Memory Market Update

HBM S-D update; pricing tailwind and 63% 2026E-28E demand CAGR even after the de-spec

- **HBM model revision: Three years rolling forecast largely unchanged, tighter 2026E-27E vs. less tight 2028E.** Following the Asia Tech research team's CoWoS model update last week, we revise our HBM industry model (higher 2026E-27E demand mainly on greater system unit sales demand vs. lower 2028E demand, reflecting content adjustment; 8Hi solution mix increase and 16Hi push-out to 2029E at the earliest). On the other hand, three years' rolling accumulated HBM bit demand is largely unchanged, at 163bn Gb. While the HBM S-D shortage trend continues through our forecast period, we sense a slight HBM S-D trend improvement from -20% in 2026E to -16% in 2028E. Reflecting the worsening accumulated S-D (over four months of shortage vs. procurement demand), we revise up our pricing forecast and overall HBM TAM (US$160bn-282bn for CY27E-28E, representing 18-24% of the three global memory makers' overall DRAM revenue sales). On the HBM supply side, we make a mild upward revision in CY27E-28E, reflecting a higher HBM wafer allocation (especially SEC).

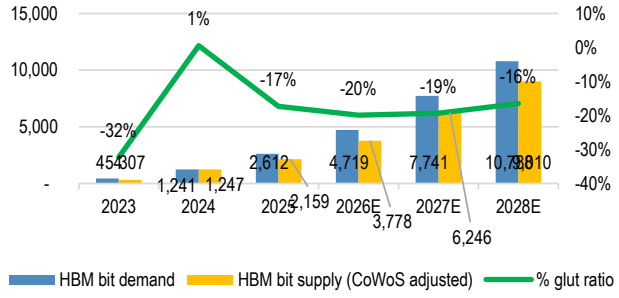
Technology - Semiconductors

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Figure 1: HBM S/D ratio (CoWoS adjusted)

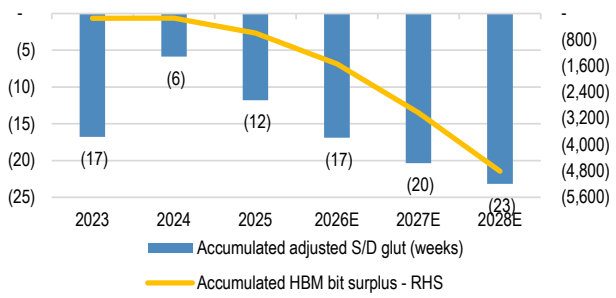
1GB equiv. Mn, % - RHS



Source: Company data, J.P. Morgan estimates.

Figure 2: Accumulated HBM bit surplus and glut ratio (weeks)

Weeks, 1GB equiv. Mn - RHS



Source: Company data, J.P. Morgan estimates.

Table 1: HBM estimate revisions

	Revised			Previous			% difference		
	2026E	2027E	2028E	2026E	2027E	2028E	2026E	2027E	2028E
HBM bit demand (unit mn, 1GB eqv) - calendar year	**3,770**	**6,618**	**9,986**	**3,579**	**6,268**	**10,751**	**5%**	**6%**	**-7%**
NVDA	2,202	2,840	4,110	2,101	2,607	4,854	5%	9%	-15%
AMD	238	583	962	235	634	999	1%	-8%	-4%
ASIC/others	1,331	3,195	4,914	1,243	3,028	4,898	7%	6%	0%
HBM procurement demand (unit mn, 1GB eqv) - t+4 months	**4,719**	**7,741**	**10,788**	**4,451**	**7,205**	**11,449**	**6%**	**7%**	**-6%**
NVDA	2,415	3,264	4,452	2,298	3,095	5,060	5%	5%	-12%
AMD	353	709	1,120	358	706	1,112	-1%	1%	1%
ASIC/others	1,952	3,768	5,215	1,796	3,404	5,276	9%	11%	-1%
HBM bit supply (1GB eqv)	4,129	6,656	9,401	4,152	6,613	9,350	-1%	1%	1%
HBM bit supply after CoWoS	**3,778**	**6,246**	**9,010**	**3,802**	**6,205**	**8,960**	**-1%**	**1%**	**1%**
CoWoS yield (%)	92%	94%	96%	92%	94%	96%	0%	0%	0%
HBM S-D glut ratio (%) : procurement year	**-20%**	**-19%**	**-16%**	**-15%**	**-14%**	**-22%**	**-5%**	**-5%**	**5%**
HBM S-D glut (weeks)	(10.4)	(10.0)	(8.6)	(7.6)	(7.2)	(11.3)	(2.8)	(2.8)	2.7
HBM S-D glut (weeks) - accumulated	(16.9)	(20.3)	(23.2)	(10.9)	(13.9)	(20.1)	(6.0)	(6.4)	(3.1)
HBM industry revenue ($ mn)	**64,420**	**160,144**	**282,197**	**64,287**	**145,617**	**252,075**	**0%**	**10%**	**12%**
HBM ASP (US$, 1Gb eqv)	2.0	3.0	3.8	1.9	2.8	3.4	1%	9%	11%

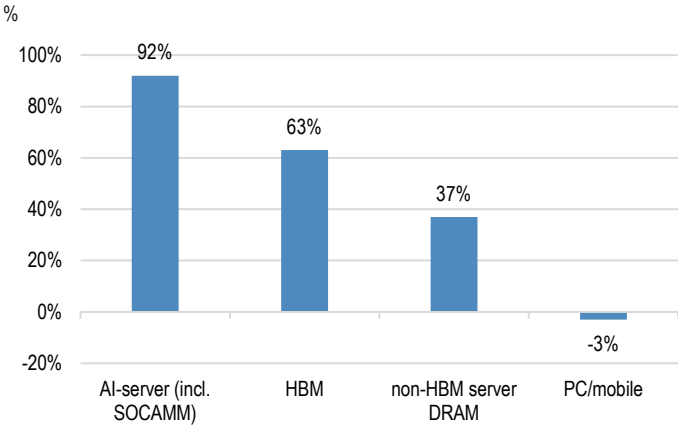
Source: J.P. Morgan estimates.

See page 6 for analyst certification and important disclosures, including non-US analyst disclosures.

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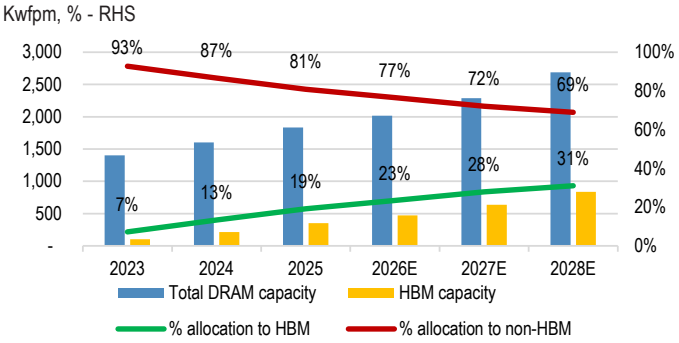
- **HBM bit demand continues to be above conventional DRAM, S-D constraint factor thesis intact.** Among the overall DRAM market, we expect HBM to show the second-highest growth in the next two years (+63% CAGR), after AI-server grade DRAM/ SOCAMM (+92%). This is followed by non-HBM server DRAM (+37%) and PC/ Mobile (-3%). This trend can be consistently witnessed from the HBM bit demand mix continuously rising over the time (from 4% in 2025 to 12% in 2028E), resulting in greater wafer capacity allocation. We forecast a 930k DRAM WSPM increase from 2025-end to 2028-end, and 58% of this incremental capacity will be used to support HBM-grade front-end wafer fabrication (installed base anticipated to grow from 390k at 2025-end to 930k at 2028-end, or from 19% to 31% during the same period). As 16Hi adoption is delayed, a meaningful wafer bit penalty scenario is unlikely; however, we expect 3x or above die penalty concept to be largely sustained and continue to view growing HBM wafer allocation as a key differentiation factor to DRAM S-D in the AI-led H/W capex cycle.

Figure 3: Bit demand growth CAGR by application (2026E-28E)



Source: J.P. Morgan estimates.

Figure 4: HBM % capacity mix in DRAM

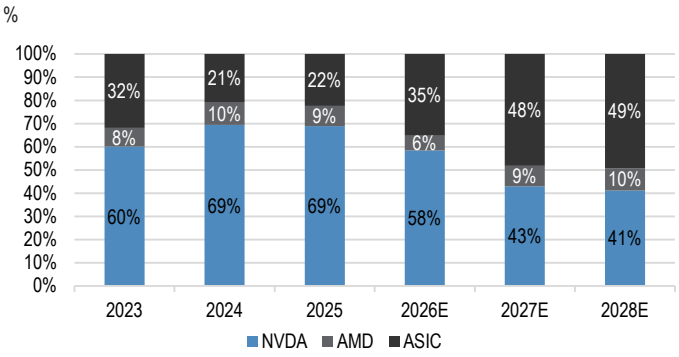


Source: Company data, J.P. Morgan estimates.

- **Who will lead the 63% HBM consumption CAGR in the next two years? ASIC will become larger than NVDA in overall HBM consumption next year.** Despite a decline in shares, NVDA continues to be the major player in the HBM market (58% of total CY26E respective HBM-grade AI chip's combined HBM bit demand) until this year, with industry-leading HBM content (most leading-edge technology using higher layer and 8 cubes per system in package). From 2027, we expect ASIC (48% of total HBM bit demand) to take over NVDA's position (43%) with a substantial system unit sales increase (ASIC: +102% y-y vs. NVDA: +15% next year). NVDA-grade HBM content (per system in package) is likely to be continuously higher vs. ASIC; however, the content premium should shrink over the time (from 1.44x in CY26E to 1.33x/1.25x in CY27E/28E) with the potential spread widening from CY29E (the earliest timeline for 16Hi adoption under consideration).

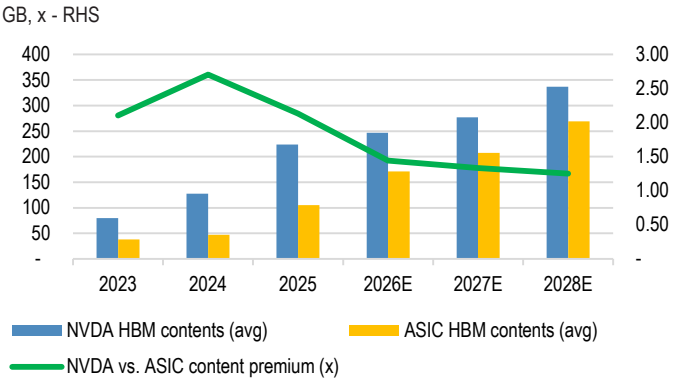
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Figure 5: HBM bit demand mix by customer



Source: Company data, J.P. Morgan estimates.

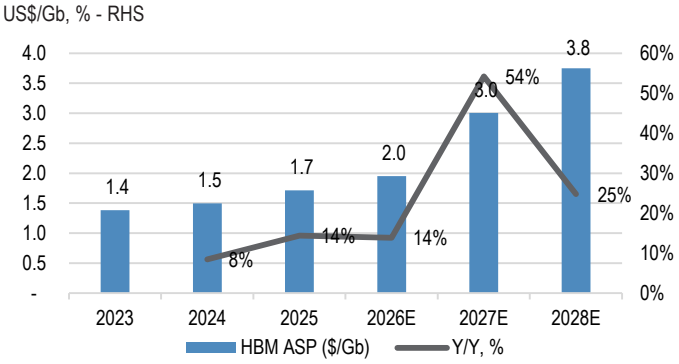
Figure 6: NVDA vs. ASIC content and premium (x)



Source: Company data, J.P. Morgan estimates.

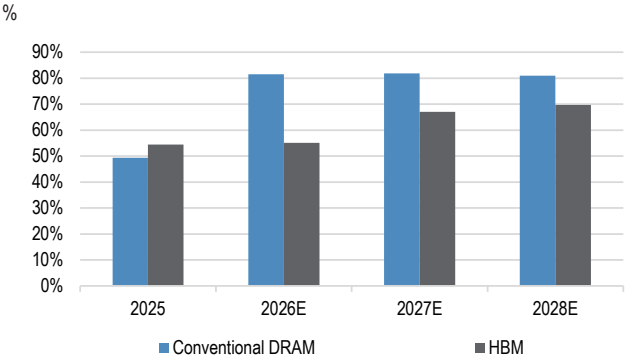
- **Tighter S-D and wafer economics balancing initiatives support a better-than-expected HBM ASP outlook.** As we highlighted in our recent SEC (link) and SKH (link) 3Q26 preview and update reports, we picked up stronger HBM ASP evidence vs. our initial expectation. We pencil in a 54%/25% blended HBM ASP increase for our top-down HBM industry model and expect the HBM industry TAM to rise to US$282bn by CY28. Stronger pricing vs. conventional DRAM in the next two years should help put HBM back to one-quarter of the total DRAM TAM by CY28 (from 24% in 2025 to 10%/16%/22% in 2026E/27E/28E). In terms of profit margin, we estimate it to be near a mid-60% to low-70% OPM across different suppliers, below that for LTA-secured server DRAM (above 80%), but a sharp improvement from the previous year. As suppliers reprice every year, HBM margins/pricing of the non-LTA portion could continue to rise until CY28E, in our view.

Figure 7: HBM ASP and Y/Y% trend



Source: Company data, J.P. Morgan estimates.

Figure 8: HBM vs. DRAM OPM



Source: Company data, J.P. Morgan estimates. Note: Blended margin from SEC/SKH

- **Multi-tiering SKUs result in higher-than-expected 8Hi product shelf life, led mainly by NVDA.** We believe NVDA/ASIC customers established the universal specs for standard HBM and qualified suppliers with minimum spec requirements in the past and placed producible capacity and cost structure as the key evaluation metrics. Moving forward, we expect to see multiple SKUs within standard HBM (not a customized version, but different segment tiering targeting slightly different workloads for various end customers). The 12Hi vs. 8Hi split within NVDA Vera Rubin Ultra is a typical example, and we have witnessed a similar approach by other customers (MI450/455x, as well as TPU v8 Sunfish/Sunfish Ultra). 12Hi is likely to be the mainstream version for the performance segment vs. the 8Hi, an economic version for the mass-tier segment. Due

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to multiple technology validation issues and cost reasons, 16Hi adoption has been pushed back to the 2029E line-up at the earliest, per our supply chain checks. Therefore, we expect TCB to be the mainstream back-end packaging technology solution for HBM over HCB in the foreseeable future.

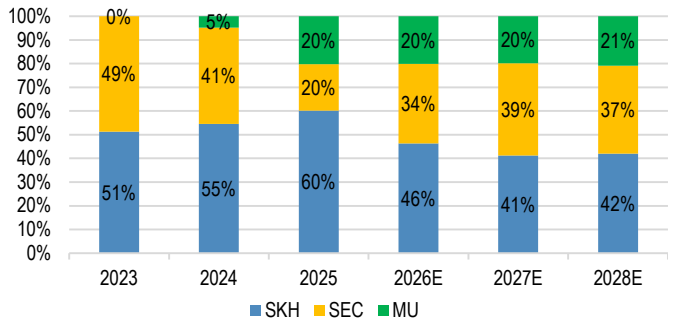
Table 2: Diversifying HBM spec across customers and SKU

	Chips	HBM generation	# of die compute / SiP	HBM monodie (Gb)	HBM layer (Hi)	HBM cube per SiP (#)	HBM density (GB) / SiP
NVDA	Blackwell 200	HBM3E	1 die solution	24	8	8	192
NVDA	Blackwell 300	HBM3E	1 die solution	24	12	8	288
NVDA	Rubin	HBM4	1 die solution	24	8	8	192
NVDA	Rubin	HBM4	1 die solution	24	12	8	288
NVDA	Rubin Ultra	HBM4E	2 die solution	32	8	8	256
NVDA	Rubin Ultra	HBM4E	2 die solution	32	12	8	384
NVDA	Feynman	HBM5	2 die solution	32	12	8	384
NVDA	Feynman	HBM5	2 die solution	32	16	8	512
AMD	Mi300x	HBM3E	1 die solution	24	8	6	144
AMD	MI325x	HBM3E	1 die solution	24	12	8	288
AMD	Mi350x	HBM3E	1 die solution	24	12	8	288
AMD	Mi450/455x	HBM4	1 die solution	24	12	12	432
AMD	Mi450/455x	HBM4	1 die solution	24	8	6	144
AMD	Mi500x	HBM4E	1 die solution	32	12	12	576
AMD	Mi500x	HBM4E	1 die solution	32	8	12	384
Google	TPU v7 Ironwood	HBM3E	1 die solution	24	8	8	192
Google	TPU v8 Zebrafish	HBM3E	1 die solution	24	12	6	216
Google	TPU v8 Sunfish	HBM3E	2 die solution	24	12	8	288
Google	TPU v8 Sunfish Ultra	HBM3E	2 die solution	24	12	8	288
Google	TPU v9 Humufish	HBM4	4 die solution	24	8	12	288
Amazon	Tranium 3	HBM3E	1 die solution	24	12	4	144
Amazon	Tranium 4	HBM4	1 die solution	24	12	6	288

Source: Company data, J.P. Morgan estimates for Rubin Ultra/Feynman/MI455 and beyond series/TPUv9.

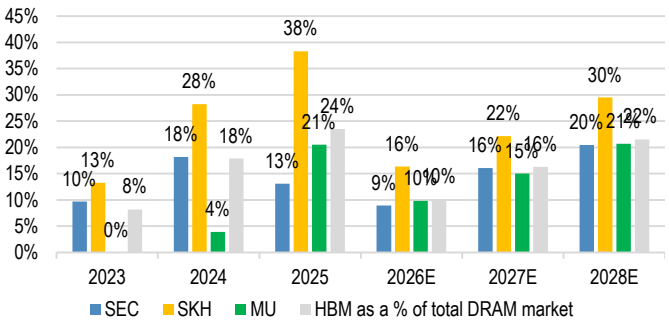
- **Intensifying competition among suppliers for value share gains amid under-supplied market conditions.** We have witnessed HBM value share split status move closer to that of the overall DRAM market value share mix, with followers (SEC and MU, which is covered by Harlan Sur) catching up against the leader (SKH) in the past 12-24 months. We estimate that SEC and MU's combined share could rise close to 54% this year, followed by 59% next year (SEC commanding a greater share vs. MU upon larger capacity, successful NVDA penetration and ASIC project scale-up initiatives). While suppliers are likely to take a slightly different approach in addressing the HBM bit demand – SKH (strategic customer being NVDA and balanced bit production across different tiering of HBM layer products with a potential focus on 8Hi) vs. SEC (priority to grab the largest HBM share in the market and scale up its wallet share within NVDA after successful HBM4 penetration) vs. MU (targeting to book equivalent share to that of overall DRAM market share) – HBM ASP negotiation is not largely impacted by the competition, given a shortage market environment. We expect custom or bespoke HBM to be the next competitive field, with products coming out as early as late 2028.

Figure 9: HBM revenue share trend by supplier



Source: Company data, J.P. Morgan estimates.

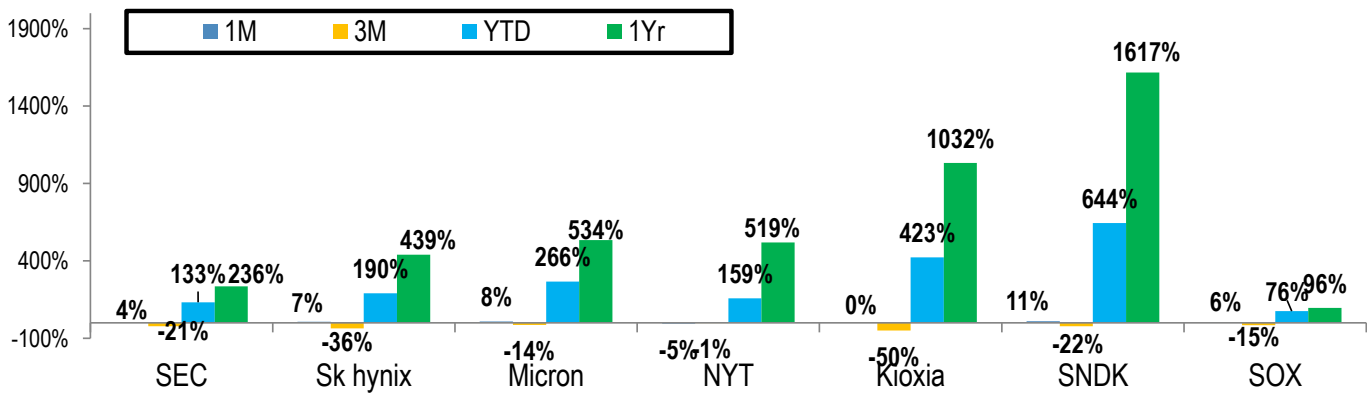
Figure 10: HBM revenue mix to DRAM by player



Source: Company data, J.P. Morgan estimates.

- **Several different custom HBM designs in the pipeline, NVHBM likely to be based on 3nm logic die.** We are witnessing an increase in bespoke HBM projects being discussed between memory makers and GPU/ASIC customers. The first official custom HBM project is likely to be NVDA-led NVHBM (link), due to release in late 2028, followed by mass ramp in 2029E. Depending on the customer, the degree of logic design freedom and responsibility differs. While the NVHBM appears to be based on 3nm logic die from TSMC (different from the diversified HBM4 logic die supply chain), memory suppliers are in charge of the final qualification incl. compatibility test with its core DRAM die. Gross margin per Gb may shrink due to an increase in cost (logic die gross margin lower vs. HBM-grade core DRAM die), but it remains clear that memory makers are contributing additional value to the overall system design, in our view. Compared to NVDA, memory makers view ASIC projects as ones that could command greater value-add in designing the logic dies.
- **Frontier AI model lab in-house chip demand not priced in, source for demand upside risk in the long term.** Leading AI model lab companies (e.g., Anthropic and Open AI) rely primarily on datacenter capacity lease business model and use a mixture of GPU/ASIC chips for the silicon workload. However, there is increasing discussion in the supply chain that model labs are exploring the use of their own custom silicon chips for specific workloads (link). While no details have been disclosed, we believe this could be an additional source of HBM bit demand on a long-term horizon. Given the rise in leading AI model lab companies' direct memory procurement supply chain management, we believe it is a worth noting the development to assess the potential demand upside to the memory industry. According to a local media release, HBM4/4E are the discussed HBM specs for leading AI model labs, and we suspect the HBM density could be in the 144-288GB range, depending on the layers (8hi or 12hi) and the number of cubes per system in package (6-, 8- or 12-cube configuration).
- **Bullish on memory; SKH > SEC on imminent shareholder return upside.** After a sharp correction during late June to late July (-36% vs. SOX: -19%), major memory stocks (SEC/SKH/MU) have rebounded 39% as of the 21 September close (vs. SOX: +19%), attributable to risk-on appetite, with memory fundamentals seeing limited signs of weakness into 2027E. We believe the HBM de-spec concern is somewhat priced in and reiterate our bullish view on memory, given: (1) tight HBM S-D, even after the de-spec; (2) HBM customization leading to higher value-share gain at memory; and (3) resilient HBM pricing into 2027E-28E. **In the near term, we retain our SKH > SEC view on constructive shareholder returns**, but do see a favorable setup for SEC under the condition of constructive shareholder returns (i.e., raising the shareholder return pool, additional dividends/share buybacks, and strong commitment to shareholder returns).

Figure 11: Global memory makers' share price performance, including SOX (Philadelphia Semiconductor index)



Source: Bloomberg Finance L.P.

Companies Discussed in This Report (all prices in this report as of market close on 22 September 2026, unless otherwise indicated)
SK hynix(000660.KS/W1,842,000/OW), SK hynix ADR(SKHY/$188.86[21 September 2026]/OW), Samsung Electronics(005930.KS/W278,000/OW)

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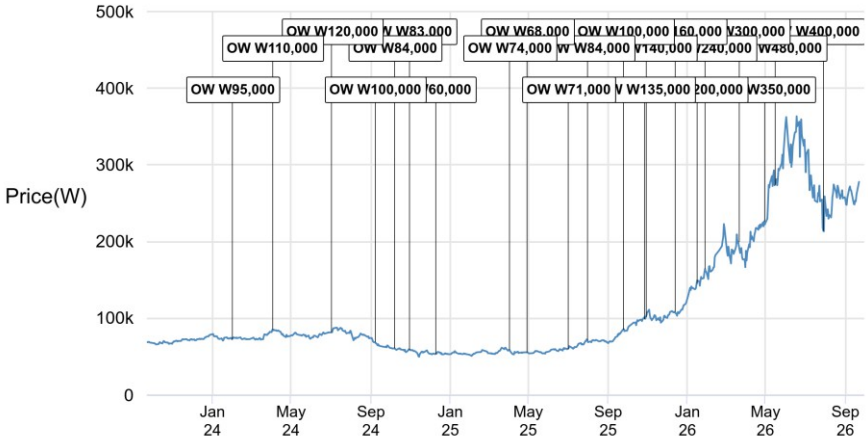
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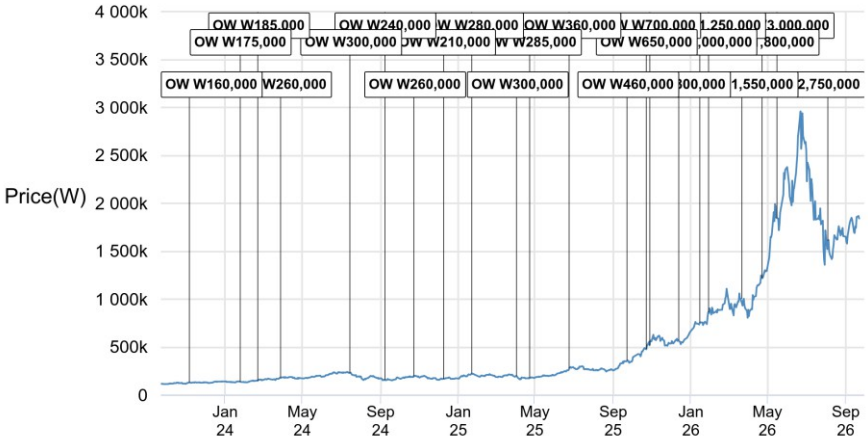
Samsung Electronics (005930.KS, 005930 KS) Price Chart



Source: Bloomberg Finance L.P. and J.P. Morgan; price data adjusted for stock splits and dividends.
Initiated coverage Oct 09, 2011. All share prices are as of market close on the previous business day.

Date	Rating	Price (W)	Price Target (W)
01-Feb-24	OW	72700	95,000
03-Apr-24	OW	85000	110,000
03-Jul-24	OW	81800	120,000
08-Sep-24	OW	68900	100,000
08-Oct-24	OW	61000	84,000
31-Oct-24	OW	59100	83,000
10-Dec-24	N	53400	60,000
03-Apr-25	OW	58800	74,000
30-Apr-25	OW	55800	68,000
02-Jul-25	OW	60200	71,000
01-Aug-25	OW	71400	84,000
25-Sep-25	OW	85400	100,000
27-Oct-25	OW	98900	135,000
30-Oct-25	OW	101700	140,000
14-Dec-25	OW	108500	160,000
16-Jan-26	OW	145000	200,000
29-Jan-26	OW	164300	240,000
22-Mar-26	OW	199800	300,000
30-Apr-26	OW	226500	350,000
17-May-26	OW	273500	480,000
30-Jul-26	OW	214000	400,000

SK hynix (000660.KS, 000660 KS) Price Chart



Source: Bloomberg Finance L.P. and J.P. Morgan; price data adjusted for stock splits and dividends.
Initiated coverage Dec 31, 2000. All share prices are as of market close on the previous business day.

Date	Rating	Price (W)	Price Target (W)
07-Nov-23	OW	133000	160,000
25-Jan-24	OW	141500	175,000
22-Feb-24	OW	149000	185,000
28-Mar-24	OW	181200	260,000
16-Jul-24	OW	230000	300,000
08-Sep-24	OW	156400	240,000
24-Oct-24	OW	196000	260,000
10-Dec-24	OW	168900	210,000
23-Jan-25	OW	225500	280,000
03-Apr-25	OW	197900	300,000
24-Apr-25	OW	181000	285,000
25-Jun-25	OW	278500	360,000
24-Sep-25	OW	361000	460,000
23-Oct-25	OW	481000	650,000
29-Oct-25	OW	519000	700,000
14-Dec-25	OW	571000	800,000
16-Jan-26	OW	756000	1,000,000
29-Jan-26	OW	862000	1,250,000
22-Mar-26	OW	1006000	1,550,000
23-Apr-26	OW	1220000	1,800,000
17-May-26	OW	1848000	3,000,000
05-Aug-26	OW	1609000	2,750,000

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Date	Rating	Price ($)	Price Target ($)
10-Sep-26	OW	198.63	245

Source: Bloomberg Finance L.P. and J.P. Morgan; price data adjusted for stock splits and dividends.
Initiated coverage Sep 09, 2026. All share prices are as of market close on the previous business day.

The chart(s) show J.P. Morgan's continuing coverage of the stocks; the current analysts may or may not have covered it over the entire period.
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