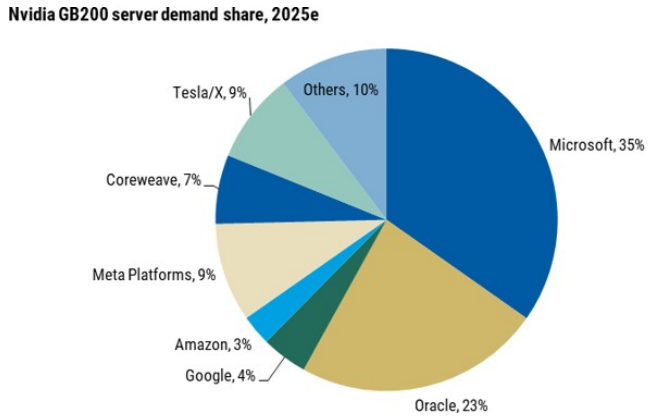
NVIDIA GB200/300 Server Racks Supply/Demand Assumptions

NVIDIA GB200/300 rack supply share (2025)



NVIDIA GB200/300 rack demand share (2025)



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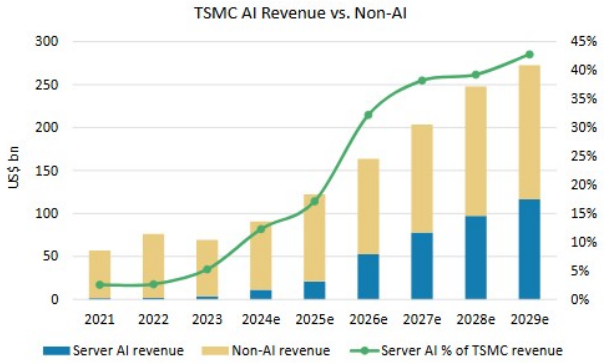
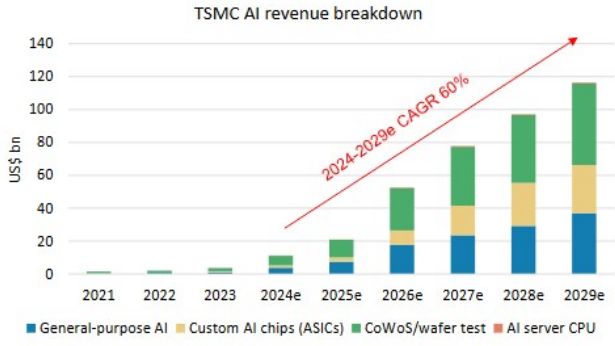
TSMC AI Semis Revenue Could Reach 60% from 2024 to 2029e

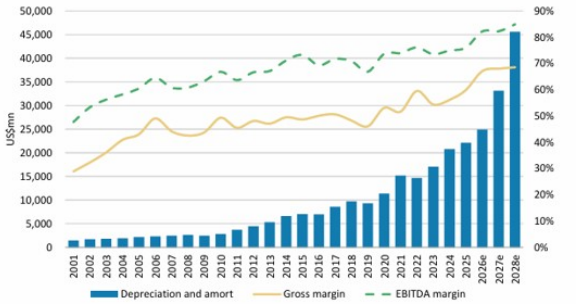
TSMC – AI semis revenue could account for >30% of 2026e revenue



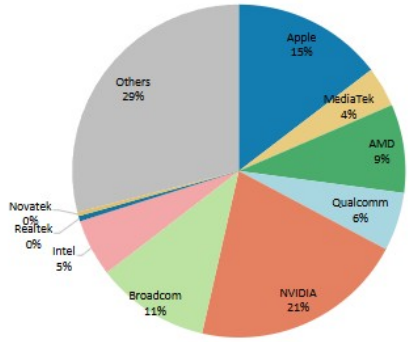
TSMC – AI semis revenue breakdown



TSMC – margin expansion



TSMC – 2026e revenue breakdown by customer



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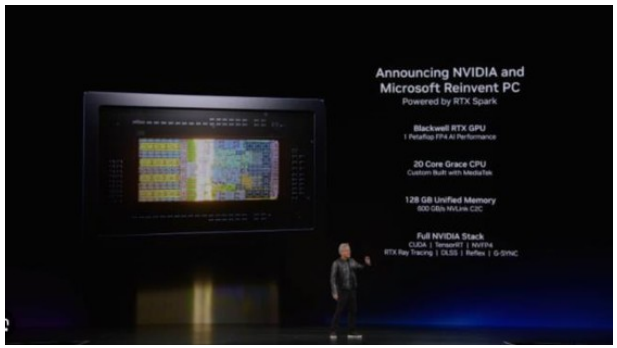
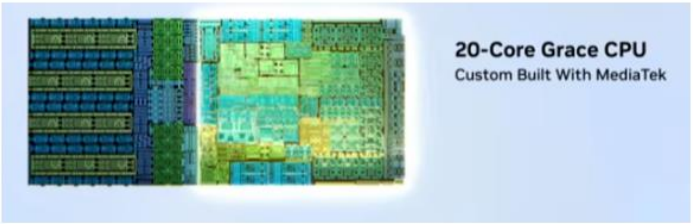
Nvidia/MediaTek New AI PC (RTX Spark) Could Trigger Potential Edge Device Replacement

New AI PC announced by Nvidia (N1X)



MediaTek provides 20-core customized Grace CPU for N1X



RTX Spark (N1X) provided by MSI (available in 3Q26)

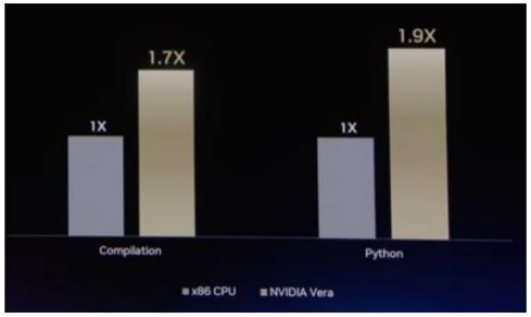
RTX Spark (N1X) provided by ASUS (available in 3Q26)

Source: Nvidia, MSI, ASUS

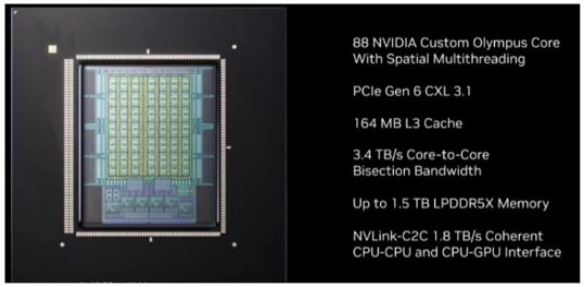
Morgan Stanley

Nvidia's Latest Vera CPU Could Support Robust Agentic CPU Demand

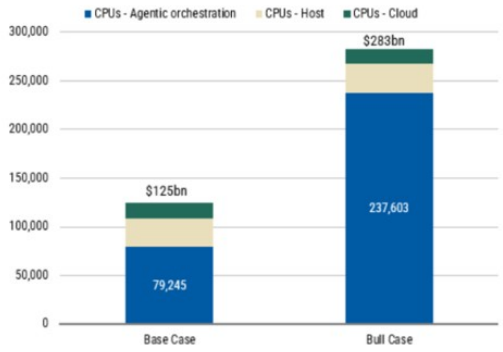
Vera performance could be 1.8x that of highest-performance x86 CPU



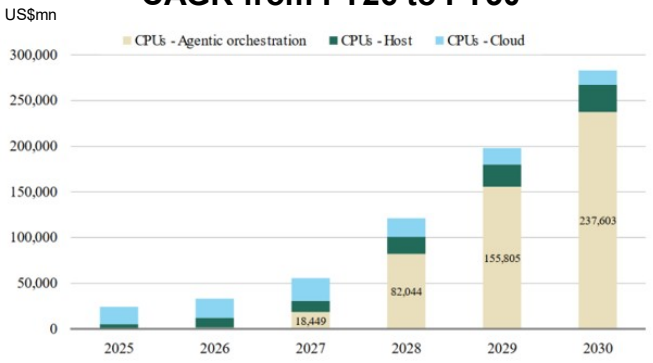
Vera CPU cores are not split across chiplets, enabling faster core-to-core connection



MS bull case implies a $238bn CPU orchestration TAM



In MS top-down model, we estimate the Agentic CPU TAM will grow at a 251% CAGR from FY26 to FY30



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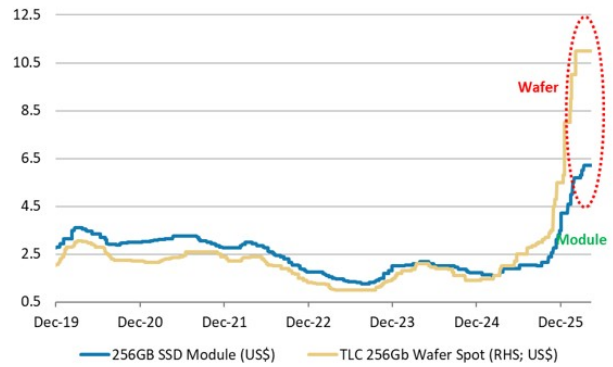
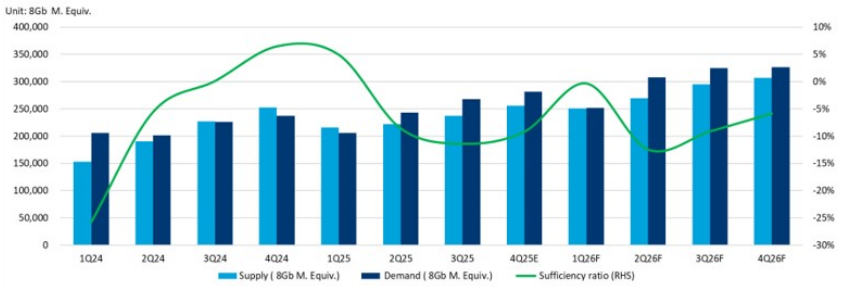
AI Storage Leads to NAND Shortage; We Also Expect NOR Flash Undersupply into 2026

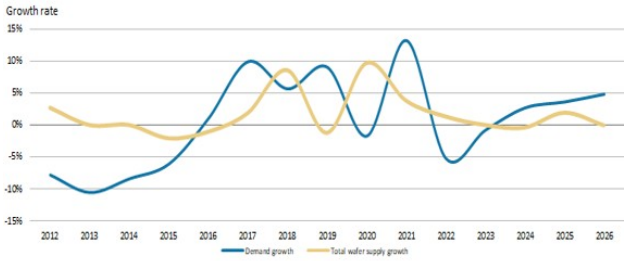
NAND wafer spot pricing and module prices



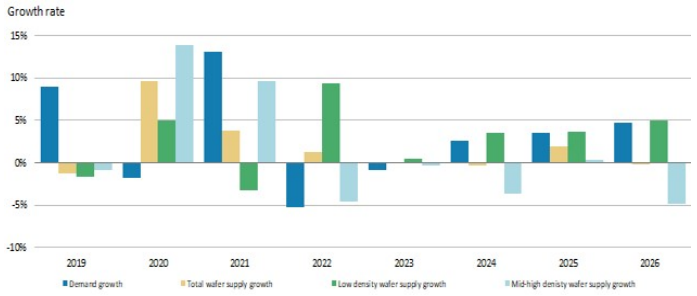
NAND supply and demand model



NOR flash demand and supply growth rates



NOR flash demand and supply growth rates



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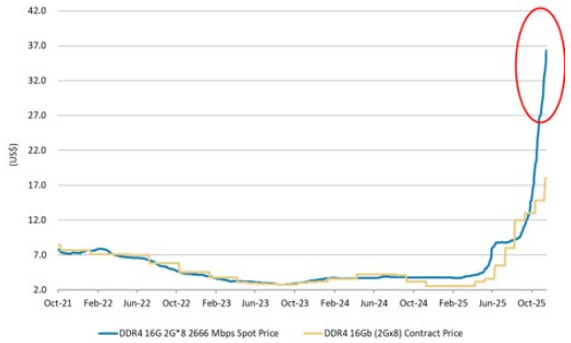
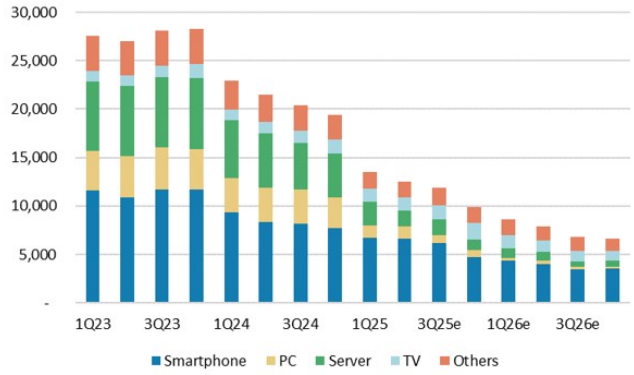
DDR4 Shortage to Persist into 2H26; Spot Price Capped

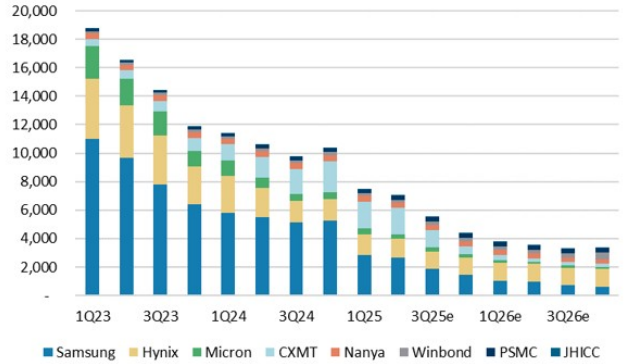
DDR4 16Gb spot vs. contract price



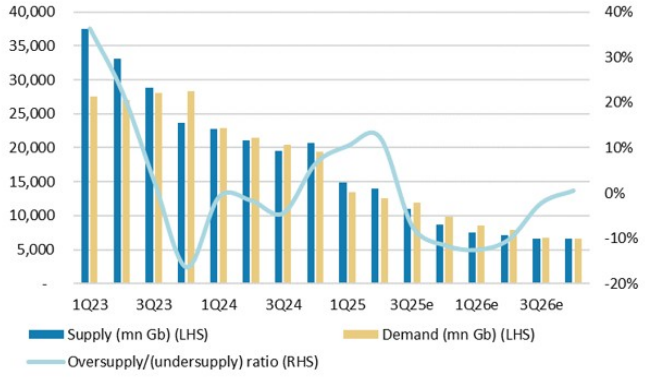
Quarterly demand breakdown, by product (mn Gb)



Quarterly supply breakdown (mn Gb)



Quarterly supply and demand summary



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AI ASIC, CPO, and Chip Testing

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AI Semis: Now and the Future – "Prompts"

- Generative AI Demand Driver:
    - Killer apps
    - Competition
    - Sovereign
- Growth limitations:
    1. Budget
    2. Energy -> in the US
    3. Chip Capacity -> in China
    4. Regulation
- Semiconductor solutions:
    - Moore's Law
    - CoWoS/ SoIC
    - HBM
    - CPO
    - Custom chip
    - GaN HVDC 800V
- Growth perspective:
    1. Inference vs. Training AI semis
    2. Edge vs. Cloud AI semis
    3. Custom ASIC vs. AI GPU

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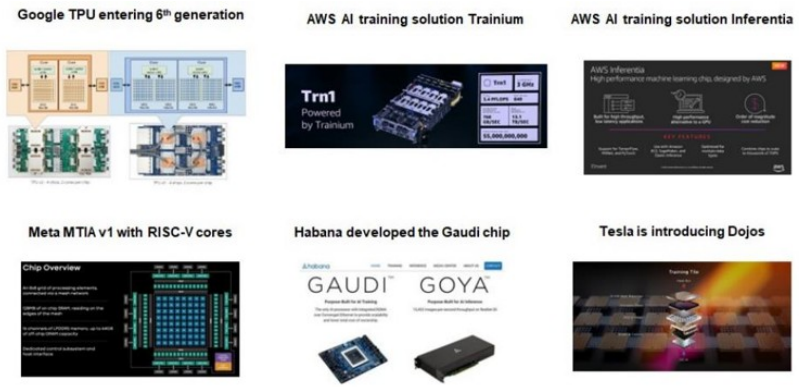
CSPs Still Need Custom Chips Even with NVIDIA Providing Powerful AI GPUs

Global CSP cloud AI custom chips



Latest evidence of AI ASIC: AWS Trainium3

Trainium Forecasts from MS Asia Research team

k Units	2023	2024	2025e	2026e	2027e	2028e
Trainium1/Inferentia2	300	600	30			
Trainium2		300	1,200			
Trainium3			85	1,700	2,380	-
Trainium4					150	2,000
Total	**300**	**900**	**1,315**	**1,700**	**2,530**	**2,000**

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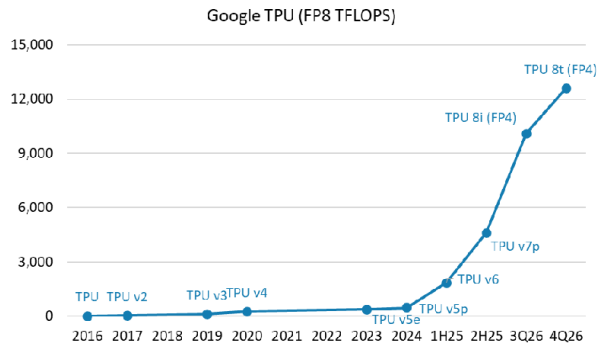
More ASIC Projects Are Coming, According to Each CSP Plan

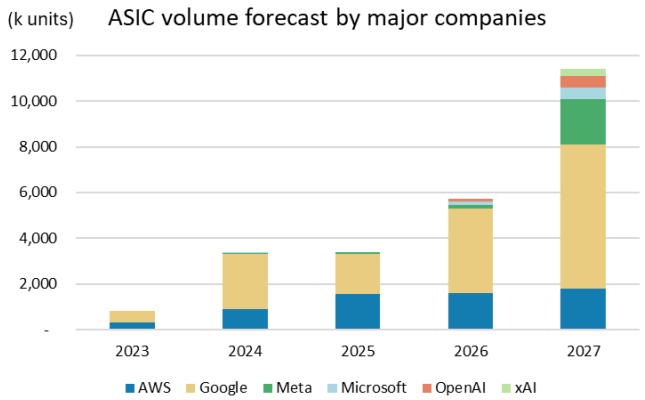
TPU Forecasts from MS Asia Research team

k Units	2023	2024	2025e	2026e	2027e	2028e
v5	500	2,400	250			
v6 (Trillium)			1,200			
v7 (Ironwood, by Broadcom)			300	2,300	200	
v8i (Sunfish; 3nm, by Broadcom)				900	4,000	2,500
v8t (Zebrafish; 3nm, by MediaTek)				500	3,000	1,000
v9 (Humufish; 2nm, by MediaTek)					150	3,000
v9a (Merope; 2nm, by US design service)						unknown
v10 (Icefish; 1.4nm, by MediaTek)						unknown
Total	**500**	**2,400**	**1,750**	**3,700**	**7,350**	**>6500**

Google TPU performance is growing rapidly



ASIC volume forecast by major companies



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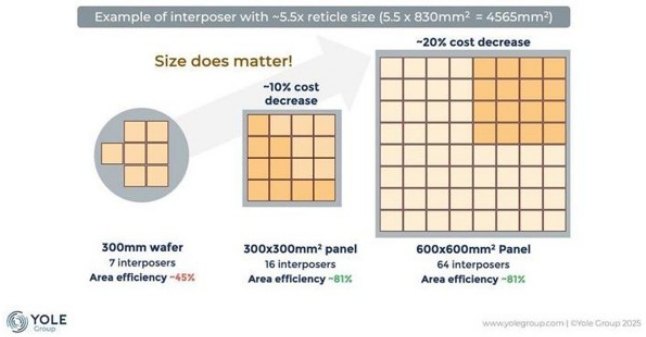
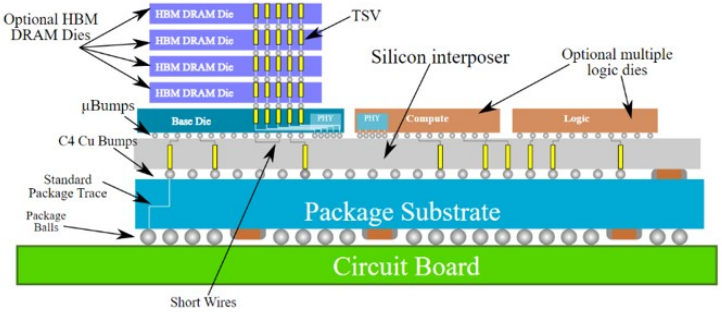
What About the Competition Between TSMC's CoWoS and Intel's EMIB?

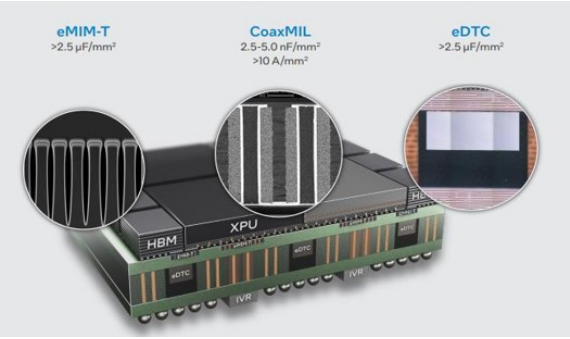
TSMC CoWoS can support up to 9.5x reticles, or four chips per wafer



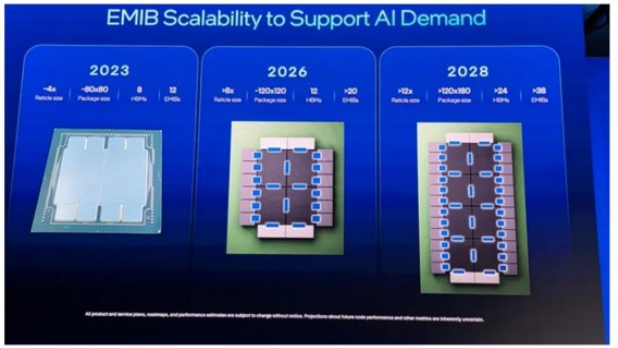
TSMC's CoWoS-S (silicon interposer) packaging architecture



Intel EMIB eDTC: APMemory's technology



Intel's EMIB can easily support larger chips with more reticles (>12) if its supply chain can execute well



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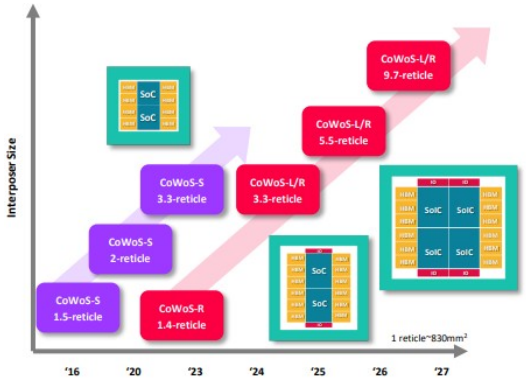
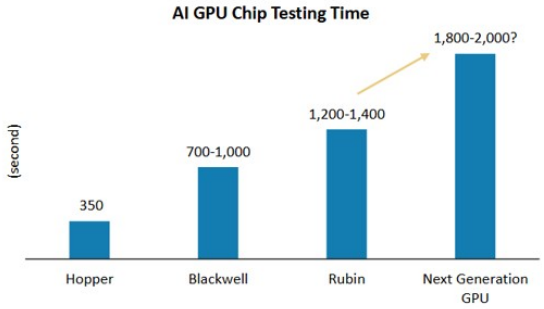
Larger Package Sizes Are Emerging as a Key Industry Trend

TSMC's roadmap for interposer size

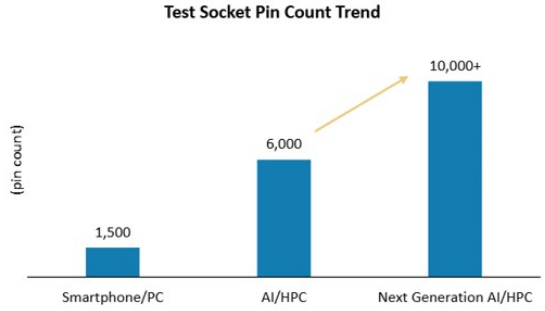


Chip testing time continuing to trend up



Testing equipment market is expected to expand at a 35% CAGR during 2024-27e

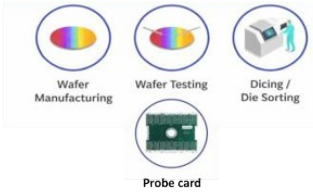
AI/HPC test socket needs higher pin counts vs. traditional consumer tech applications



Source: Company data,

Morgan Stanley

Mapping the Roles of Hon Precision, WinWay and MPI in the Semi Supply Chain

	Wafer Manufacturing	Wafer-level Packaging	Chip Testing		System Assembly/Module
			Burn-in and Final Test	SLT	
Testing surface					
Manufacture	TSMC	TSMC, OSAT (ASE, SPIL & Amkor)	OSAT (ASE, KYEC, PTI, Sigurd)	OSAT (ASE, KYEC, PTI, Sigurd)	Hon Hai, Winstron and Quanta
Equipment	Wet Etching: GPTC, Scientech Wafer Testing: TEL, TSK Dicing: E&R, Everprecision Die Sorting: GMM	GPM, GPTC, AllRing, APT	**Hon Precision**, Advantest, Teradyne	**Hon Precision**, Chroma	Cooling equipment: AVC, Auras
Material Kit/Jig	**Probe Card: MPI, Winway, Technoprobe**	PCB: GCE, WUS HDI substrate: Unimicron	**Socket: Winway**		

Source

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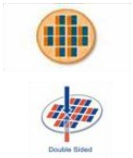
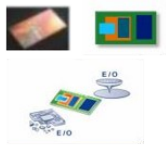
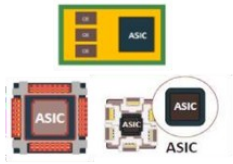
New Evolution for Testing Equipment and Components: CPO

Test Insertion	Insertion 1	Insertion 2	Insertion 3	Insertion 4		Insertion 5 (potential)
				Insertion 4O	Insertion 4E	
Test content	Electronic IC (EIC) & Photonic IC (PIC)	EIC die to PIC wafer (after SoIC)	Optical engine (die-to-die)	CPO package (ASIC+OE) Optical Testing	CPO package (ASIC+OE) Electrical Testing (2025-2026) Optical+Electrical Testing (starting 2027e)	CPO package (ASIC+OE) SLT?
Testing surface						
Key Product timeline	2025-2026 Scale-out CPO switch (Spectrum+Quantum) products 2027e onward: Scale-out CPO switch (Spectrum+Quantum) + Scale-up CPO switch products					
Testing details	El. & opt. DC, (power, loss, dark current etc.)	E/O, O/E, O/O, high speed, S-parameters	Full calibration/DC, high-speed functional, optical loopback, alternatively: S-parameters	Optical Light Transmission Testing, optical loopback	BER testing, signal testing	Full system functional validation
Testing service provider	Foundry (Wafer-level) TSMC	Foundry (Wafer-level) TSMC	OSAT (Die/chip level) SPIL (ASE Group)	OSAT (Die/package level) SPIL (ASE Group)	OSAT (Die/package level) SPIL (ASE Group)	OSAT (Die/package level) SPIL (ASE Group)
Equipment and Consumable Vendor	PIC ATE tester: 1) Advantest + TEL + Formfactor 2) Chroma (underqualification) EIC tester: 1) Teradyne + TEL EIC Probe card: FormFactor	Wafer level testing: 1)Ficontec +Formfactor +Teradyne 2) Advantest+ **MPI**	Die-to-die prober: 1. TEL 2. MPI Optical engine E/O tester+laser reliability test+ELS source test head: Chroma **Optical and Electrical Test Socket: Winway**	CPO switch tester: Chroma **Coaxial socket/Hypersocket: Winway**	ATE tester: 1) Advantest (under qualification) 2)Teradyne **FT Handler+ELS source test head+optical alignmnet stage : Hon Precision** **Coaxial socket/Hypersocket: Winway**	CPO SLT tester: Chroma (under qualification) **Coaxial socket/Hypersocket: Winway**

Source

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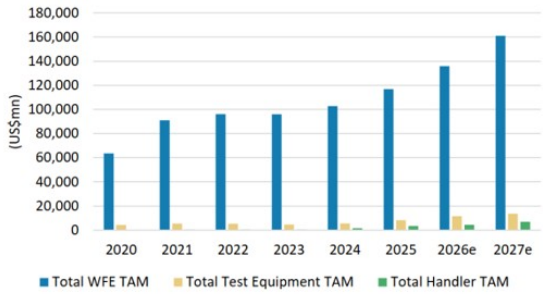
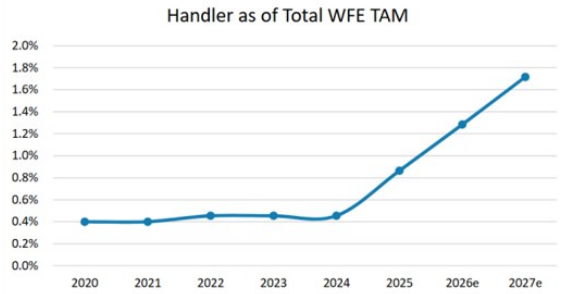
Hon Precision: Key Beneficiary of the Structural Trend Toward Longer Testing Times; OW

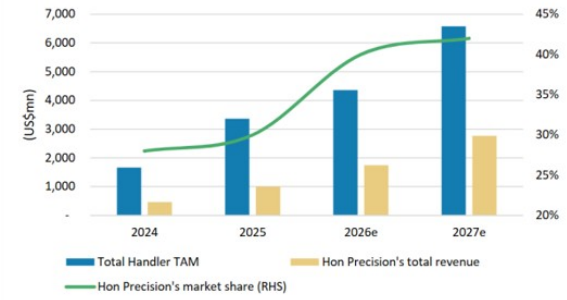
We expect the overall handler market to increase from US$436mn in 2023 to US$6.6bn in 2027e



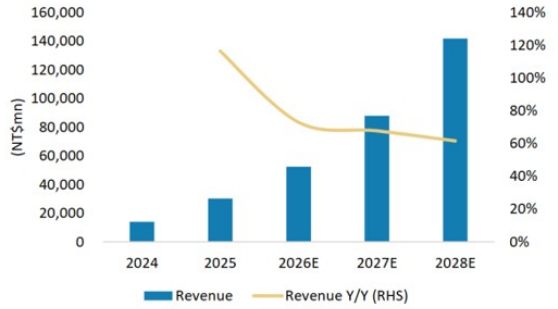
We expect handlers to account for 1.7% of global WFE TAM in 2027e, vs 0.4% in 2020



Hon Precision to lift its total handler market share from 28% in 2024 to 42% by 2027e



We expect Hon Precision's revenue to expand at a 67% CAGR, 2025-28e



Source: Company data,

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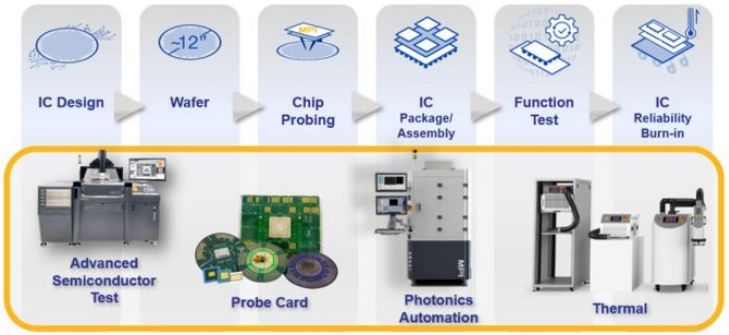
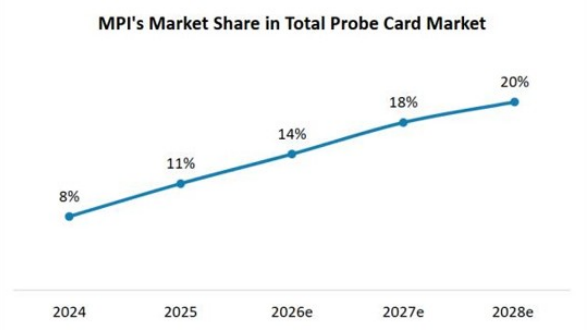
MPI: Probe Card Technology Leader with CPO Optionality; OW

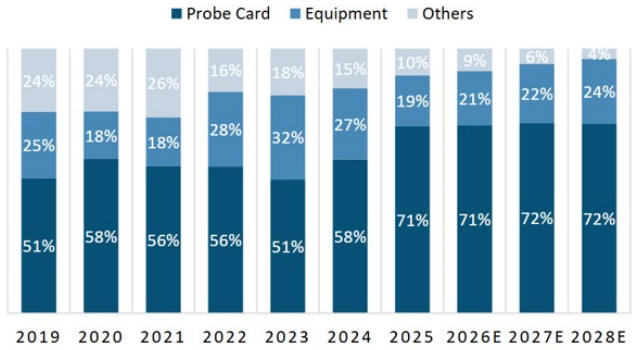
MPI's product in chip manufacturing and test process



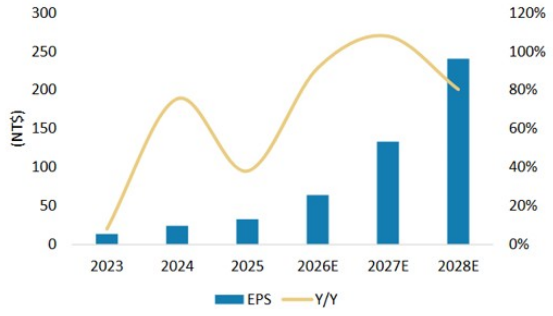
We expect MPI's probe card market share to grow from 8% in 2024 to 20% by 2028e



Probe cards to remain the key focus, with CPO equipment acting as driving force



We expect MPI's EPS to rise at a 94% CAGR, 2025-28e

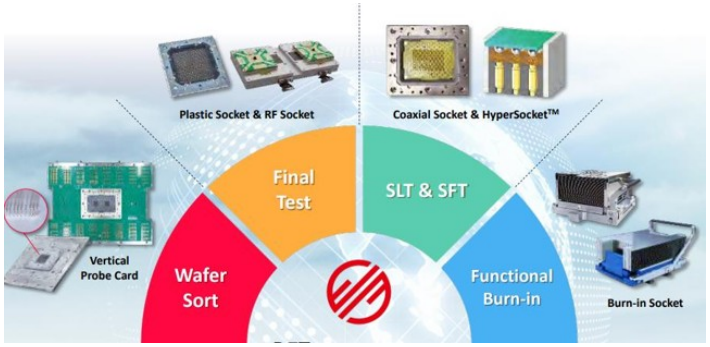


Source: Company data,

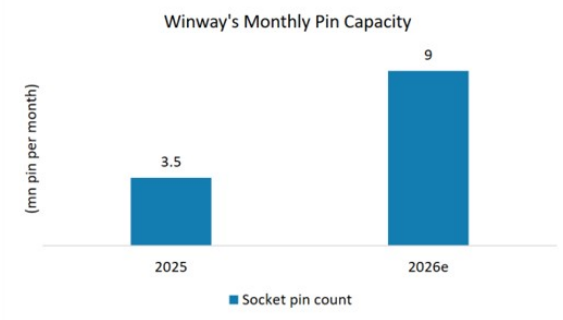
Morgan Stanley

WinWay: Socket Leader Leveraging AI Packaging Complexity; OW

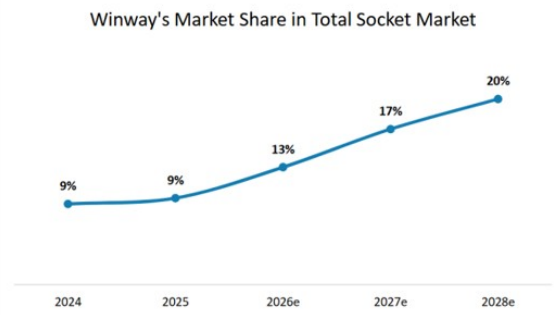
WinWay's total solution of probe card and socket enables vertical integration strategy



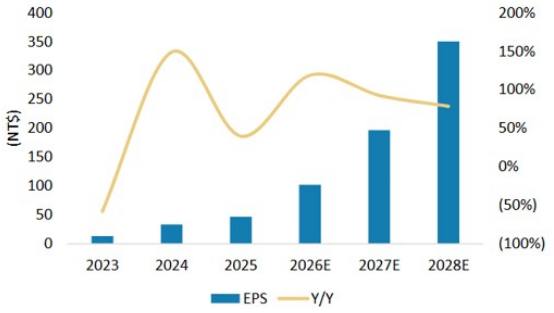
WinWay to expand its pin capacity from 3.5mn per month in 2025 to 9mn per month in 2026



We expect WinWay's market share to grow from 8.6% in 2024 to 20% in 2028e



We expect WinWay's EPS to rise at a 95% CAGR, 2025-28e



Source: Company data,

Morgan Stanley

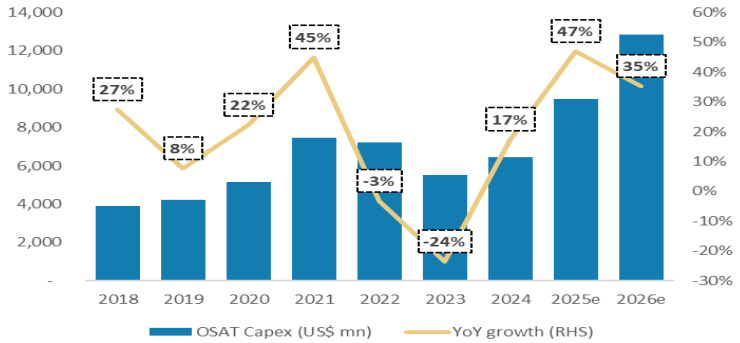
China Semis:

OSAT, Compound, MCU, and AI GPU

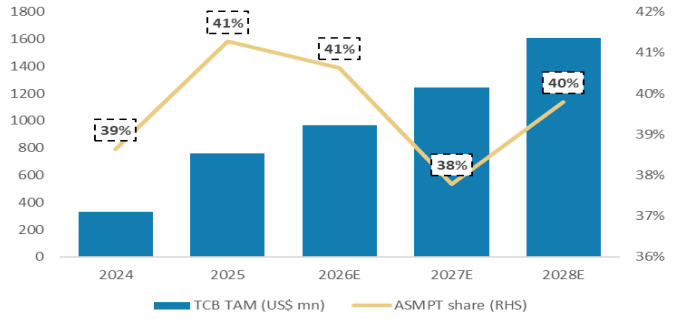
Morgan Stanley

Positive on Back-end Equipment (ASMPT); Neutral on China OSAT

OSAT capex expected to grow ~35% in 2026 driven by both mainstream semi and advanced packaging



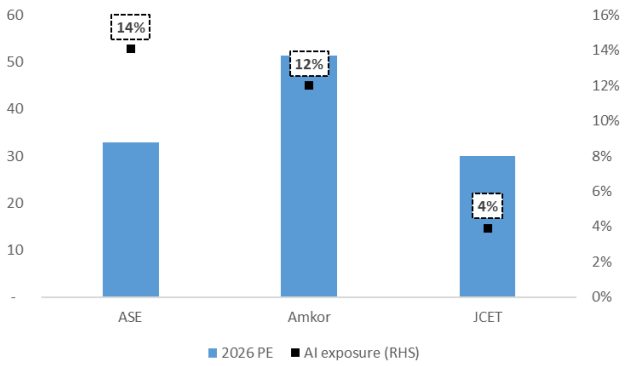
We expect ASMPT's share in TCB to be ~40% in 2028



ASMPT Equipment Matrix – CPO Assembly Flow

CPO Assembly Step	Process Technology	ASMPT Equipment	Precision
LD on PIC (Laser Diode Attach)	Eutectic Bonding	**NANO**	**< 0.5 µm**
µLens on PIC (Microlens Attach)	C2W (Chip to Wafer)	**NANO**	**0.2 µm**
EIC on PIC (Electronic IC Attach)	TCB / Mass Reflow / Hybrid Bonding	**FIREBIRD / NOVA Pro / LITHOBOLT**	**0.2 – 1 µm**
FAU on PIC (Fiber Array Unit Attach)	High-Precision Bonding	**NOVA / NANO**	**< 1 µm**
OE on Substrate (Optical Engine Attach)	TCB / Mass Reflow	**FIREBIRD XD / NUCLEUS XD**	**1 µm**

JCET's AI exposure the lowest vs. its peers



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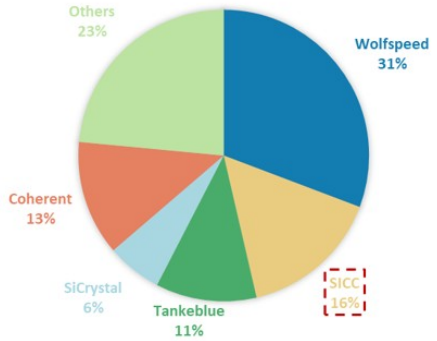
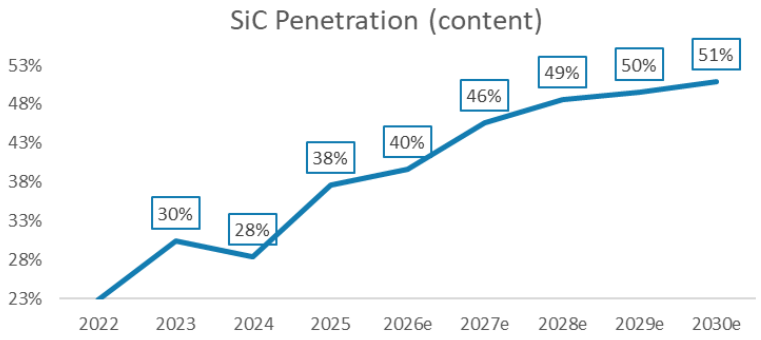
Prefer SiC over GaN: SICC (OW) and InnoScience (EW)

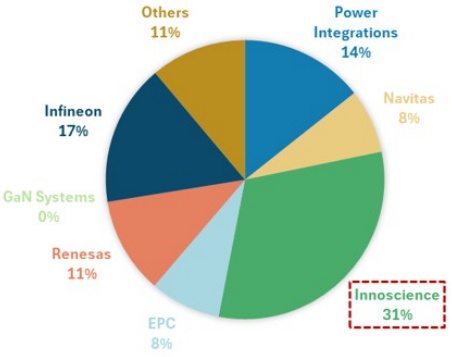
SICC market share rise in SiC substrate market (2025)



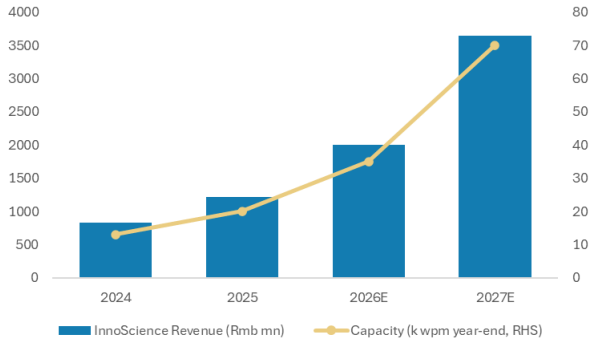
We expect SiC penetration to exceed 50% by 2030



InnoScience dominates the GaN market with TAM ~US$584mn in 2025



Significant capacity expansion to support strong revenue growth but depreciation may weigh on profitability



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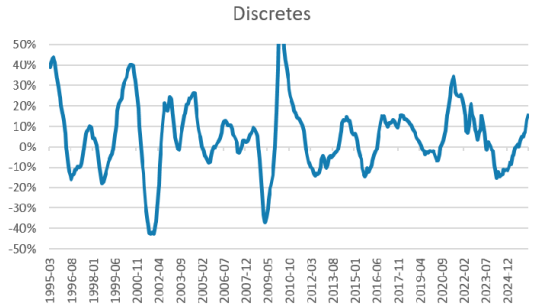
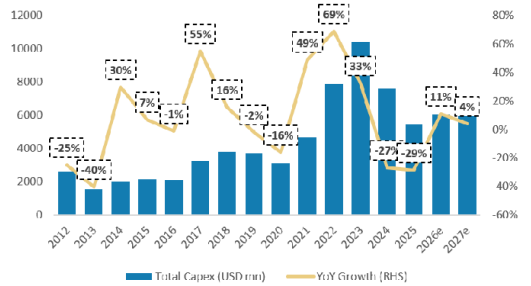
Power Semi: Supply-driven Up-cycle

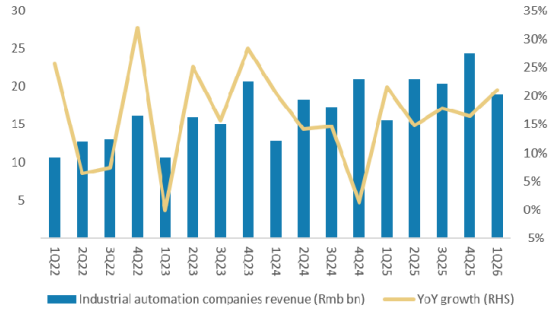
Total discrete revenue yoy growth turned positive since 4Q25



Global leading power semi companies' capex declined for two years



Industrial automation companies' revenue grew robustly at 21% YoY in 1Q26



China's EV wholesale growth is weak YTD but turning incrementally positive