Goldman Sachs Research

Equity Research

8 February 2026 | 9:32PM KST

GLOBAL TECHNOLOGY: SEMICONDUCTORS - MEMORY

Global Memory S/D update and BOM cost analysis: Expect further tightness across DRAM, NAND, and HBM; reiterate Buy on Samsung, Hynix, SNDK, Tokyo Electron, Ulvac, and Disco

We update our S/D model post 4QCY25 earnings of major memory players, where we now expect even tighter S/D across DRAM, NAND, and HBM for 2026E/2027E. With the tighter S/D, we believe memory companies will continue to enjoy significant pricing upside, and hence expect earnings/margin to reach historical high levels.

DRAM: We now expect 2026E/2027E DRAM S/D will be in a larger undersupply of 4.9%/2.5% (vs. prior expectation of 3.3%/1.1% undersupply), respectively. The supply shortage that we expect in 2026E will be the most severe one during the last 15+ years, mainly driven by the strong demand from server-related applications (DDR, LPDDR, HBM, SOCAMM) that are seeing no signs of slowing down, as well as the limited capacity additions and the healthy level of inventory across the industry.

NAND: We now expect 2026E/2027E NAND S/D will be in a larger undersupply of 4.2%/2.1% (vs. prior expectation of 2.5%/1.2% undersupply), respectively. Similar to DRAM, we expect the NAND industry to see one of the largest shortages in history in 2026E, mainly driven by strong growth in enterprise SSD demand and the limited spending and capacity additions by the suppliers.

HBM: We raise our TAM estimates for 2026E/2027E by 8%/9% to US$54bn/US$75bn (from US$50bn/US$69bn) mainly to reflect better HBM demand coming from both GPUs and ASICs. Our higher HBM demand estimates are more attributable to higher ASIC demand, and now expect ASIC to comprise 33%/36% of HBM demand in 2026E/2027E (compared to 28%/34% previously). We now expect greater HBM industry undersupply of 5.1%/4.0% for 2026E/2027E, compared to our previous forecast of 0.7%/1.6% undersupply.

BOM cost analysis: In this report, we also conduct a BOM cost analysis, to examine how high the memory cost burden has risen, and to see the impact of potential demand destruction. Our conclusion is while the higher memory cost could lead to demand destruction for PC/smartphones and lower DRAM content adoption for these products, given the significant undersupply we expect for this year, even under a highly negative scenario we expect the DRAM industry S/D to remain tight.

We highlight Samsung Electronics (SEC), SK Hynix (Hynix), SanDisk, Tokyo Electron, Ulvac, and Disco as companies that mainly benefit from the tighter memory industry S/D we expect.

Giuni Lee
+82(2)3788-1177 | giuni.lee@gs.com
Goldman Sachs (Asia) L.L.C., Seoul Branch

James Schneider, Ph.D.
+1(212)357-2929 |
jim.schneider@gs.com
Goldman Sachs & Co. LLC

Shuhei Nakamura
+81(3)4587-9932 |
shuhei.nakamura@gs.com
Goldman Sachs Japan Co., Ltd.

Daiki Takayama
+81(3)4587-9870 |
daiki.takayama@gs.com
Goldman Sachs Japan Co., Ltd.

Taeyong Lee
+82(2)3788-0981 | taeyong.lee@gs.com
Goldman Sachs (Asia) L.L.C., Seoul Branch

Kaho Otake
+81(3)4587-7498 | kaho.otake@gs.com
Goldman Sachs Japan Co., Ltd.

Lal Kablan
+1(212)357-8793 | lal.kablan@gs.com
Goldman Sachs & Co. LLC

Conventional memory: expect one of the largest shortages in history this year for both DRAM/NAND

DRAM: Expect one of the most severe shortages this year led by strength in servers and limited capacity increase

We update our DRAM S/D industry model post 4Q25 earnings, and now expect 2026E/2027E DRAM S/D will be in a larger undersupply of 4.9%/2.5% (vs. prior expectation of a 3.3%/1.1% undersupply), respectively. The supply shortage that we expect in 2026E will be the most severe one during the last 15+ years, mainly driven by the strong demand from server-related applications (DDR, LPDDR, HBM, SOCAMM) that are seeing no signs of slowing down, as well as the limited capacity additions and the healthy level of inventory across the industry.

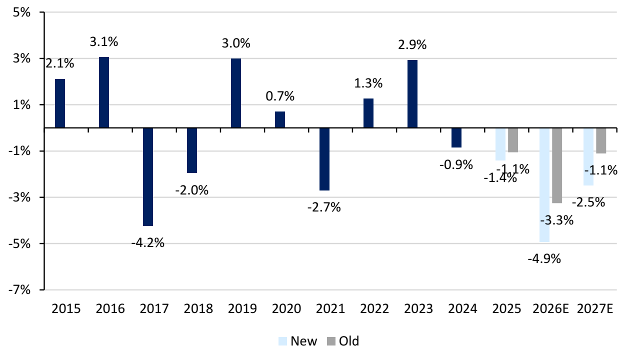
DRAM Demand: limited growth from PC/smartphone more than offset by strong growth in servers

We now expect 2026E/2027E global DRAM demand to grow 25%/17% yoy (vs. +23%/+15% yoy previously). As we mainly reflect our global team's higher shipment forecast for both AI servers and general servers, as well as higher 2027E forecast for SOCAMM, our server DRAM demand forecast for 2026E/2027E is revised up by 6%/10%, and we now expect server DRAM (excl. HBM) demand to grow 39%/22% yoy during those years and reach 44%/46% of global DRAM demand. If also including HBM bit demand, we expect the combined server-related DRAM demand for 2026E/2027E to reach 53%/57% of global DRAM demand, showing server has become by far the most important driver for global DRAM demand.

On the other hand, we lower our 2026E/2027E mobile DRAM demand forecast by 7%/7% to reflect our global team's recent downward revision in smartphone shipment and our lower DRAM content per unit assumption coming from the rapidly rising memory cost. As a result, we expect mobile DRAM demand to meaningfully decelerate this year and only grow 7% yoy, compared to the high-teens% level it saw during the past couple of years.

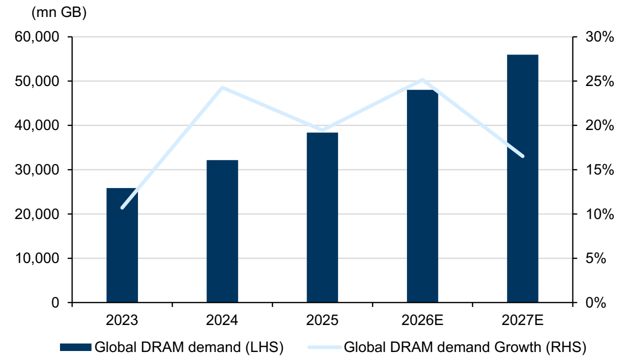
We also lower our 2026E/2027E PC DRAM demand forecast by 3%/5% mainly to reflect both our global team's downward revision in PC shipment and lower DRAM content assumptions, and now expect DRAM demand from PC to grow only 5% yoy, also compared to the high-teens% level during the past couple of years.

Exhibit 1: We now expect 2026E DRAM S/D to be in a larger undersupply of 4.9% (vs. prior expectation of 3.3% undersupply)
DRAM industry S/D



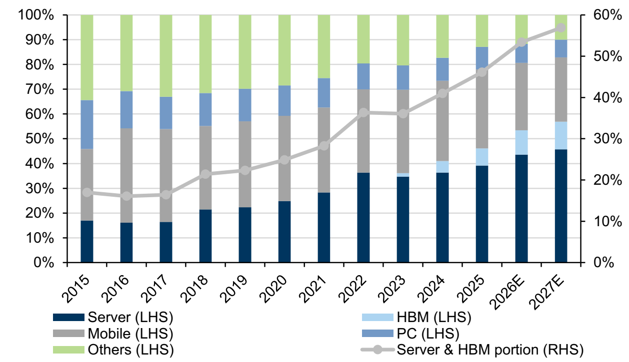
Source: Goldman Sachs Global Investment Research

Exhibit 2: Global DRAM demand growth



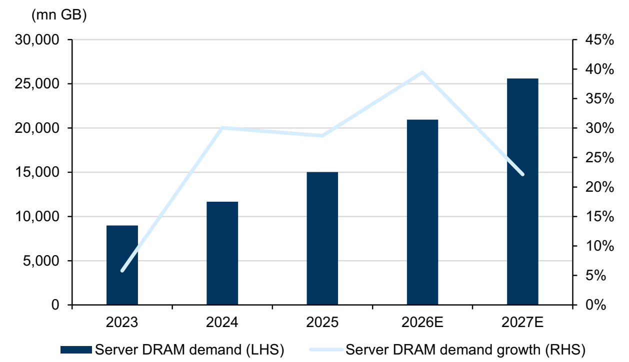
Source: Goldman Sachs Global Investment Research

Exhibit 3: DRAM bit demand mix



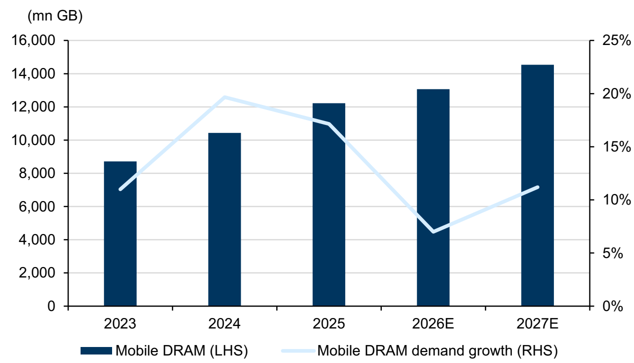
Source: Goldman Sachs Global Investment Research

Exhibit 4: Server DRAM demand growth (excl. HBM)



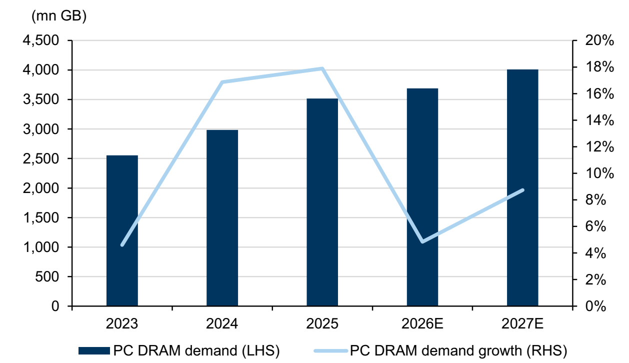
Source: Goldman Sachs Global Investment Research

Exhibit 5: Mobile DRAM demand growth



Source: Goldman Sachs Global Investment Research

Exhibit 6: PC DRAM demand growth

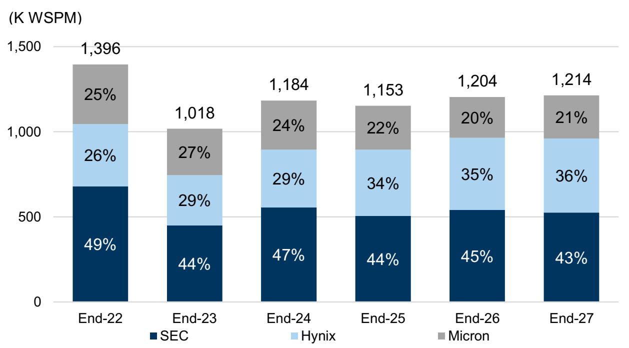


Source: Goldman Sachs Global Investment Research

DRAM Supply: tight supply led by limited conventional DRAM capacity additions and healthy inventory

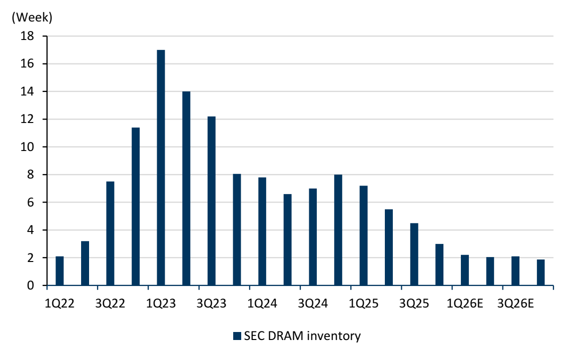
We now expect 2026E/2027E global DRAM supply to grow 21%/19% yoy (vs. +20%/+18% yoy previously). We make minimal changes to our DRAM bit supply forecast, as we think the limited clean room space for major suppliers will likely limit meaningful upside to supply at least in the near-to-mid-term, despite the suppliers' intention to alleviate the industry tightness and the higher capex forecast post earnings. We continue to expect wafer capacity additions especially for conventional DRAM to see limited growth, as only SEC has enough flexibility to add new capacity at its P4 fab, while we expect Hynix to use its clean room space at M15X mainly for HBM. As new fabs such as SEC's P5 and Hynix' Yongin fab will likely not ramp before 2H27, we expect limited upside to industry supply before then. In addition, the healthy inventory level across suppliers will likely contribute to the limited upside to supply, in our view. Inventory levels at mobile customers have come down significantly to very low levels, while the limited bit supply we expect for 1Q26 is likely going to lead to a decline in PC/server customer inventory, which we expect to contribute to a more favorable pricing trend. Based on our checks, certain customers are already asking for memory allocation even for 2028, showing how the supply situation currently is extremely tight.

Exhibit 7: DRAM top 3 players conventional DRAM capacity



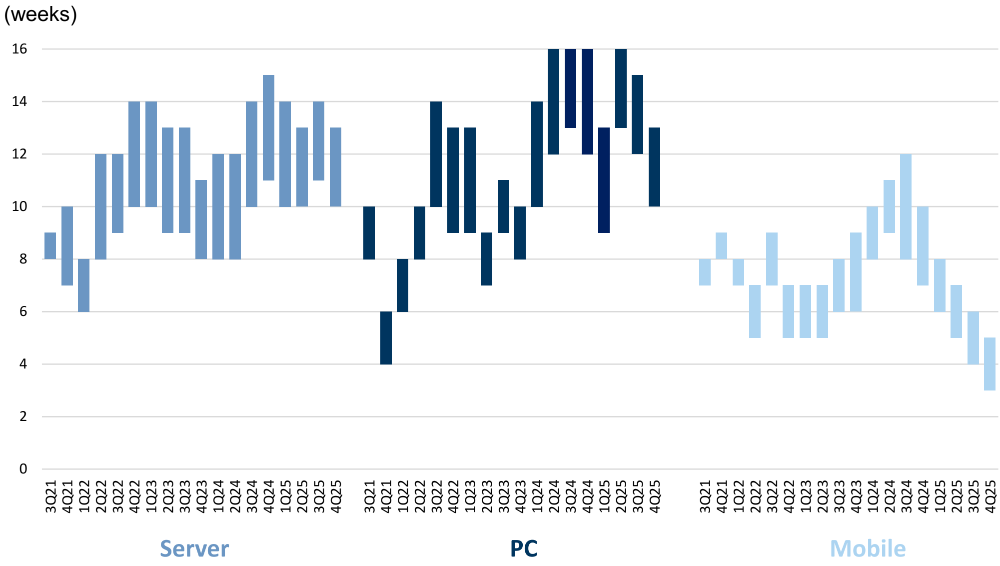
Source: Company data, Goldman Sachs Global Investment Research

Exhibit 8: SEC DRAM Inventory



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 9: DRAM customer inventory level

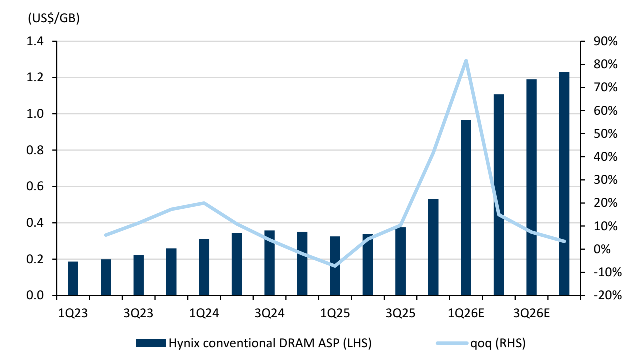


Source: Goldman Sachs Global Investment Research

2026E Conventional DRAM pricing to rise ~180% yoy and OPM to reach 70%-80% for SEC/Hynix

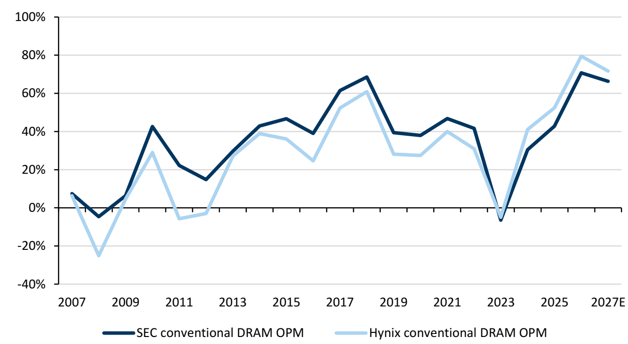
Post 4Q25 earnings at end-January, we meaningfully raised our 2026E conventional DRAM pricing forecast for both SEC and Hynix, and now expect a 176%/184% yoy increase. Based on this forecast, we expect conventional DRAM ASP to reach close to US$1.25/Gb (or US$10/GB) by the end of this year, which would also be close to the level of HBM3E 12Hi pricing we expect for this year. Hence, we expect conventional DRAM pricing to see some adjustments in 2027, albeit a benign one considering the tight S/D we are expecting for next year as well. Based on our pricing assumptions, we expect 2026E/2027E conventional DRAM operating margin to reach 71%/66% for SEC and 79%/72% for Hynix, around the highest level in history for SEC and by far the highest level ever for Hynix.

Exhibit 10: Hynix conventional DRAM ASP and qoq growth



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 11: SEC/Hynix conventional DRAM OPM



Source: Company data, Goldman Sachs Global Investment Research

NAND: Robust eSSD demand and supply discipline to lead to one of the largest shortages this year

We update our NAND S/D industry model post 4Q25 earnings, and now expect 2026E/2027E NAND S/D will be in a larger undersupply of 4.2%/2.1% (vs. prior expectation of a 2.5%/1.2% undersupply), respectively. Similar to DRAM, we expect the NAND industry to see one of the largest shortages in history in 2026E, mainly driven by strong growth in enterprise SSD demand and the limited spending and capacity additions by the suppliers.

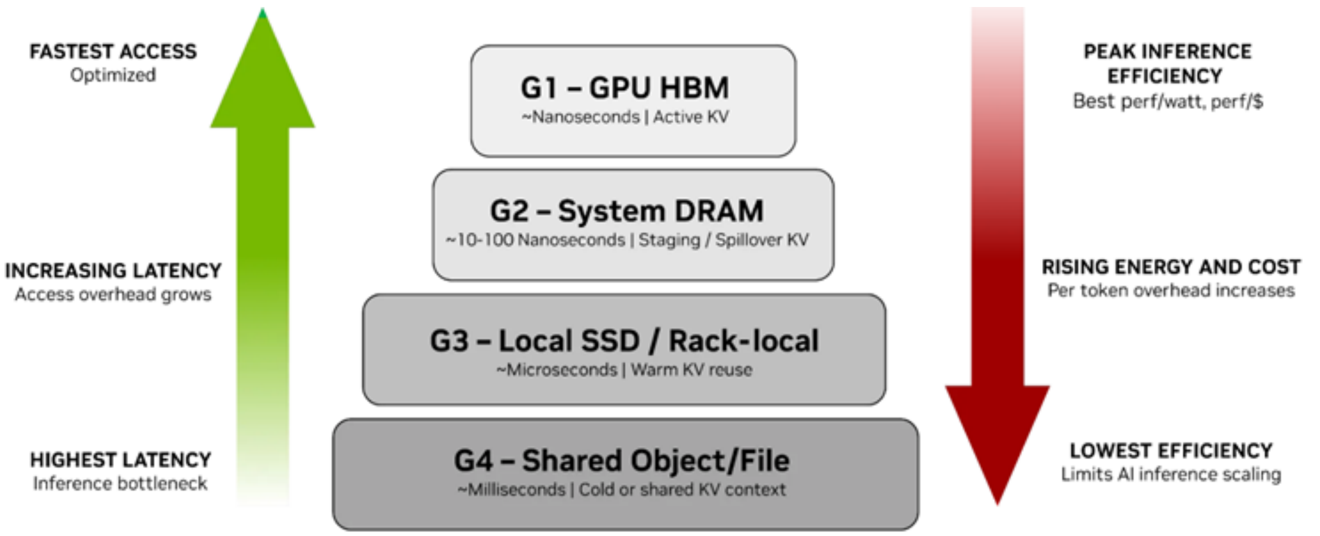
Understanding and gauging the impact of BlueField DPU and ICMSP (Inference Context Memory Storage Platform)

Q1. What is BlueField DPU and ICMSP architecture (Inference Context Memory Storage Platform) and why Nvidia developed this?

KV cache is a type of memory that stores conversation history with AI agents to prevent AI models from recomputing the entire conversation history from scratch. Because of KV cache, AI agents can respond to user requests much faster and more accurately as it can remember the context. However, this creates exponential storage demand as the number of AI agent users increases and the length of conversation increases. This growth creates a significant performance bottleneck. The size of the KV cache far exceeds the limited capacity of high-bandwidth memory (HBM, the G1 tier), forcing the data to be offloaded to server DRAM (G2 tier) and local storage (G3 tier). As the data continues to expand, it is further pushed to network storage (G4 tier), which increases network traffic and significantly slows down data transfer speeds.

To resolve this systemic issue, NVIDIA has launched the ICMSP (Inference Context Memory Storage Platform). The ICMSP is a dedicated storage tier for KV cache, virtually a new G3.5 tier that resides between local storage (G3) and network (G4) storage. Powered by the BlueField DPU (Data Processing Unit), the ICMSP architecture enables a GPU to have high-speed access to a large, shared pool of context memory.

Exhibit 12: KV cache memory hierarchy



Source: Nvidia

Q2. How much incremental NAND demand can we expect and what is the overall impact to NAND market?

We believe the addition of the ICMSP is likely to create a substantial new opportunity for NAND demand, particularly for enterprise SSDs (eSSDs), which are optimized for fast read performance. Based on Jensen Huang's keynote speech at CES 2026, the ICMSP is projected to increase memory space by 16 TB for each GPU, in addition to a 512 GB on-board SSD for each BlueField DPU. Based on this, we estimate incremental NAND demand per rack (assuming a 72-GPU configuration) to be 1,161TB. On a market-wide scale, we believe Rubin platform alone can generate incremental 29EB/79EB of NAND demand in 2026/2027, which represents 3%/6% of our total NAND demand estimates. Our estimates are in-line with SanDisk's comment that it expects additional 75EB to 100EB of NAND in 2027 due to launch of ICMSP.

NAND Demand: growth led by strong eSSD demand, while expect NAND demand from PC/smartphone to remain flattish

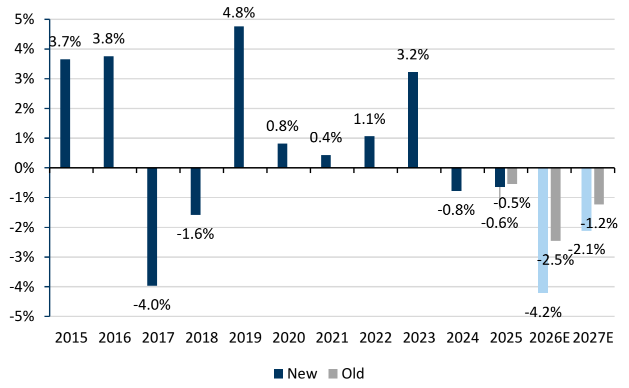
We now expect 2026E/2027E global NAND demand to grow 22%/15% yoy (vs. +19%/+14% yoy previously). Our enterprise SSD demand forecast for 2026E/2027E is revised up by 14%/14%, and we now expect eSSD demand to grow 58%/23% yoy during those years and reach 36%/39% of global NAND demand.

We lower our 2026E/2027E mobile NAND demand forecast by 6%/7% mainly to reflect our global team's lower smartphone shipment estimates and our lower NAND content per unit assumption coming from the rapidly rising memory cost. As a result, we expect 2026E mobile NAND demand to remain flat yoy, the first time in history to see no growth in this segment.

We also lower our 2026E/2027E client SSD demand forecast by 1%/1% mainly to reflect both our global team's downward revision in PC shipment and lower NAND content assumptions, and now also expect 2026E NAND demand from PC to remain flat yoy, also the lowest level in history.

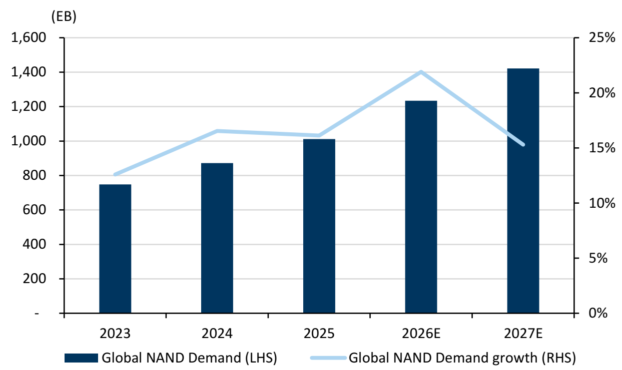
Exhibit 13: We now expect 2026E NAND S/D will be in undersupply of 4.2% (vs. prior expectation of 2.5% undersupply)

NAND industry S/D



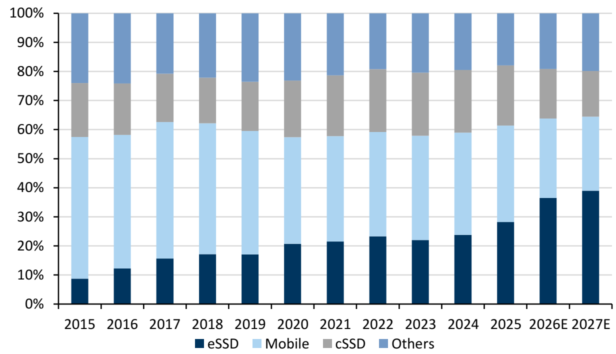
Source: Goldman Sachs Global Investment Research

Exhibit 14: Global NAND demand growth



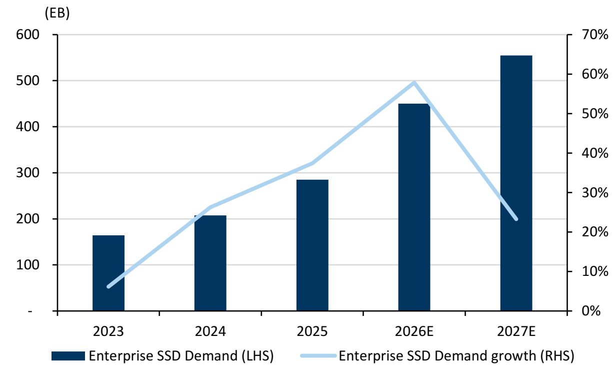
Source: Goldman Sachs Global Investment Research

Exhibit 15: NAND bit demand mix



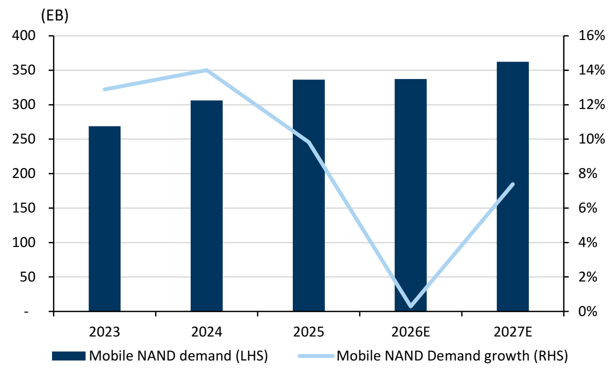
Source: Goldman Sachs Global Investment Research

Exhibit 16: Enterprise SSD demand growth



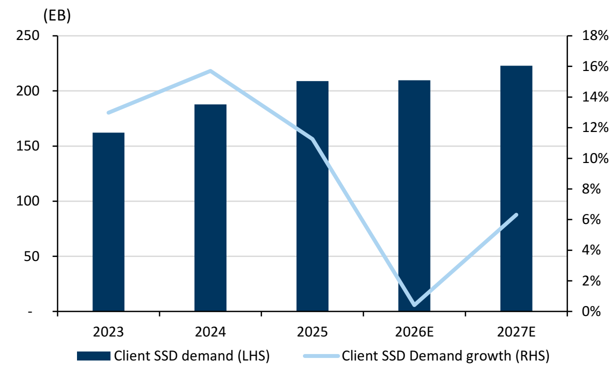
Source: Goldman Sachs Global Investment Research

Exhibit 17: Mobile NAND demand growth



Source: Goldman Sachs Global Investment Research

Exhibit 18: Client SSD demand growth

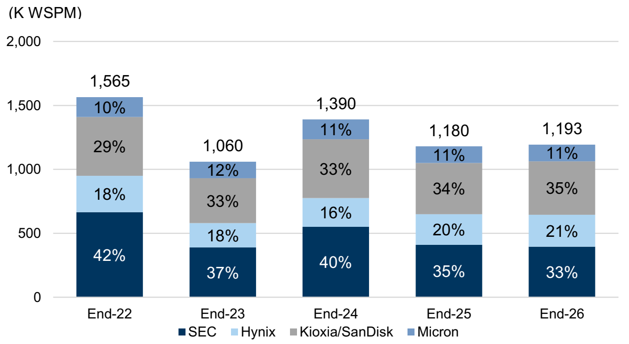


Source: Goldman Sachs Global Investment Research

NAND Supply: supply discipline intact with focus on tech migration

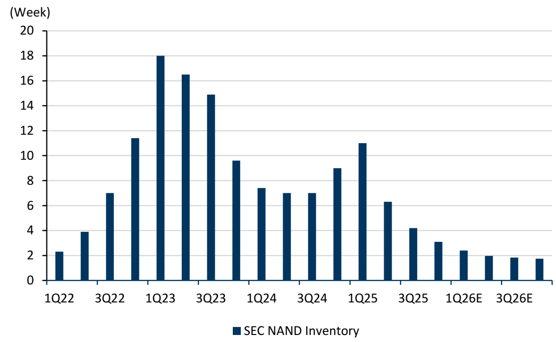
We now expect 2026E/2027E global NAND supply to grow 18%/18% yoy (vs. +17%/+15% yoy previously). Most of the incremental supply we model is our higher assumption for supply coming from the main Chinese NAND player. However, we make minimal changes to the NAND bit supply forecast for the rest of the players, considering our view that major suppliers have focused on DRAM spending over NAND, and also given we expect the continued focus in NAND will be on tech migration rather than wafer capacity increase. We continue to expect limited NAND wafer capacity additions, as meaningful space for NAND will likely be limited to SEC's P4 fab and Kioxia's Kitakami fab in the near-to-mid-term, but we believe both companies will continue to focus on migration to higher layer-count 3D NAND rather than new capacity. Inventory level across NAND suppliers is also healthy, which we believe will contribute to the limited supply upside.

Exhibit 19: We expect limited NAND wafers to be added by the major suppliers in the near-to-mid-term
Top5 NAND player wafer capacity



Source: TrendForce, Company data, Goldman Sachs Global Investment Research

Exhibit 20: SEC NAND Inventory

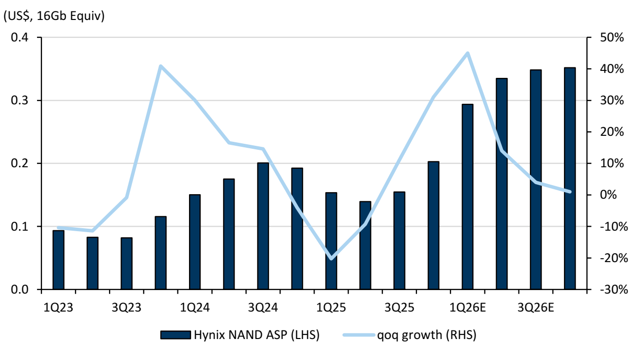


Source: Company data, Goldman Sachs Global Investment Research

2026E NAND pricing to rise 100%-120% yoy and OPM to reach 40%+ for SEC/Hynix

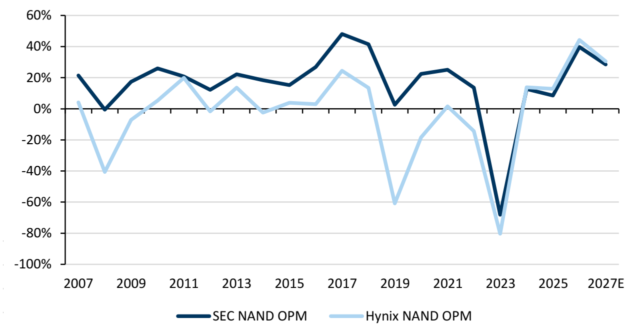
Post 4Q25 earnings at end-January, we meaningfully raised our 2026E NAND pricing forecast for both SEC/Hynix, and now expect a 121%/102% yoy increase. Based on this forecast, we expect NAND ASP to reach around US$0.15-0.18/GB by the end of this year, which would be a level last seen during 2018. As we currently model NAND ASP adjusting by around 15% yoy in 2027, we expect NAND operating margin to also decline but still remain at around a 30% level. Our 2026E/2027E NAND operating margin estimate for SEC is 40%/28%, and the same for Hynix is 44%/31%, where for the former it will still be lower than the level seen during 2017-2018, while for the latter 2026E NAND OPM will be the highest in history.

Exhibit 21: Hynix NAND ASP and qoq growth



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 22: SEC/Hynix NAND OPM



Source: Company data, Goldman Sachs Global Investment Research

HBM: Expect 2026E/2027E TAM to reach US$54bn/US$75bn with tighter S/D

Raise 2026E/2027E HBM TAM forecast by 8%/9% to US$54bn/US$75bn

While we revise down our 2025E HBM TAM estimate by 3% to US$33bn (from US$35bn) mainly due to slightly lower HBM ASP estimates, we raise our TAM estimates for

2026E/2027E by 8%/9% to US$54bn/US$75bn (from US$50bn/US$69bn) mainly to reflect better HBM demand coming from both GPUs and ASICs. Consistent with our global team's view of an accelerating ASIC adoption in servers, our higher HBM demand estimates are more attributable to higher ASIC demand, where we have raised 2026E/2027E HBM demand from ASIC by 27%/14% compared to raising HBM demand from GPU for the same period by 1%/5%. As a result, we now expect ASIC to comprise 33%/36% of HBM demand in 2026E/2027E (compared to 28%/34% previously). We also think that the continued increase in hyperscaler capex for the industry could lead to potential upside to our HBM demand and TAM forecast.

Our HBM ASP estimates are largely unchanged, where we expect -8% yoy for 2026E given our continued expectation for a meaningful decline in HBM3E 12Hi pricing this year; however, we expect +5% yoy rebound in 2027E given our expectation that HBM4 will comprise the largest mix on the back of solid demand for NVDA's Rubin GPU, as well as a sizable HBM4E mix (GSe: 20%) providing tailwind to blended pricing.

Exhibit 23: HBM demand and TAM

	2022	2023	2024	2025	2026E	2027E
Total HBM demand ('000 GB)	**215,999**	**349,471**	**1,492,389**	**2,677,990**	**4,708,616**	**6,252,369**
yoy%		*62%*	*327%*	*79%*	*76%*	*33%*
% of total DRAM demand	*1%*	*1%*	*5%*	*7%*	*10%*	*11%*
GPU portion of HBM demand		*80%*	*75%*	*79%*	*67%*	*64%*
ASIC portion of HBM demand		*20%*	*25%*	*21%*	*33%*	*36%*
HBM demand from GPU ('000 GB)		**280,743**	**1,123,471**	**2,103,438**	**3,150,873**	**3,998,726**
GPU HBM demand yoy%			*300%*	*87%*	*50%*	*27%*
HBM demand from ASIC ('000 GB)		**68,728**	**368,918**	**574,552**	**1,557,743**	**2,253,642**
ASIC HBM demand yoy%			*437%*	*56%*	*171%*	*45%*
Average HBM ASP (US$/GB)	**10.8**	**11.3**	**11.7**	**12.5**	**11.5**	**12.1**
yoy change		*5%*	*3%*	*7%*	*-8%*	*5%*
HBM TAM ($mn)	**2,333**	**3,963**	**17,437**	**33,449**	**54,107**	**75,439**
yoy change		*70%*	*340%*	*92%*	*62%*	*39%*

Data for 2022, 2023, 2024, and 2025 are estimated (GSe)

Source: Goldman Sachs Global Investment Research

Exhibit 24: HBM content of key AI accelerators

Company	Chip Type	Chip Name	Memory	# of Cube	Contents per chip (GB)
NVIDIA	GPU	Rubin Ultra	HBM4E 16-Hi (64Gb)	16	1,024
	GPU	Rubin	HBM4 12-Hi (36GB)	8	288
	GPU	B300	HBM3E 12-Hi (36GB)	8	288
	GPU	B200	HBM3E 8-Hi (24GB)	8	192
	GPU	B200A	HBM3E 12-Hi (36GB)	4	144
	GPU	B100	HBM3E 8-Hi (24GB)	8	192
	GPU	H200, GH200	HBM3E 8-Hi (24GB)	6	141
	GPU	H100	HBM3 8-Hi (16GB)	5	80
	GPU	A100	HBM2E 8-Hi (16GB)	5	80
AMD	GPU	MI500	HBM4E		
	GPU	MI450	HBM4 12-Hi (36GB)	12	432
	GPU	MI350X/MI355X	HBM3E 12-Hi (36GB)	8	288
	GPU	MI325X	HBM3E 12-Hi (36GB)	8	288
	GPU	MI300X	HBM3 12-Hi (24GB)	8	192
	GPU	MI300A	HBM3 8-Hi (16GB)	8	128
	GPU	MI250/250X	HBM2E 8-Hi (16GB)	8	128
Intel	ASIC	Gaudi 3	HBM2E 8-Hi (16GB)	8	128
	GPU	Max 1550	HBM2E 8-Hi (16GB)	8	128
	GPU	Max 1350	HBM2E 8-Hi (16GB)	6	96
	GPU	Max 1100	HBM2E 8-Hi (16GB)	3	48
	ASIC	Gaudi 2	HBM2E 8-Hi (16GB)	6	96
	ASIC	Gaudi 1	HBM2 8-Hi (8GB)	4	32
Google	ASIC	TPU v7p (Ironwood)	HBM3E 8-Hi (24GB)	8	192
	ASIC	TPU v6e (Trillium)	HBM3 8-Hi (16GB)	2	32
	ASIC	TPU v5p	HBM2E (16GB)	6	95
	ASIC	TPU v5e	HBM2E (8GB)	2	16
	ASIC	TPU v4	HBM2 8-Hi (8GB)	4	32
	ASIC	TPU v3	HBM2 8-Hi (8GB)	4	32
AWS	ASIC	Trainium 4	HBM4 12-Hi (36GB)	8	288
	ASIC	Trainium 3	HBM3E 12-Hi (36GB)	4	144
	ASIC	Trainium 2	HBM3E 8-Hi (24GB)	4	96
	ASIC	Trainium 1	HBM2E 8-Hi (16GB)	2	32
	ASIC	Inferentia 2	HBM2E 8-Hi (16GB)	2	32
Microsoft	ASIC	Maia 200	HBM3E 12-Hi (36GB)	6	216
	ASIC	Maia 100	HBM2E 8-Hi (16GB)	4	64
Meta	ASIC	MTIA v3	HBM3E		192
	ASIC	MTIA v2	LPDDR5		128
	ASIC	MTIA v1	LPDDR5		64
Huawei	ASIC	Ascend 950PR			128
	ASIC	Ascend 910D	HBM2E	4	
	ASIC	Ascend 910C	HBM2E 8-Hi (16GB)	8	128
	ASIC	Ascend 910B	HBM2E 8-Hi (16GB)	4	64
Alibaba	ASIC	T-head PPU	HBM2E		96

Source: Company data, Goldman Sachs Global Investment Research

Expect tighter HBM S/D for both 2026E/2027E

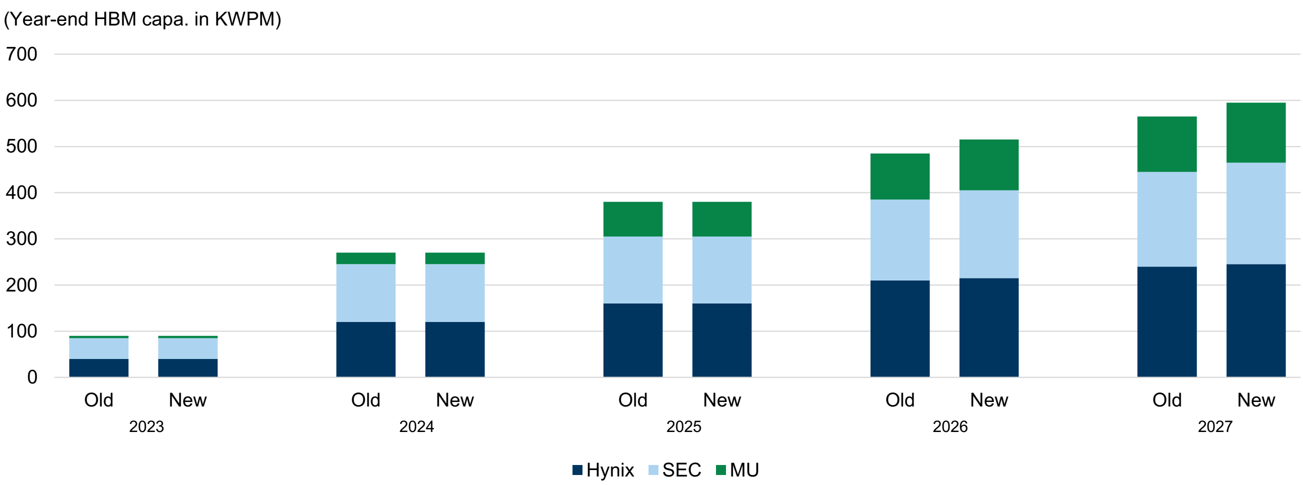
Based on our checks, both SEC and Hynix are increasing their respective HBM capacity at a higher pace, likely due to stronger demand for both GPU and ASIC. We especially believe SEC, having guided that its HBM revenue will increase 3X this year, will likely focus on increasing its 1c nm DRAM capacity as well as TSV capacity to support its progress in HBM4, and also increase its exposure in ASIC customers with its HBM3E. We expect the company to reach 190K/month HBM capacity by end-2026 (vs. 175K/month previously), compared to 145K/month at end-2025. For Hynix, we expect the stronger demand coming from its main customer NVDA is likely leading to a higher HBM bit supply target for this year, and in order to meet this it will also likely increase its HBM capacity to 215K/month by end-2026 (vs. 210K/month previously) compared to 160K/month at end-2025. Our latest forecast for industry HBM capacity is now at around 515K/month at end-2026 (vs. 485K/month previously) and 595K/month at end-2027 (vs. 565K/month previously).

Despite our higher HBM supply forecast for the industry mainly led by our higher HBM capacity estimates, as we have increased our HBM demand estimates more materially, we now expect a tighter HBM industry undersupply of 5.1%/4.0% for 2026E/2027E, compared to our previous forecast of 0.7%/1.6% undersupply.

We continue to expect that the HBM competitive landscape will intensify this year, especially with SEC starting to provide HBM3E in mass scale to ASIC customers starting last year, as well as its progress in HBM4 qualification where it mentioned on its latest earnings call that it will start delivering HBM4 including the 11.7Gbps SKU in large scale to its customer starting from this month. From the low base last year when it saw its HBM revenue decline 15% yoy, we expect HBM revenue this year to grow 157% yoy to reach close to US$15bn. We expect Hynix to see more modest growth in its 2026E HBM revenue after growing its HBM business by around 116% yoy last year, but still maintain the market share leadership at around 52%.

Exhibit 25: We bake in a higher industry-wide HBM capacity outlook (515K/month at end-2026 vs. 485K/month previously)

Industry HBM capacity estimates



Source: Goldman Sachs Global Investment Research

Exhibit 26: HBM industry S/D

	2022	2023	2024	2025	2026E	2027E
SK Hynix ('000 GB)	**108,063**	**178,715**	**782,360**	**1,540,435**	**2,342,069**	**3,063,683**
yoy change		*65%*	*338%*	*97%*	*52%*	*31%*
Blended # of dies per 12" wafer	450	450	450	435	435	435
HBM wafer starts (kwpm/month)	24	33	90	140	200	235
yoy growth (%)		*40%*	*172%*	*56%*	*43%*	*18%*
Blended monodie density (Gb)	13	15	19	23	24	27
Total DRAM supply ('000 GB)	7,031,250	8,001,250	9,388,750	11,637,500	14,254,447	16,430,753
HBM portion (%)	*1.5%*	*2.2%*	*8.3%*	*13.2%*	*16.4%*	*18.6%*
Samsung Electronics ('000 GB)	**92,936**	**140,260**	**586,046**	**545,651**	**1,286,730**	**1,739,552**
yoy change		*51%*	*318%*	*-7%*	*136%*	*35%*
Blended # of dies per 12" wafer	450	450	450	435	435	430
HBM wafer starts (kwpm/month)	26	37	95	130	170	205
yoy growth (%)		*45%*	*158%*	*36%*	*31%*	*21%*
Blended monodie density (Gb)	12	14	19	21	23	25
Total DRAM supply ('000 GB)	10,406,250	11,678,125	13,322,500	14,556,250	16,997,236	19,599,648
HBM portion (%)	*0.9%*	*1.2%*	*4.4%*	*3.7%*	*7.6%*	*8.9%*
Micron ('000 GB)	**15,000**	**17,500**	**80,000**	**500,000**	**840,000**	**1,200,000**
yoy change		*17%*	*357%*	*525%*	*68%*	*43%*
Implied Micron share (%)	7%	5%	6%	19%	19%	20%
Total DRAM supply ('000 GB)	5,185,068	5,693,335	7,195,117	8,628,011	10,450,095	12,611,190
HBM portion (%)	*0.3%*	*0.3%*	*1.1%*	*5.8%*	*8.0%*	*9.5%*
Total HBM Supply ('000 GB)	**215,999**	**336,474**	**1,448,406**	**2,586,086**	**4,468,799**	**6,003,235**
yoy change		*56%*	*330%*	*79%*	*73%*	*34%*
Total HBM demand ('000 GB)	**215,999**	**349,471**	**1,492,389**	**2,677,990**	**4,708,616**	**6,252,369**
yoy change		*62%*	*327%*	*79%*	*76%*	*33%*
HBM Supply/Demand		**-3.7%**	**-2.9%**	**-3.4%**	**-5.1%**	**-4.0%**

Data for 2022, 2023, 2024, and 2025 are estimated

Source: Goldman Sachs Global Investment Research

Exhibit 27: HBM revenue by company and market share

	2022	2023	2024	2025	2026E	2027E
HBM Demand ('000 GB)	**215,999**	**349,471**	**1,492,389**	**2,677,990**	**4,708,616**	**6,252,369**
yoy change		*62%*	*327%*	*79%*	*76%*	*33%*
Average HBM ASP (US/GB)	**10.8**	**11.3**	**11.7**	**12.5**	**11.5**	**12.1**
yoy change		*5%*	*3%*	*7%*	*-8%*	*5%*
HBM TAM (mn)	**2,333**	**3,963**	**17,437**	**33,449**	**54,107**	**75,439**
yoy change		*70%*	*340%*	*92%*	*62%*	*39%*
HBM revenue						
Hynix HBM revenue ($mn)	**1,182**	**2,110**	**9,488**	**20,534**	**28,353**	**38,748**
yoy change		*78%*	*350%*	*116%*	*38%*	*37%*
Hynix DRAM revenue ($mn)	22,307	15,900	32,986	52,699	135,342	147,337
HBM portion (%)	*5.3%*	*13.3%*	*28.8%*	*39.0%*	*20.9%*	*26.3%*
Samsung HBM revenue ($mn)	**1,007**	**1,603**	**6,853**	**5,792**	**14,870**	**20,544**
yoy change		*59%*	*327%*	*-15%*	*157%*	*38%*
Samsung DRAM revenue ($mn)	32,496	20,859	38,307	51,080	154,419	160,831
HBM portion (%)	*3.1%*	*7.7%*	*17.9%*	*11.3%*	*9.6%*	*12.8%*
Micron HBM revenue ($mn)	**143**	**250**	**1,096**	**7,124**	**10,884**	**16,146**
yoy change		*75%*	*338%*	*550%*	*53%*	*48%*
Micron DRAM revenue ($mn)	19,627	11,576	20,576	32,989	83,200	71,475
HBM portion (%)	*0.7%*	*2.2%*	*5.3%*	*21.6%*	*13.1%*	*22.6%*
HBM revenue m/s						
Hynix HBM market share	51%	53%	54%	61%	52%	51%
SEC HBM market share	43%	40%	39%	17%	27%	27%
Micron HBM market share	6%	6%	6%	21%	20%	21%

Data for 2022, 2023, 2024, and 2025 are estimated per GSe

Source: Goldman Sachs Global Investment Research

BOM analysis indicates substantial memory cost burden, yet memory S/D to still be tight even under a highly negative scenario

One of the largest concerns coming from the soaring memory pricing has been the impact it would have on the pricing of consumer products such as PCs and smartphones, and as a result, a potential impact on end-demand. Many PC and smartphone customers have recently commented on this concern.

Exhibit 28: PC and smartphone brands comment on higher memory costs

PC OEM	Comments
Dell	Increased price for notebooks and desktops ranging from 10-30% COO comments that demand for memory is way ahead of supply
HP	Plans to redesign some products with lower memory configuration Considering a price raise, especially for low-end products
Lenovo	Reportedly stockpliled RAM that could last until 1H26 Believes rising memory price to negatively impact EPS by 10% in FY2026 ($0.3/$3)
Samsung	Raised consumer price for recently released Galaxy Book 6
Smartphone OEM	**Comments**
Apple	Expects impact on gross margins starting from 1Q26 due to memory prices Anticipates memory price to significantly increase in 1H26
Samsung	Expects memory price hikes to impact smartphone manufacturing costs Signaled price increase for the upcoming Galaxy S26 Plans to use Chinese display panels to offset memory price hikes
Xiaomi	Imposed mark-ups of 100 yuan to 300 yuan on several tablets due to high memory costs Raised flagship model Xiaomi 17 Ultra model price by 10%
Asus	Will not release new smartphones for 2026 due to memory price hikes

Source: Company data, Goldman Sachs Global Investment Research

Therefore, in this report we have conducted a proprietary BOM analysis to see how much cost burden from memory has increased, and a sensitivity analysis to see the potential impact that this would have on DRAM demand and S/D outlook.

Smartphones: memory cost could reach 23%-29% of BOM by 3Q26

To gauge the memory cost in smartphone BOM, we calculated the proportion of memory cost in the total BOM of two leading smartphone brands, Apple's iPhone and Samsung's Galaxy S series. Memory costs were adjusted in accordance with historical DRAM and NAND pricing, along with the estimation that other BOM costs stayed the same until a new model was released.

For iPhones, we expect DRAM and NAND costs to reach around 23% of total BOM by 3Q26, which is the highest level since 2010 and compares to 10% in 3Q25. This increase could also be partly attributed to the rise in DRAM capacity in line with Apple's on-device AI initiative, as Apple increased its standard model DRAM capacity to 8GB from 6GB starting with iPhone 16 and NAND capacity to 256GB from 128GB starting with iPhone 17, but still memory cost burden is expected to increase meaningfully.

Samsung is also expected to see a steep increase in memory cost portion as we expect memory (DRAM and NAND combined) to reach around 29% of total BOM by 3Q26, a significant increase compared to 13% in 3Q25.

Given there could be different outcomes for the memory pricing trend during the next few quarters, we also examined the memory bull case where every quarter between 1Q26 and 3Q26 will see a 10%p higher pricing growth compared to our base case, and the memory bear case where pricing growth is 10%p less than our base case for every quarter during the same period.

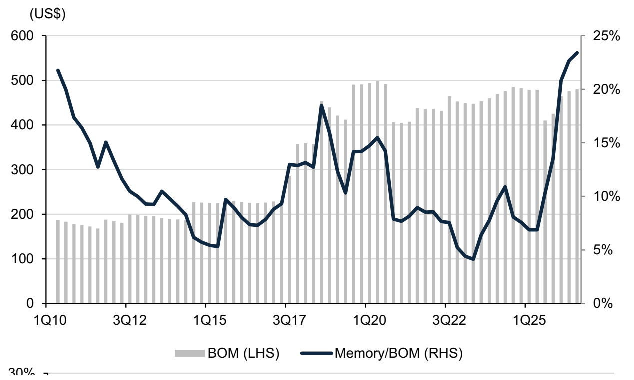
Under the memory bull case for iPhone, total memory cost portion of the BOM increases up to 28% by 3Q26, while under the bear case we expect memory to comprise around 19% of BOM by 3Q26. For Samsung's Galaxy S, we expect the bull case will lead memory cost reaching 34% of BOM by 3Q26, while bear case will lead to memory comprising 24% of BOM by 3Q26.

PC: memory cost could reach 17% of BOM by 3Q26

We have conducted a similar analysis for PC, using Dell XPS series as the sample. Under the similar assumptions we used for smartphones, we estimate that memory cost will reach 17% of total BOM by 3Q26, compared to 7% in 3Q25. Under the memory bull case, memory cost could reach 20% of BOM, while under the bear case it could reach 13% of BOM.

Exhibit 29: iPhone BOM trend & Memory/BOM (%) Estimates

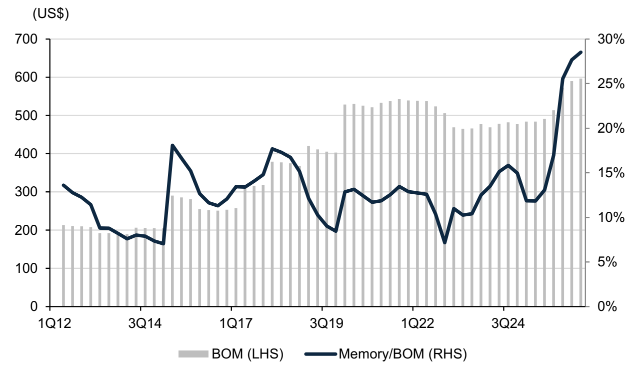
Memory costs expected to reach around 23% of total BOM in 3Q26



Source: Tech Insights, IHS iSuppli, Counterpoint, Company data, Goldman Sachs Global Investment Research

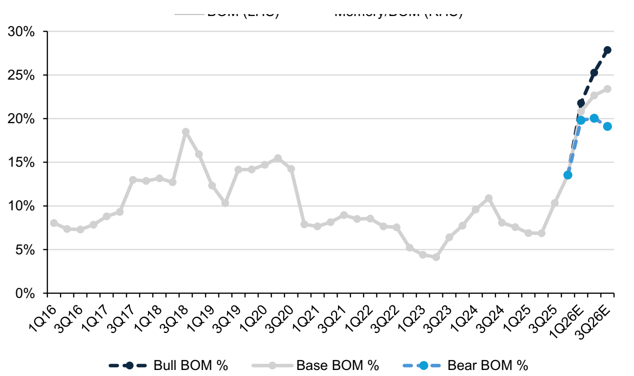
Exhibit 30: Galaxy S Series BOM trend & Memory/BOM (%) Estimates

Memory costs expected to reach around 29% of total BOM in 3Q26



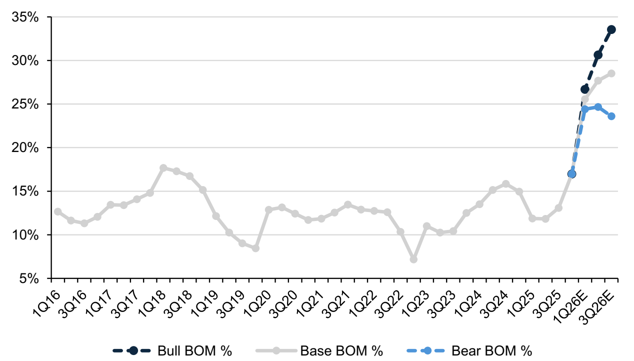
Source: Tech Insights, IHS iSuppli, Counterpoint, Company data, Goldman Sachs Global Investment Research

Exhibit 31: iPhone BOM Trend Scenario



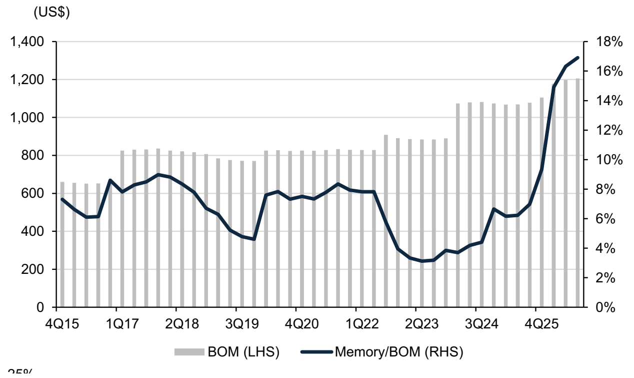
Source: iHS iSuppli, Tech Insights, Counterpoint, Company data, Goldman Sachs Global Investment Research

Exhibit 32: Galaxy S Series BOM Trend Scenario



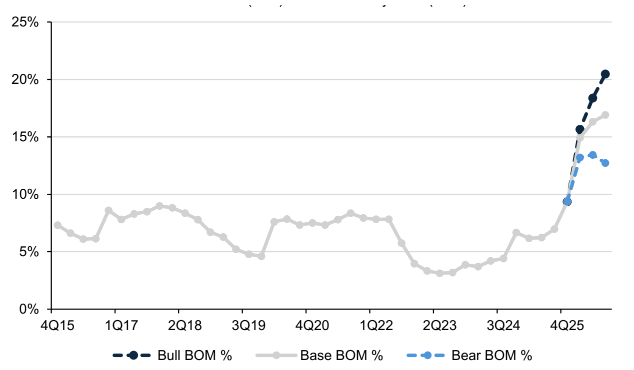
Source: iHS iSuppli, Tech Insights, Counterpoint, Company data, Goldman Sachs Global Investment Research

Exhibit 33: Dell XPS Series BOM trend & Memory/BOM (%) Estimates
Memory costs expected to reach around 17% of total BOM in 3Q26



Source: iHS iSuppli, Tech Insights, Counterpoint, Company data, Goldman Sachs Global Investment Research

Exhibit 34: Dell XPS Series BOM Trend Scenario



Source: iHS iSuppli, Tech Insights, Counterpoint, Company data, Goldman Sachs Global Investment Research

Memory S/D to still be tight even under highly negative case scenario

We also conduct a sensitivity analysis to see the potential impact that the higher memory cost would have on DRAM demand and S/D outlook. We assumed several different scenarios for the shipment for smartphone/PC and the average DRAM content per smartphone/PC.

Assuming a highly negative scenario where smartphone shipment declines by 11% yoy this year (vs. our base case of -6% yoy), average DRAM content per smartphone increases by 9% yoy (vs. base case of +14% yoy), PC shipment declines by 10% yoy (vs. our base case of -5% yoy), and average DRAM content per PC increases by 5% yoy (vs. base case of +10% yoy), 2026E DRAM demand growth could fall to +21% yoy compared to our base case of +25% yoy. This would still lead to a DRAM industry undersupply of 1.7% for this year (compared to our base case of 4.9% undersupply).

Therefore, while the higher memory cost could lead to demand destruction for PC/smartphones and lower DRAM content adoption for these products, given the significant undersupply we expect for this year, even under a highly negative scenario we would expect the DRAM industry S/D to remain tight.

Exhibit 35: DRAM demand change under different scenarios

					Smartphone DRAM Content (GB)				
				2025	9.70				
				2026	10.53	10.77	11.01	11.25	11.49
					2026 DRAM Per Smartphone content Growth YoY				
Smartphone Shipment (000)				Case	Highly Neg.	Negative	Base	Positive	Highly Pos.
2025	2026	2026 Shipment YoY	Case	(Mn GB)	9%	11%	14%	16%	19%
1,259,889	1,250,263		Highly Pos.	-1%	13,159	13,462	13,765	14,069	14,372
	1,218,765		Positive	-3%	12,828	13,123	13,419	13,714	14,010
	1,187,268		Base	-6%	12,496	12,784	13,072	13,360	13,648
	1,155,771		Negative	-8%	12,165	12,445	12,725	13,005	13,285
	1,124,274		Highly Neg.	-11%	11,833	12,106	12,378	12,651	12,923

					PC DRAM Content (GB)				
				2025	12.35				
				2026	12.96	13.27	13.58	13.89	14.20
					2026 DRAM Per PC content Growth YoY				
PC Shipment (000)				Case	Highly Neg.	Negative	Base	Positive	Highly Pos.
2025	2026	2026 Shipment YoY	Case	(Mn GB)	5%	7%	10%	12%	15%
284,685	285,730		Highly Pos.	0%	3,704	3,792	3,881	3,969	4,057
	278,612		Positive	-2%	3,612	3,698	3,784	3,870	3,956
	271,495		Base	-5%	3,520	3,603	3,687	3,771	3,855
	264,378		Negative	-7%	3,427	3,509	3,591	3,672	3,754
	257,261		Highly Neg.	-10%	3,335	3,415	3,494	3,573	3,653

Source: Goldman Sachs Global Investment Research

Exhibit 36: Total DRAM demand yoy change

		Content Growth YoY				
2026 Shipment YoY		Highly Neg.	Negative	Base	Positive	Highly Pos.
	Highly Pos.	25.4%	26.4%	27.5%	28.5%	29.5%
	Positive	24.3%	25.3%	26.3%	27.3%	28.3%
	Base	23.2%	24.2%	25.2%	26.1%	27.1%
	Negative	22.1%	23.1%	24.0%	24.9%	25.9%
	Highly Neg.	21.0%	21.9%	22.8%	23.8%	24.7%

Source: Goldman Sachs Global Investment Research

Exhibit 37: Total DRAM supply/demand

		Content Growth YoY				
2026 Shipment YoY		Highly Neg.	Negative	Base	Positive	Highly Pos.
	Highly Pos.	-5.1%	-5.9%	-6.6%	-7.4%	-8.1%
	Positive	-4.3%	-5.0%	-5.8%	-6.5%	-7.2%
	Base	-3.4%	-4.2%	-4.9%	-5.6%	-6.4%
	Negative	-2.5%	-3.3%	-4.0%	-4.8%	-5.5%
	Highly Neg.	-1.7%	-2.4%	-3.1%	-3.8%	-4.6%

Source: Goldman Sachs Global Investment Research

Company Highlights

Samsung Electronics (Buy; TP: W205,000)

We expect SEC to be one of the key beneficiaries of conventional memory shortage, given its outsized exposure in this segment relative to peers. We believe the company will continue to enjoy significant earnings upside given our continued expectation of a much stronger conventional memory pricing increase starting 1Q26 and continuing throughout 2026. Adding the significant improvement in its HBM business that we expect from this year driven by stronger demand from ASIC customers (especially from SEC's strong positioning in Google TPU) and increased market share of Nvidia (mainly in HBM4), we estimate 2026E OP will more than quadruple yoy to reach over W180tn, and ROE to get close to 30% which is a level not seen during the past 20 years. Shares are trading at 7.4X P/E and 1.9X P/B on 2026E numbers which we believe offers attractive valuation, and we reiterate our Buy rating with a 12m TP of W205,000.

Exhibit 38: SEC DRAM key assumptions

DRAM: Key assumptions	1Q25	2Q25	3Q25	4Q25	1Q26E	2Q26E	3Q26E	4Q26E	2023	2024	2025	2026E	2027E
ASP (US$, 1Gb equiv.)	**0.4**	**0.4**	**0.4**	**0.6**	**1.0**	**1.1**	**1.2**	**1.2**	**0.2**	**0.4**	**0.4**	**1.1**	**1.0**
Sequential change (%)	*-20%*	*2%*	*16%*	*41%*	*69%*	*11%*	*7%*	*4%*	*-42%*	*61%*	*22%*	*158%*	*-10%*
Shipment (mn, 1Gb equiv.)	**25,000**	**27,650**	**31,700**	**32,100**	**32,421**	**33,069**	**34,723**	**35,765**	**93,425**	**106,580**	**116,450**	**135,978**	**156,797**
Sequential change (%)	*2%*	*11%*	*15%*	*1%*	*1%*	*2%*	*5%*	*3%*	*12%*	*14%*	*9%*	*17%*	*15%*
Wafer capacity (WPM, 12-inch equiv.)	**650**	**650**	**670**	**650**	**670**	**690**	**710**	**730**	**568**	**616**	**655**	**700**	**741**
Sequential change (%)	*-4%*	*0%*	*3%*	*-3%*	*3%*	*3%*	*3%*	*3%*	*-18%*	*9%*	*6%*	*7%*	*6%*
Sales (W tn)	**12.8**	**14.0**	**18.4**	**27.5**	**46.6**	**52.1**	**57.7**	**61.8**	**27.3**	**52.4**	**72.7**	**218.2**	**217.1**
Sequential change (%)	*-15%*	*9%*	*31%*	*49%*	*70%*	*12%*	*11%*	*7%*	*-34%*	*92%*	*39%*	*200%*	*-1%*
Operating profit (W tn)	**3.6**	**3.4**	**7.0**	**15.3**	**30.4**	**34.6**	**39.1**	**43.0**	**-1.1**	**16.2**	**29.3**	**147.1**	**138.1**
Sequential change (%)	*-28%*	*-7%*	*107%*	*118%*	*99%*	*14%*	*13%*	*10%*	*-106%*	*-1574%*	*81%*	*402%*	*-6%*
OP Margin (%)	**28%**	**24%**	**38%**	**56%**	**65%**	**66%**	**68%**	**70%**	**-4%**	**31%**	**40%**	**67%**	**64%**

Source: Company data, Goldman Sachs Global Investment Research

Exhibit 39: SEC NAND key assumptions

NAND: Key assumptions	1Q25	2Q25	3Q25	4Q25	1Q26E	2Q26E	3Q26E	4Q26E	2023	2024	2025	2026E	2027E
ASP (US$, 16Gb equiv.)	**0.1**	**0.1**	**0.1**	**0.2**	**0.3**	**0.3**	**0.3**	**0.3**	**0.1**	**0.1**	**0.1**	**0.3**	**0.2**
Sequential change (%)	*-15%*	*-5%*	*5%*	*24%*	*70%*	*10%*	*4%*	*1%*	*-45%*	*63%*	*-8%*	*121%*	*-15%*
Shipment (mn, 16Gb equiv.)	**34,200**	**43,400**	**47,700**	**42,700**	**44,408**	**44,852**	**45,749**	**44,834**	**145,670**	**163,000**	**168,000**	**179,843**	**201,060**
Sequential change (%)	*-10%*	*27%*	*10%*	*-10%*	*4%*	*1%*	*2%*	*-2%*	*13%*	*12%*	*3%*	*7%*	*12%*
Wafer capacity (WPM, 12-inch equiv.)	**480**	**430**	**420**	**410**	**400**	**390**	**395**	**395**	**499**	**483**	**435**	**395**	**370**
Sequential change (%)	*-13%*	*-10%*	*-2%*	*-2%*	*-2%*	*-3%*	*1%*	*0%*	*-23%*	*-3%*	*-10%*	*-9%*	*-6%*
Sales (W tn)	**6.2**	**7.2**	**8.3**	**9.6**	**16.8**	**18.5**	**19.3**	**19.1**	**16.6**	**31.6**	**31.3**	**73.7**	**67.1**
Sequential change (%)	*-21%*	*17%*	*14%*	*16%*	*76%*	*10%*	*5%*	*-1%*	*-37%*	*90%*	*-1%*	*136%*	*-9%*
Operating profit (W tn)	**-0.1**	**-0.3**	**0.7**	**2.4**	**6.2**	**7.3**	**7.9**	**7.9**	**-11.3**	**4.0**	**2.7**	**29.3**	**19.1**
Sequential change (%)	*-147%*	*198%*	*-320%*	*225%*	*160%*	*19%*	*8%*	*0%*	*-416%*	*-135%*	*-33%*	*999%*	*-35%*
OP Margin (%)	**-2%**	**-5%**	**9%**	**25%**	**37%**	**40%**	**41%**	**41%**	**-68%**	**13%**	**9%**	**40%**	**28%**

Source: Company data, Goldman Sachs Global Investment Research

Exhibit 40: SEC earnings summary

	1Q25	2Q25	3Q25	4Q25	1Q26E	2Q26E	3Q26E	4Q26E	2023	2024	2025	2026E	2027E
Sales (W tn)	79.14	74.57	86.06	93.84	122.16	124.28	136.18	139.02	258.94	300.87	333.61	521.65	515.00
DS (Semiconductor)	25.11	27.90	33.10	44.00	70.29	77.49	84.26	88.41	66.59	111.07	130.11	320.45	314.51
Semiconductor	25.11	27.90	33.10	44.00	70.28	77.48	84.25	88.40	66.59	111.07	130.11	320.41	314.47
Memory	19.10	21.24	26.70	37.10	63.51	70.55	77.01	80.92	44.13	84.50	104.14	291.98	284.22
DRAM	12.82	14.00	18.40	27.50	46.65	52.08	57.69	61.80	27.32	52.35	72.72	218.22	217.12
NAND	6.20	7.23	8.27	9.59	16.85	18.46	19.31	19.11	16.60	31.55	31.29	73.73	67.06
System LSI / Foundry	6.01	6.66	6.40	6.90	6.77	6.93	7.24	7.49	22.46	26.57	25.97	28.43	30.25
SDC (Display Panel)	5.88	6.38	8.10	9.48	5.95	6.36	7.99	8.62	30.97	29.17	29.84	28.92	29.14
AM-OLED	5.88	6.38	8.10	9.48	5.95	6.36	7.99	8.62	30.97	29.17	29.84	28.92	29.14
DX	51.48	43.30	48.03	44.02	48.78	42.27	45.63	42.69	168.85	173.73	186.83	179.37	178.09
MX/NW (Mobile, Networks)	37.00	29.20	34.10	29.25	34.72	28.18	31.47	28.27	112.41	117.27	129.55	122.64	121.79
Mobile	36.20	28.50	33.45	28.30	33.88	27.32	30.61	27.40	108.63	114.41	126.45	119.21	118.10
Handset	29.05	21.96	25.80	21.30	27.07	20.90	24.22	20.72	85.10	89.71	98.11	92.91	91.58
PC	5.05	4.51	5.45	5.00	4.87	4.61	4.59	4.59	16.40	16.88	20.01	18.66	18.84
Tablet	2.10	2.03	2.20	2.00	1.95	1.81	1.80	2.09	7.14	7.82	8.33	7.64	7.68
Equipment and others	0.80	0.70	0.65	0.95	0.84	0.86	0.86	0.87	3.78	2.86	3.10	3.43	3.69
VD/DA (Visual Display, Appliances)	14.48	14.10	13.93	14.77	14.06	14.09	14.15	14.43	56.44	56.46	57.28	56.74	56.30
VD	7.80	7.00	7.30	8.80	7.56	7.19	7.53	8.14	30.38	30.92	30.90	30.42	29.73
Appliances and others	6.68	7.10	6.63	5.97	6.51	6.90	6.62	6.29	26.06	25.54	26.38	26.32	26.57
Harman	3.41	3.82	3.95	4.60	3.64	4.16	4.30	4.79	14.39	14.27	15.78	16.90	17.26
Others	(6.74)	(6.83)	(7.12)	(8.26)	(6.50)	(6.00)	(6.00)	(5.50)	(21.86)	(27.37)	(28.95)	(24.00)	(24.00)
Operating Profit (W tn)	6.69	4.68	12.17	20.07	38.12	42.77	48.09	52.05	6.57	32.73	43.60	181.04	170.01
DS (Semiconductor)	1.11	0.36	7.00	16.42	35.02	40.66	46.02	50.16	(14.87)	15.12	24.89	171.86	157.39
Semiconductor	1.11	0.36	7.00	16.42	35.01	40.65	46.01	50.15	(14.87)	15.12	24.89	171.82	157.35
Memory	3.53	3.05	7.74	17.66	36.60	41.95	47.01	50.85	(12.39)	20.16	31.97	176.40	157.16
DRAM	3.64	3.39	7.00	15.27	30.41	34.60	39.10	42.95	(1.10)	16.15	29.30	147.06	138.09
NAND	(0.11)	(0.33)	0.73	2.38	6.19	7.35	7.91	7.89	(11.31)	3.99	2.67	29.34	19.07
System LSI / Foundry	(2.42)	(2.69)	(0.74)	(1.24)	(1.59)	(1.30)	(1.00)	(0.70)	(2.48)	(5.04)	(7.08)	(4.58)	0.19
SDC (Display Panel)	0.49	0.48	1.24	1.95	0.38	0.49	1.02	1.35	5.57	3.74	4.16	3.23	3.57
AM-OLED	0.49	0.48	1.24	1.95	0.38	0.49	1.02	1.35	5.57	3.74	4.16	3.23	3.57
DX	4.68	3.30	3.45	1.30	2.41	1.25	0.67	0.15	14.27	12.37	12.73	4.48	7.52
MX/NW (Mobile, Networks)	4.34	3.10	3.56	1.90	2.44	1.23	0.72	0.43	13.01	10.64	12.90	4.82	6.57
Mobile	4.24	3.01	3.48	1.81	2.35	1.12	0.62	0.31	12.43	10.31	12.54	4.41	6.06
Handset	3.86	2.67	3.10	1.56	2.15	0.98	0.49	0.20	11.16	9.04	11.18	3.82	5.36
PC	0.07	0.06	0.08	0.05	0.04	0.03	0.02	0.01	0.22	0.23	0.26	0.11	0.15
Tablet	0.32	0.28	0.31	0.20	0.16	0.11	0.11	0.10	1.06	1.04	1.11	0.48	0.55
Equipment and others	0.10	0.09	0.08	0.09	0.09	0.10	0.10	0.11	0.58	0.33	0.36	0.41	0.51
VD/DA (Visual Display, Appliances)	0.34	0.20	(0.11)	(0.60)	(0.03)	0.02	(0.05)	(0.28)	1.26	1.73	(0.17)	(0.34)	0.96
VD (Visual Display)	0.33	0.18	0.12	0.18	0.29	0.16	0.02	(0.09)	2.06	1.72	0.80	0.38	0.69
Appliances and others	0.01	0.02	(0.23)	(0.78)	(0.33)	(0.14)	(0.07)	(0.19)	(0.80)	0.01	(0.97)	(0.72)	0.27
Harman	0.31	0.50	0.40	0.32	0.34	0.40	0.43	0.47	1.17	1.31	1.53	1.64	1.70
Others	0.10	0.04	0.08	0.08	(0.02)	(0.03)	(0.05)	(0.07)	0.43	0.19	0.30	(0.17)	(0.17)
OP Margin (%)	8%	6%	14%	21%	31%	34%	35%	37%	3%	11%	13%	35%	33%
DS (Semiconductor)	4%	1%	21%	37%	50%	52%	55%	57%	-22%	14%	19%	54%	50%
Semiconductor	4%	1%	21%	37%	50%	52%	55%	57%	-22%	14%	19%	54%	50%
Memory	18%	14%	29%	48%	58%	59%	61%	63%	-28%	24%	31%	60%	55%
DRAM	28%	24%	38%	56%	65%	66%	68%	70%	-4%	31%	40%	67%	64%
NAND	-2%	-5%	9%	25%	37%	40%	41%	41%	-68%	13%	9%	40%	28%
System LSI / Foundry	-40%	-40%	-12%	-18%	-23%	-19%	-14%	-9%	-11%	-19%	-27%	-16%	1%
SDC (Display Panel)	8%	8%	15%	21%	6%	8%	13%	16%	18%	13%	14%	11%	12%
AM-OLED	8%	8%	15%	21%	6%	8%	13%	16%	18%	13%	14%	11%	12%
DX	9%	8%	7%	3%	5%	3%	1%	0%	8%	7%	7%	2%	4%
MX/NW (Mobile, Networks)	12%	11%	10%	6%	7%	4%	2%	2%	12%	9%	10%	4%	5%
Mobile	12%	11%	10%	6%	7%	4%	2%	1%	11%	9%	10%	4%	5%
Handset	13%	12%	12%	7%	8%	5%	2%	1%	13%	10%	11%	4%	6%
PC	1%	1%	1%	1%	1%	1%	0%	0%	1%	1%	1%	1%	1%
Tablet	15%	14%	14%	10%	8%	6%	6%	5%	15%	13%	13%	6%	7%
Equipment and others	12%	12%	12%	10%	11%	12%	12%	13%	15%	11%	11%	12%	14%
VD/DA (Visual Display, Appliances)	2%	1%	-1%	-4%	0%	0%	0%	-2%	2%	3%	0%	-1%	2%
VD (Visual Display)	4%	3%	2%	2%	4%	2%	0%	-1%	7%	6%	3%	1%	2%
Appliances and others	0%	0%	-4%	-13%	-5%	-2%	-1%	-3%	-3%	0%	-4%	-3%	1%
Harman	9%	13%	10%	7%	9%	10%	10%	10%	8%	9%	10%	10%	10%
Others	-1%	-1%	-1%	-1%	0%	1%	1%	1%	-2%	-1%	-1%	1%	1%

Source: Company data, Goldman Sachs Global Investment Research

SK Hynix (Buy; TP: W1,200,000)

With our expectation for one of the strongest memory upcycles to pan out throughout 2026, we expect Hynix to see an unprecedented operating margin level for both DRAM (high-70%) and NAND (mid-40%) this year. With our unchanged view that the company will maintain its solid leadership in the AI memory space, we expect the company's ROE to exceed 70% this year which would be the highest level ever and a significant improvement compared to 44% last year. Adding the announced measures such as buybacks/dividends/potential ADR listing that could lead to upside in shareholder value, we remain constructive on the mid/long-term outlook for the stock, and reiterate our Buy rating with a 12m TP of W1,200,000.

Exhibit 41: Hynix DRAM key assumptions

DRAM: Key assumptions	1Q25	2Q25	3Q25	4Q25	1Q26E	2Q26E	3Q26E	4Q26E	2023	2024	2025	2026E	2027E
ASP (US$, 1Gb equiv.)	**0.5**	**0.5**	**0.5**	**0.7**	**1.0**	**1.2**	**1.2**	**1.3**	**0.2**	**0.4**	**0.6**	**1.2**	**1.1**
Sequential change (%)	*0%*	*1%*	*4%*	*24%*	*55%*	*12%*	*6%*	*3%*	*-37%*	*77%*	*28%*	*109%*	*-5%*
Shipment (mn, 1Gb equiv.)	**18,850**	**23,400**	**25,300**	**25,550**	**25,550**	**27,083**	**29,520**	**31,882**	**64,010**	**75,110**	**93,100**	**114,036**	**131,446**
Sequential change (%)	*-8%*	*24%*	*8%*	*1%*	*0%*	*6%*	*9%*	*8%*	*14%*	*17%*	*24%*	*22%*	*15%*
Wafer capacity (WPM, 12-inch equiv.)	**490**	**505**	**530**	**550**	**580**	**610**	**620**	**640**	**326**	**400**	**519**	**613**	**666**
Sequential change (%)	*7%*	*3%*	*5%*	*4%*	*5%*	*5%*	*2%*	*3%*	*-14%*	*23%*	*30%*	*18%*	*9%*
Sales (W bn)	**14,025**	**17,030**	**18,997**	**24,883**	**38,329**	**44,872**	**51,115**	**56,860**	**20,849**	**45,150**	**74,934**	**191,176**	**198,906**
Sequential change (%)	*-4%*	*21%*	*12%*	*31%*	*54%*	*17%*	*14%*	*11%*	*-27%*	*117%*	*66%*	*155%*	*4%*
Operating profit (W bn)	**7,535**	**9,399**	**11,038**	**16,982**	**29,302**	**34,468**	**39,712**	**44,618**	**355**	**20,986**	**44,953**	**148,100**	**140,684**
Sequential change (%)	*0%*	*25%*	*17%*	*54%*	*73%*	*18%*	*15%*	*12%*	*-96%*	*5817%*	*114%*	*229%*	*-5%*
OP Margin (%)	**54%**	**55%**	**58%**	**68%**	**76%**	**77%**	**78%**	**78%**	**2%**	**46%**	**60%**	**77%**	**71%**

Source: Company data, Goldman Sachs Global Investment Research

Exhibit 42: Hynix NAND key assumptions

NAND: Key assumptions	1Q25	2Q25	3Q25	4Q25	1Q26E	2Q26E	3Q26E	4Q26E	2023	2024	2025	2026E	2027E
ASP (US$, 16Gb equiv.)	**0.2**	**0.1**	**0.2**	**0.2**	**0.3**	**0.3**	**0.3**	**0.4**	**0.1**	**0.2**	**0.2**	**0.3**	**0.3**
Sequential change (%)	*-20%*	*-9%*	*11%*	*31%*	*45%*	*14%*	*4%*	*1%*	*-43%*	*90%*	*-8%*	*102%*	*-14%*
Shipment (mn, 16Gb equiv.)	**14,250**	**24,300**	**23,300**	**25,550**	**24,273**	**24,515**	**25,741**	**26,513**	**79,500**	**77,970**	**87,400**	**101,042**	**112,425**
Sequential change (%)	*-17%*	*71%*	*-4%*	*10%*	*-5%*	*1%*	*5%*	*3%*	*18%*	*-2%*	*12%*	*16%*	*11%*
Wafer capacity (WPM, 12-inch equiv.)	**235**	**235**	**235**	**240**	**240**	**240**	**240**	**250**	**213**	**205**	**236**	**243**	**255**
Sequential change (%)	*4%*	*0%*	*0%*	*2%*	*0%*	*0%*	*0%*	*4%*	*-25%*	*-4%*	*15%*	*3%*	*5%*
Sales (W bn)	**3,175**	**4,735**	**4,997**	**7,501**	**10,268**	**11,659**	**12,552**	**13,058**	**9,720**	**18,923**	**20,409**	**47,537**	**43,353**
Sequential change (%)	*-32%*	*49%*	*6%*	*50%*	*37%*	*14%*	*8%*	*4%*	*-31%*	*95%*	*8%*	*133%*	*-9%*
Operating profit (W bn)	**66**	**(70)**	**369**	**2,243**	**4,324**	**5,181**	**5,667**	**5,861**	**(7,808)**	**2,612**	**2,608**	**21,033**	**13,242**
Sequential change (%)	*-89%*	*-206%*	*-625%*	*508%*	*93%*	*20%*	*9%*	*3%*	*n.m*	*n.m*	*0%*	*706%*	*-37%*
OP Margin (%)	**2%**	**-1%**	**7%**	**30%**	**42%**	**44%**	**45%**	**45%**	**-80%**	**14%**	**13%**	**44%**	**31%**

Source: Company data, Goldman Sachs Global Investment Research

Exhibit 43: Hynix earnings summary

(W bn)	1Q25	2Q25	3Q25	4Q25	1Q26E	2Q26E	3Q26E	4Q26E	2023	2024	2025	2026E	2027E
Revenue	**17,639**	**22,232**	**24,449**	**32,827**	**49,027**	**56,982**	**64,159**	**70,434**	**32,766**	**66,193**	**97,147**	**240,602**	**244,390**
DRAM	14,025	17,030	18,997	24,883	38,329	44,872	51,115	56,860	20,849	45,150	74,934	191,176	198,906
NAND	3,175	4,735	4,997	7,501	10,268	11,659	12,552	13,058	9,720	18,923	20,409	47,537	43,353
Others	439	467	455	443	430	451	492	516	2,197	2,121	1,804	1,888	2,132
Gross profit	**10,102**	**11,983**	**14,029**	**22,576**	**38,997**	**45,895**	**51,769**	**57,497**	**(533)**	**31,828**	**58,691**	**194,158**	**180,788**
SG&A	2,661	2,770	2,646	3,407	5,393	6,268	6,416	7,043	7,197	8,361	11,485	25,120	26,883
Operating profit	**7,441**	**9,213**	**11,383**	**19,170**	**33,604**	**39,627**	**45,354**	**50,453**	**(7,730)**	**23,467**	**47,206**	**169,038**	**153,905**
DRAM	7,535	9,399	11,038	16,982	29,302	34,468	39,712	44,618	355	20,986	44,953	148,100	140,684
NAND	66	(70)	369	2,243	4,324	5,181	5,667	5,861	(7,808)	2,612	2,608	21,033	13,242
Others	(161)	(116)	(23)	(55)	(21)	(23)	(25)	(26)	(277)	(130)	(355)	(94)	(21)
Pre-tax profit	**9,299**	**8,723**	**14,790**	**17,653**	**33,744**	**39,652**	**45,441**	**50,644**	**(11,658)**	**23,885**	**50,466**	**169,480**	**156,032**
Net income	**8,107**	**6,997**	**12,595**	**15,220**	**25,306**	**29,737**	**34,079**	**37,981**	**(9,112)**	**19,789**	**42,919**	**127,102**	**117,016**
EPS (W)	**11,744**	**10,135**	**18,242**	**22,043**	**36,651**	**43,069**	**49,357**	**55,008**	**(13,242)**	**28,719**	**62,161**	**184,085**	**169,477**
Margins (%)													
Gross profit margin	**57**	**54**	**57**	**69**	**80**	**81**	**81**	**82**	**(2)**	**48**	**60**	**81**	**74**
Operating profit margin	**42**	**41**	**47**	**58**	**69**	**70**	**71**	**72**	**(24)**	**35**	**49**	**70**	**63**
DRAM	54	55	58	68	76	77	78	78	2	46	60	77	71
NAND	2	(1)	7	30	42	44	45	45	(80)	14	13	44	31
Others	(37)	(25)	(5)	(12)	(5)	(5)	(5)	(5)	(13)	(6)	(20)	(5)	(1)
Net profit margin	**46**	**31**	**52**	**46**	**52**	**52**	**53**	**54**	**(28)**	**30**	**44**	**53**	**48**
Sequential growth (%)													
Revenue	*(11)*	*26*	*10*	*34*	*49*	*16*	*13*	*10*	*(27)*	*102*	*47*	*148*	*2*
Gross profit	*(3)*	*19*	*17*	*61*	*73*	*18*	*13*	*11*	*na*	*na*	*84*	*231*	*(7)*
Operating profit	*(8)*	*24*	*24*	*68*	*75*	*18*	*14*	*11*	*na*	*na*	*101*	*258*	*(9)*
Net income	*1*	*(14)*	*80*	*21*	*66*	*18*	*15*	*11*	*na*	*na*	*117*	*196*	*(8)*

Source: Company data, Goldman Sachs Global Investment Research

SanDisk (Buy, TP: $700)

We continue to expect that a combination of tight supply and accelerating demand will drive meaningful upward revisions to SanDisk's earnings outlook over the next 12 months. Given continued supply-side prudence, SanDisk management believes the NAND industry will remain increasingly undersupplied in FY3Q. With enterprise market expectations now in the high-60% bit-growth range for 2026, we believe the company is well positioned to sustain gross margin expansion throughout the year. We maintain our Buy rating, as we expect limited NAND supply additions for the foreseeable future and believe SanDisk's product portfolio and mix continue to strengthen in this environment. Our 12-month target price is $700, which is based on a 22X P/E multiple applied to our normalized EPS estimate of $32.00. Key downside risks include: (1) NAND recovery fails to materialize; (2) YMTC continues to iterate on its roadmap; (3) SanDisk fails to gain eSSD traction.

Micron (Neutral, TP: $235)
We expect Micron to continue executing on its HBM product roadmap, capturing roughly 20% share of a fast-growing, high-margin market. Previous commentary from the management suggests ongoing supply constraints in terms of cleanroom capacity driving limited bit growth of just 20% for 2026. We remain Neutral-rated on the stock given our view of roughly balanced risk/reward at current levels and risk of pricing retracement in HBM in 2026 given qualification of additional suppliers (such as Samsung), but would consider being more constructive on the stock if we see continued supply growth discipline across the industry into 2027. Our 12-month price target of $235 is based on 15x our normalized EPS estimate of $15.65. Key upside/downside risks include: (1) continued execution on the company's HBM roadmap and share gain vis-a-vis Samsung and SK Hynix, (2) sizable step-up (above current expectations) in HBM content for AI accelerators, (3) continued signs of CXMT gaining DRAM market share, negatively impacting pricing dynamics.

Kioxia Holdings (Neutral, TP: Y13,000)
While we expect the company to continue to enjoy the tightness in the NAND market and expect Kioxia's CY26 pricing to be up more than 70% yoy, we remain Neutral-rated on the stock given (1) OEM contracts for which prices are negotiated quarterly account for the majority of sales, while its exposure to channel and spot markets (where prices are rising sharply) is minimal, and (2) as a pure-play NAND maker, the company has no option but to source the DRAM included in eSSDs from externally, and for which we expect a corresponding cost increase. Also, even though we are modelling OPM of 50% in FY3/27(which is the peak level for the industry in previous cycles), we believe there is little room for the company's multiples to expand further, as historically P/E multiples ascribed at cycle peaks in the NAND industry have remained in the mid-to-high single digits. Our 12-month target price of ¥13,000 is based on the correlation between P/B and the average of FY3/26E-FY3/27E ROE (implies FY3/27E P/E 5.9X, P/B 3.1X). Key risks are NAND industry cyclicality, high dependence on specific customers, volatile capacity utilization trends, rise of NAND players in China, etc.

Implications for the Japan SPE names
In the context of tighter S-D balance for both DRAM and NAND, we expect a strong memory WFE cycle ahead into CY26-27. Given cleanroom constraints and relatively higher margins for DRAM vs. NAND, memory companies are expected to prioritize DRAM spending over NAND, and thus we are relatively more constructive on the DRAM WFE cycle vs. NAND. We highlight **Tokyo Electron (Buy, TP: Y43,000)** among our coverage in this context as the company has relatively high market share in a wide range of tools used for leading-edge DRAM manufacturing, ranging from EUV coater/developer, etching for capacitors, batch deposition, and supercritical dry cleaning tools. We also highlight **Ulvac (Buy, TP: Y8,400)** among the SMID names as a key DRAM (particularly Samsung) capex beneficiary. Among the back-end names, we continue to be bullish on **Disco (Buy, TP: Y68,000)** as the company continues to enjoy a dominant market share in HBM grinding and dicing tools, and higher HBM capacity bodes well for its tool demand going forward.

Price Target Risks and Methodology - Samsung Electronics
Valuation methodology: Our 12m 2026E EV/EBITDA-based SOTP target price for the

common share is W205,000. Our 12-month target price for the preference share is W159,000, which is based on our target pref to common shares discount of 22%, derived from averaging: 1) the pref discount of the 2-factor model and 2) the average preference share discount to common shares during the past 1 month. We are Buy rated on both the common and preference shares.

Key downside risks: 1) major deterioration in memory supply/demand, 2) sharp contraction in smartphone margins, and 3) mobile OLED market share loss.

Investment Thesis - Samsung Electronics

Samsung Electronics (SEC) is one of the largest tech companies in the world, with the #1 market share in several products including memory chips, OLED panels, smartphones, and TVs. We expect the company to benefit from its outsized exposure in conventional memory where pricing for both DRAM and NAND continues to see significant upside. Adding the significant improvement in its HBM business, we forecast the company's ROE to meaningfully improve in 2026E, yet the valuation still looks attractive. With the attractive risk/reward profile, we are Buy rated on the name.

Price Target Risks and Methodology - SK Hynix Inc.

Valuation methodology: Our 2026E/27E avg. P/B-based 12m TP is W1,200,000. We use 30% as an AI premium given this is the average premium at which Hynix shares have traded over SEC over the last one year, with the former seeing significant growth in HBM revenue while the latter has shown limited growth during the same period. We apply this to the peak multiple of 2.16X during one of the strongest pricing upcycles (2009-2010), which results in a target multiple of 2.8X, from which we derive our target price.

Key risks: Key risks include 1) major deterioration in memory supply/demand and delay in technology migration, 2) weaker demand for smartphones/PCs/servers which would impact overall conventional memory demand, 3) Samsung's positive HBM business progress which would impact HBM revenue and profit, 4) lower AI-related capex which would impact overall HBM demand, and thus HBM revenue/profit for the company.

Investment Thesis - SK Hynix Inc.

SK Hynix (Hynix) is the leader in the HBM market, the second-largest DRAM supplier, and one of the leading NAND suppliers globally. We expect one of the strongest memory upcycles to pan out throughout 2026, as the incrementally higher AI spending mainly from the hyperscalers and their intentions to continue to do so is driving our view that memory demand from servers (server DRAM, SOCAMM, HBM, and eSSD) will significantly outpace supply. Hence, we are Buy rated on the name.

Disclosure Appendix

Reg AC

We, Giuni Lee, James Schneider, Ph.D., Shuhei Nakamura, Daiki Takayama, Taeyong Lee, Kaho Otake and Lal Kablan, hereby certify that all of the views expressed in this report accurately reflect our personal views about the subject company or companies and its or their securities. We also certify that no part of our compensation was, is or will be, directly or indirectly, related to the specific recommendations or views expressed in this report.

Unless otherwise stated, the individuals listed on the cover page of this report are analysts in Goldman Sachs' Global Investment Research division.

GS Factor Profile

The Goldman Sachs Factor Profile provides investment context for a stock by comparing key attributes to the market (i.e. our universe of rated stocks) and its sector peers. The four key attributes depicted are: Growth, Financial Returns, Multiple (e.g. valuation) and Integrated (a composite of Growth, Financial Returns and Multiple). Growth, Financial Returns and Multiple are calculated by using normalized ranks for specific metrics for each stock. The normalized ranks for the metrics are then averaged and converted into percentiles for the relevant attribute. The precise calculation of each metric may vary depending on the fiscal year, industry and region, but the standard approach is as follows:

Growth is based on a stock's forward-looking sales growth, EBITDA growth and EPS growth (for financial stocks, only EPS and sales growth), with a higher percentile indicating a higher growth company. **Financial Returns** is based on a stock's forward-looking ROE, ROCE and CROCI (for financial stocks, only ROE), with a higher percentile indicating a company with higher financial returns. **Multiple** is based on a stock's forward-looking P/E, P/B, price/dividend (P/D), EV/EBITDA, EV/FCF and EV/Debt Adjusted Cash Flow (DACF) (for financial stocks, only P/E, P/B and P/D), with a higher percentile indicating a stock trading at a higher multiple. The **Integrated** percentile is calculated as the average of the Growth percentile, Financial Returns percentile and (100% - Multiple percentile).

Financial Returns and Multiple use the Goldman Sachs analyst forecasts at the fiscal year-end at least three quarters in the future. Growth uses inputs for the fiscal year at least seven quarters in the future compared with the year at least three quarters in the future (on a per-share basis for all metrics).

For a more detailed description of how we calculate the GS Factor Profile, please contact your GS representative.

M&A Rank

Across our global coverage, we examine stocks using an M&A framework, considering both qualitative factors and quantitative factors (which may vary across sectors and regions) to incorporate the potential that certain companies could be acquired. We then assign a M&A rank as a means of scoring companies under our rated coverage from 1 to 3, with 1 representing high (30%-50%) probability of the company becoming an acquisition target, 2 representing medium (15%-30%) probability and 3 representing low (0%-15%) probability. For companies ranked 1 or 2, in line with our standard departmental guidelines we incorporate an M&A component into our target price. M&A rank of 3 is considered immaterial and therefore does not factor into our price target, and may or may not be discussed in research.

Quantum

Quantum is Goldman Sachs' proprietary database providing access to detailed financial statement histories, forecasts and ratios. It can be used for in-depth analysis of a single company, or to make comparisons between companies in different sectors and markets.

Disclosures

Rating and pricing information

DISCO (Buy, ¥65,800), Tokyo Electron (Buy, ¥41,030) and Ulvac (Buy, ¥8,241); Kioxia Holdings (Neutral, ¥19,095), Micron Technology Inc. (Neutral, $394.69), SK Hynix Inc. (Buy, W839,000), Samsung Electronics (Buy, W158,600), Samsung Electronics (Pref) (Buy, W112,400) and SanDisk Corp. (Buy, $597.95).

The rating(s) for SK Hynix Inc., Samsung Electronics and Samsung Electronics (Pref) is/are relative to the other companies in its/their coverage universe: Hansol Chemical, LG Display, LG Electronics, LG Innotek Co., SK Hynix Inc., SKC, Samsung Electro-Mechanics, Samsung Electronics, Samsung Electronics (Pref)

The rating(s) for Kioxia Holdings is/are relative to the other companies in its/their coverage universe: Advantest, DISCO, Ebara, HOYA, JEOL, Kioxia Holdings, Lasertec, SCREEN Holdings, Tokyo Electron, Tokyo Seimitsu, Ulvac

The rating(s) for Micron Technology Inc. and SanDisk Corp. is/are relative to the other companies in its/their coverage universe: ARM Holdings, Accenture Plc, Advanced Micro Devices Inc., American Tower Corp., Amkor Technology Inc., Analog Devices Inc., Applied Materials Inc., Broadcom Inc., Cadence Design Systems Inc., Camtek, Cognizant Technology Solutions, Crown Castle Inc., EPAM Systems Inc., Entegris Inc., GlobalFoundries Inc., Globant SA, IHS Holding, International Business Machines Corp., KLA Corp., Lam Research Corp., MKS Instruments Inc., Marvell Technology Inc., Microchip Technology Inc., Micron Technology Inc., NXP Semiconductors NV, Nvidia Corp., ON Semiconductor Corp., Qnity, SBA Communications Corp., SanDisk Corp., Seagate Technology, SiTime Corp., Synopsys Inc., TaskUs Inc., Teradyne Inc., Texas Instruments Inc., Western Digital Corp.

Company-specific regulatory disclosures

The following disclosures relate to relationships between The Goldman Sachs Group, Inc. (with its affiliates, "Goldman Sachs") and companies covered by Goldman Sachs Global Investment Research and referred to in this research.

Goldman Sachs beneficially owned 1% or more of common equity (excluding positions managed by affiliates and business units not required to be aggregated under US securities law) as of the second most recent month end: SK Hynix Inc. (W839,000)

Goldman Sachs beneficially owned 5% or more of common equity (excluding positions managed by affiliates and business units not required to be aggregated under US securities law) as of the second most recent month end: Kioxia Holdings (¥19,095)

Goldman Sachs has received compensation for investment banking services in the past 12 months: Kioxia Holdings (¥19,095) and Micron Technology Inc. ($394.69)

Goldman Sachs expects to receive or intends to seek compensation for investment banking services in the next 3 months: Kioxia Holdings (¥19,095), Micron Technology Inc. ($394.69), Samsung Electronics (W158,600), Samsung Electronics (Pref) (W112,400), SanDisk Corp. ($597.95) and SK Hynix Inc. (W839,000)

Goldman Sachs had an investment banking services client relationship during the past 12 months with: Kioxia Holdings (¥19,095), Micron Technology

Inc. ($394.69), Samsung Electronics (W158,600), Samsung Electronics (Pref) (W112,400), SanDisk Corp. ($597.95) and SK Hynix Inc. (W839,000)

Goldman Sachs had a non-investment banking securities-related services client relationship during the past 12 months with: Micron Technology Inc. ($394.69), Samsung Electronics (W158,600), Samsung Electronics (Pref) (W112,400) and SanDisk Corp. ($597.95)

Goldman Sachs had a non-securities services client relationship during the past 12 months with: Micron Technology Inc. ($394.69), Samsung Electronics (W158,600), Samsung Electronics (Pref) (W112,400), SanDisk Corp. ($597.95) and SK Hynix Inc. (W839,000)

Goldman Sachs has managed or co-managed a public or Rule 144A offering in the past 12 months: Kioxia Holdings (¥19,095)

Goldman Sachs makes a market in the securities or derivatives thereof: Micron Technology Inc. ($394.69) and SanDisk Corp. ($597.95)

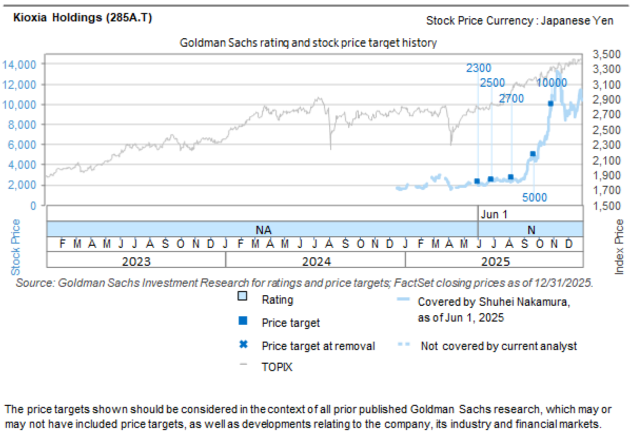
Distribution of ratings/investment banking relationships

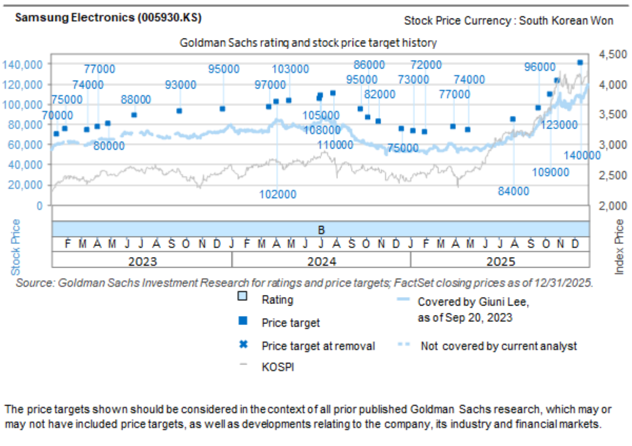
Goldman Sachs Investment Research global Equity coverage universe

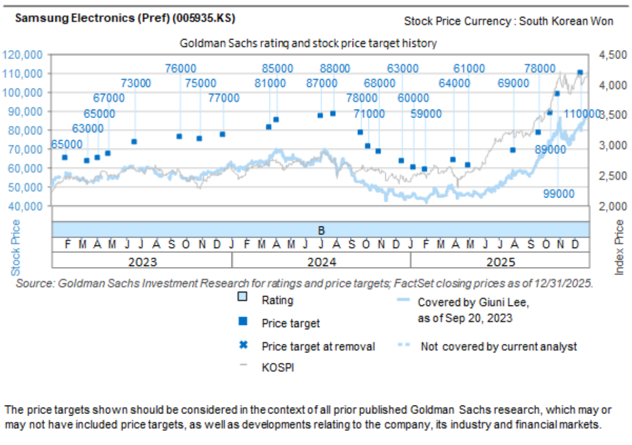
	Rating Distribution			Investment Banking Relationships		
	Buy	Hold	Sell	Buy	Hold	Sell
Global	50%	34%	16%	65%	61%	46%

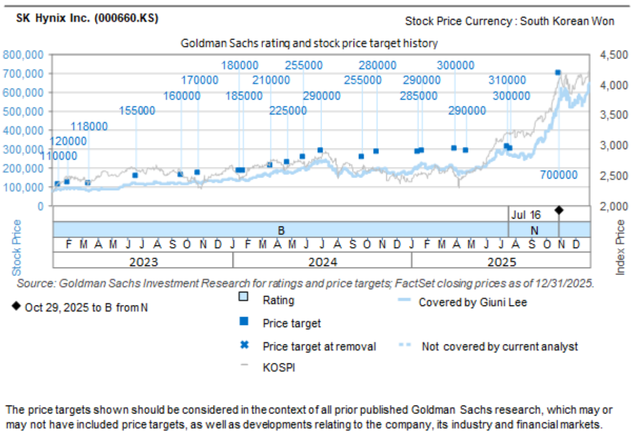
As of January 1, 2026, Goldman Sachs Global Investment Research had investment ratings on 3,055 equity securities. Goldman Sachs assigns stocks as Buys and Sells on various regional Investment Lists; stocks not so assigned are deemed Neutral. Such assignments equate to Buy, Hold and Sell for the purposes of the above disclosure required by the FINRA Rules. See ‘Ratings, Coverage universe and related definitions’ below. The Investment Banking Relationships chart reflects the percentage of subject companies within each rating category for whom Goldman Sachs has provided investment banking services within the previous twelve months.

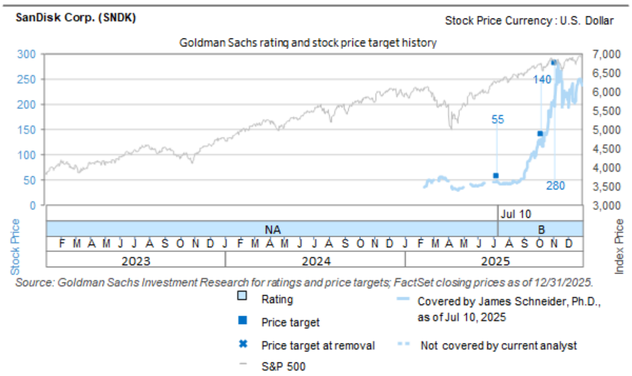
Price target and rating history chart(s)



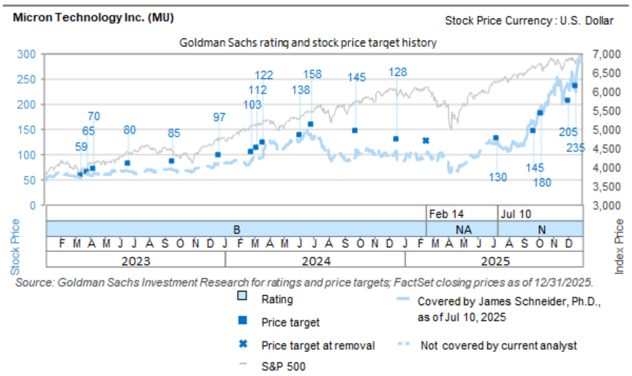








The price targets shown should be considered in the context of all prior published Goldman Sachs research, which may or may not have included price targets, as well as developments relating to the company, its industry and financial markets.



The price targets shown should be considered in the context of all prior published Goldman Sachs research, which may or may not have included price targets, as well as developments relating to the company, its industry and financial markets.

Target price history table(s)

Samsung Electronics (Pref) (005935.KS)

Date of report	Target price (W)
29-Jan-26	159,000
08-Jan-26	142,000
16-Dec-25	110,000
30-Oct-25	99,000
14-Oct-25	89,000
22-Sep-25	78,000
31-Jul-25	69,000
01-May-25	61,000
01-Apr-25	64,000
02-Feb-25	59,000
08-Jan-25	60,000
16-Dec-24	63,000
31-Oct-24	68,000
08-Oct-24	71,000
23-Sep-24	78,000
31-Jul-24	88,000
05-Jul-24	87,000
05-Apr-24	85,000
21-Mar-24	81,000

Samsung Electronics (005930.KS)

Date of report	Target price (W)
29-Jan-26	205,000
08-Jan-26	180,000
16-Dec-25	140,000
30-Oct-25	123,000
14-Oct-25	109,000
22-Sep-25	96,000
31-Jul-25	84,000
01-May-25	74,000
01-Apr-25	77,000
02-Feb-25	72,000
08-Jan-25	73,000
16-Dec-24	75,000
31-Oct-24	82,000
08-Oct-24	86,000
23-Sep-24	95,000
31-Jul-24	110,000
05-Jul-24	108,000
01-Jul-24	105,000
30-Apr-24	103,000
05-Apr-24	102,000
21-Mar-24	97,000

SK Hynix Inc. (000660.KS)

Date of report	Target price (W)
28-Jan-26	1,200,000
29-Oct-25	700,000
24-Jul-25	300,000
16-Jul-25	310,000
24-Apr-25	290,000
01-Apr-25	300,000
23-Jan-25	290,000
15-Jan-25	285,000
24-Oct-24	280,000
23-Sep-24	255,000
01-Jul-24	290,000
27-May-24	255,000
25-Apr-24	225,000
21-Mar-24	210,000

Regulatory disclosures

Disclosures required by United States laws and regulations

See company-specific regulatory disclosures above for any of the following disclosures required as to companies referred to in this report: manager or co-manager in a pending transaction; 1% or other ownership; compensation for certain services; types of client relationships; managed/co-managed public offerings in prior periods; directorships; for equity securities, market making and/or specialist role. Goldman Sachs trades or may trade as a principal in debt securities (or in related derivatives) of issuers discussed in this report.

The following are additional required disclosures: **Ownership and material conflicts of interest:** Goldman Sachs policy prohibits its analysts, professionals reporting to analysts and members of their households from owning securities of any company in the analyst's area of coverage. **Analyst compensation:** Analysts are paid in part based on the profitability of Goldman Sachs, which includes investment banking revenues. **Analyst as officer or director:** Goldman Sachs policy generally prohibits its analysts, persons reporting to analysts or members of their households from serving as an officer, director or advisor of any company in the analyst's area of coverage. **Non-U.S. Analysts:** Non-U.S. analysts may not be associated persons of Goldman Sachs & Co. LLC and therefore may not be subject to FINRA Rule 2241 or FINRA Rule 2242 restrictions on communications with a subject company, public appearances and trading in securities covered by the analysts.

Distribution of ratings: See the distribution of ratings disclosure above. **Price chart:** See the price chart, with changes of ratings and price targets in prior periods, above, or, if electronic format or if with respect to multiple companies which are the subject of this report, on the Goldman Sachs website at https://www.gs.com/research/hedge.html.

Additional disclosures required under the laws and regulations of jurisdictions other than the United States

The following disclosures are those required by the jurisdiction indicated, except to the extent already made above pursuant to United States laws and regulations. **Australia:** Goldman Sachs Australia Pty Ltd and its affiliates are not authorised deposit-taking institutions (as that term is defined in the Banking Act 1959 (Cth)) in Australia and do not provide banking services, nor carry on a banking business, in Australia. This research, and any access to it, is intended only for "wholesale clients" within the meaning of the Australian Corporations Act, unless otherwise agreed by Goldman Sachs. In producing research reports, members of Global Investment Research of Goldman Sachs Australia may attend site visits and other meetings hosted by the companies and other entities which are the subject of its research reports. In some instances the costs of such site visits or meetings may be met in part or in whole by the issuers concerned if Goldman Sachs Australia considers it is appropriate and reasonable in the specific circumstances relating to the site visit or meeting. To the extent that the contents of this document contains any financial product advice, it is general advice only and has been prepared by Goldman Sachs without taking into account a client's objectives, financial situation or needs. A client should, before acting on any such advice, consider the appropriateness of the advice having regard to the client's own objectives, financial situation and needs. A copy of certain Goldman Sachs Australia and New Zealand disclosure of interests and a copy of Goldman Sachs' Australian Sell-Side Research Independence Policy Statement are available at: https://www.goldmansachs.com/disclosures/australia-new-zealand/index.html. **Brazil:** Disclosure information in relation to CVM Resolution n. 20 is available at https://www.gs.com/worldwide/brazil/area/gir/index.html. Where applicable, the Brazil-registered analyst primarily responsible for the content of this research report, as defined in Article 20 of CVM Resolution n. 20, is the first author named at the beginning of this report, unless indicated otherwise at the end of the text. **Canada:** This information is being provided to you for information purposes only and is not, and under no circumstances should be construed as, an advertisement, offering or solicitation by Goldman Sachs & Co. LLC for purchasers of securities in Canada to trade in any Canadian security. Goldman Sachs & Co. LLC is not registered as a dealer in any jurisdiction in Canada under applicable Canadian securities laws and generally is not permitted to trade in Canadian securities and may be prohibited from selling certain securities and products in certain jurisdictions in Canada. If you wish to trade in any Canadian securities or other products in Canada please contact Goldman Sachs Canada Inc., an affiliate of The Goldman Sachs Group Inc., or another registered Canadian dealer. **Hong Kong:** Further information on the securities of covered companies referred to in this research may be obtained on request from Goldman Sachs (Asia) L.L.C. **India:** Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (India) Securities Private Limited, Research Analyst - SEBI Registration Number INH000001493, 10th Floor, Ascent-Worli, Sudam Kalu Ahire Marg, Worli, Mumbai-400 025, India, Corporate Identity Number U74140MH2006FTC160634, Phone +91 22 6616 9000, Fax +91 22 6616 9001. Goldman Sachs may beneficially own 1% or more of the securities (as such term is defined in clause 2 (h) the Indian Securities Contracts (Regulation) Act, 1956) of the subject company or companies referred to in this research report. Investment in securities market are subject to market risks. Read all the related documents carefully before investing. Registration granted by SEBI and certification from NISM in no way guarantee performance of the intermediary or provide any assurance of returns to investors. Goldman Sachs (India) Securities Private Limited compliance officer and investor grievance contact details can be found at: https://www.goldmansachs.com/worldwide/india/documents/Grievance-Redressal-and-Escalation-Matrix.pdf, and a copy of the annual audit compliance report can be found at this link: https://publishing.gs.com/content/site/india-annual-compliance-report.html. **Japan:** See below. **Korea:** This research, and any access to it, is intended only for "professional investors" within the meaning of the Financial Services and Capital Markets Act, unless otherwise agreed by Goldman Sachs. Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (Asia) L.L.C., Seoul Branch. **New Zealand:** Goldman Sachs New Zealand Limited and its affiliates are neither "registered banks" nor "deposit takers" (as defined in the Reserve Bank of New Zealand Act 1989) in New Zealand. This research, and any access to it, is intended for "wholesale clients" (as defined in the Financial Advisers Act 2008) unless otherwise agreed by Goldman Sachs. A copy of certain Goldman Sachs Australia and New Zealand disclosure of interests is available at: https://www.goldmansachs.com/disclosures/australia-new-zealand/index.html. **Russia:** Research reports distributed in the Russian Federation are not advertising as defined in the Russian legislation, but are information and analysis not having product promotion as their main purpose and do not provide appraisal within the meaning of the Russian legislation on appraisal activity. Research reports do not constitute a personalized investment recommendation as defined in Russian laws and regulations, are not addressed to a specific client, and are prepared without analyzing the financial circumstances, investment profiles or risk profiles of clients. Goldman Sachs assumes no responsibility for any investment decisions that may be taken by a client or any other person based on this research report. **Singapore:** Goldman Sachs (Singapore) Pte. (Company Number: 198602165W), which is regulated by the Monetary Authority of Singapore, accepts legal responsibility for this research, and should be contacted with respect to any matters arising from, or in connection with, this research. **Taiwan:** This material is for reference only and must not be reprinted without permission. Investors should carefully consider their own investment risk. Investment results are the responsibility of the individual investor. **United Kingdom:** Persons who would be categorized as retail clients in the United Kingdom, as such term is defined in the rules of the Financial Conduct Authority, should read this research in conjunction with prior Goldman Sachs research on the covered companies referred to herein and should refer to the risk warnings that have been sent to them by Goldman Sachs International. A copy of these risks warnings, and a glossary of certain financial terms used in this report, are available from Goldman Sachs International on request.

European Union and United Kingdom: Disclosure information in relation to Article 6 (2) of the European Commission Delegated Regulation (EU) (2016/958) supplementing Regulation (EU) No 596/2014 of the European Parliament and of the Council (including as that Delegated Regulation is implemented into United Kingdom domestic law and regulation following the United Kingdom's departure from the European Union and the European Economic Area) with regard to regulatory technical standards for the technical arrangements for objective presentation of investment recommendations or other information recommending or suggesting an investment strategy and for disclosure of particular interests or indications of conflicts of interest is available at https://www.gs.com/disclosures/europeanpolicy.html which states the European Policy for Managing Conflicts of Interest in Connection with Investment Research.

Japan: Goldman Sachs Japan Co., Ltd. is a Financial Instrument Dealer registered with the Kanto Financial Bureau under registration number Kinsho 69, and a member of Japan Securities Dealers Association, Financial Futures Association of Japan Type II Financial Instruments Firms Association, The Investment Trusts Association, Japan, and Japan Investment Advisers Association. Sales and purchase of equities are subject to commission pre-determined with clients plus consumption tax. See company-specific disclosures as to any applicable disclosures required by Japanese stock exchanges, the Japanese Securities Dealers Association or the Japanese Securities Finance Company.

Ratings, coverage universe and related definitions

Buy (B), Neutral (N), Sell (S) Analysts recommend stocks as Buys or Sells for inclusion on various regional Investment Lists. Being assigned a Buy or Sell on an Investment List is determined by a stock's total return potential relative to its coverage universe. Any stock not assigned as a Buy or a Sell on an Investment List with an active rating (i.e., a stock that is not Rating Suspended, Not Rated, Early-Stage Biotech, Coverage Suspended or Not Covered), is deemed Neutral. Each region manages Regional Conviction Lists, which are selected from Buy rated stocks on the respective region's Investment Lists and represent investment recommendations focused on the size of the total return potential and/or the likelihood of the realization of the return across their respective areas of coverage. The addition or removal of stocks from such Conviction Lists are managed by the Investment Review Committee or other designated committee in each respective region and do not represent a change in the analysts' investment rating for such stocks.

Total return potential represents the upside or downside differential between the current share price and the price target, including all paid or anticipated dividends, expected during the time horizon associated with the price target. Price targets are required for all covered stocks. The total return potential, price target and associated time horizon are stated in each report adding or reiterating an Investment List membership.

Coverage Universe: A list of all stocks in each coverage universe is available by primary analyst, stock and coverage universe at https://www.gs.com/research/hedge.html.

Not Rated (NR). The investment rating, target price and earnings estimates (where relevant) are removed pursuant to Goldman Sachs policy when Goldman Sachs is acting in an advisory capacity in a merger or in a strategic transaction involving this company, when there are legal, regulatory or policy constraints due to Goldman Sachs' involvement in a transaction, and in certain other circumstances. **Early-Stage Biotech (ES).** An investment rating and a target price are not assigned pursuant to Goldman Sachs policy when this company neither has a drug, treatment or medical device that has passed a Phase II clinical trial nor a license to distribute a post-Phase II drug, treatment or medical device. **Rating Suspended (RS).** Goldman Sachs Research has suspended the investment rating and price target for this stock, because there is not a sufficient fundamental basis for determining an investment rating or target price. The previous investment rating and target price, if any, are no longer in effect for this stock and should not be relied upon. **Coverage Suspended (CS).** Goldman Sachs has suspended coverage of this company. **Not Covered (NC).** Goldman Sachs does not cover this company.

Global product; distributing entities

Goldman Sachs Global Investment Research produces and distributes research products for clients of Goldman Sachs on a global basis. Analysts based in Goldman Sachs offices around the world produce research on industries and companies, and research on macroeconomics, currencies, commodities and portfolio strategy. This research is disseminated in Australia by Goldman Sachs Australia Pty Ltd (ABN 21 006 797 897); in Brazil by Goldman Sachs do Brasil Corretora de Títulos e Valores Mobiliários S.A.; Public Communication Channel Goldman Sachs Brazil: 0800 727 5764 and / or contatogoldmanbrasil@gs.com. Available Weekdays (except holidays), from 9am to 6pm. Canal de Comunicação com o Público Goldman Sachs Brasil: 0800 727 5764 e/ou contatogoldmanbrasil@gs.com. Horário de funcionamento: segunda-feira à sexta-feira (exceto feriados), das 9h às 18h; in Canada by Goldman Sachs & Co. LLC; in Hong Kong by Goldman Sachs (Asia) L.L.C.; in India by Goldman Sachs (India) Securities Private Ltd.; in Japan by Goldman Sachs Japan Co., Ltd.; in the Republic of Korea by Goldman Sachs (Asia) L.L.C., Seoul Branch; in New Zealand by Goldman Sachs New Zealand Limited; in Russia by OOO Goldman Sachs; in Singapore by Goldman Sachs (Singapore) Pte. (Company Number: 198602165W); and in the United States of America by Goldman Sachs & Co. LLC. Goldman Sachs International has approved this research in connection with its distribution in the United Kingdom.

Goldman Sachs International ("GSI"), authorised by the Prudential Regulation Authority ("PRA") and regulated by the Financial Conduct Authority ("FCA") and the PRA, has approved this research in connection with its distribution in the United Kingdom.

European Economic Area: Goldman Sachs Bank Europe SE ("GSBE") is a credit institution incorporated in Germany and, within the Single Supervisory Mechanism, subject to direct prudential supervision by the European Central Bank and in other respects supervised by German Federal Financial Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht, BaFin) and Deutsche Bundesbank and disseminates research within the European Economic Area.

General disclosures

This research is for our clients only. Other than disclosures relating to Goldman Sachs, this research is based on current public information that we consider reliable, but we do not represent it is accurate or complete, and it should not be relied on as such. The information, opinions, estimates and forecasts contained herein are as of the date hereof and are subject to change without prior notification. We seek to update our research as appropriate, but various regulations may prevent us from doing so. Other than certain industry reports published on a periodic basis, the large majority of reports are published at irregular intervals as appropriate in the analyst's judgment.

Goldman Sachs conducts a global full-service, integrated investment banking, investment management, and brokerage business. We have investment banking and other business relationships with a substantial percentage of the companies covered by Global Investment Research. Goldman Sachs & Co. LLC, the United States broker dealer, is a member of SIPC (https://www.sipc.org).

Our salespeople, traders, and other professionals may provide oral or written market commentary or trading strategies to our clients and principal trading desks that reflect opinions that are contrary to the opinions expressed in this research. Our asset management area, principal trading desks and investing businesses may make investment decisions that are inconsistent with the recommendations or views expressed in this research.

The analysts named in this report may have from time to time discussed with our clients, including Goldman Sachs salespersons and traders, or may discuss in this report, trading strategies that reference catalysts or events that may have a near-term impact on the market price of the equity securities discussed in this report, which impact may be directionally counter to the analyst's published price target expectations for such stocks. Any such trading strategies are distinct from and do not affect the analyst's fundamental equity rating for such stocks, which rating reflects a stock's return potential relative to its coverage universe as described herein.

We and our affiliates, officers, directors, and employees will from time to time have long or short positions in, act as principal in, and buy or sell, the securities or derivatives, if any, referred to in this research, unless otherwise prohibited by regulation or Goldman Sachs policy.

The views attributed to third party presenters at Goldman Sachs arranged conferences, including individuals from other parts of Goldman Sachs, do not necessarily reflect those of Global Investment Research and are not an official view of Goldman Sachs.

Any third party referenced herein, including any salespeople, traders and other professionals or members of their household, may have positions in the products mentioned that are inconsistent with the views expressed by analysts named in this report.

This research is not an offer to sell or the solicitation of an offer to buy any security in any jurisdiction where such an offer or solicitation would be illegal. It does not constitute a personal recommendation or take into account the particular investment objectives, financial situations, or needs of individual clients. Clients should consider whether any advice or recommendation in this research is suitable for their particular circumstances and, if appropriate, seek professional advice, including tax advice. The price and value of investments referred to in this research and the income from them may fluctuate. Past performance is not a guide to future performance, future returns are not guaranteed, and a loss of original capital may occur. Fluctuations in exchange rates could have adverse effects on the value or price of, or income derived from, certain investments.

Certain transactions, including those involving futures, options, and other derivatives, give rise to substantial risk and are not suitable for all investors. Investors should review current options and futures disclosure documents which are available from Goldman Sachs sales representatives or at https://www.theocc.com/about/publications/character-risks.jsp and https://www.goldmansachs.com/disclosures/cftc_fcm_disclosures. Transaction costs may be significant in option strategies calling for multiple purchase and sales of options such as spreads. Supporting documentation will be supplied upon request.

Differing Levels of Service provided by Global Investment Research: The level and types of services provided to you by Goldman Sachs Global Investment Research may vary as compared to that provided to internal and other external clients of GS, depending on various factors including your individual preferences as to the frequency and manner of receiving communication, your risk profile and investment focus and perspective (e.g., marketwide, sector specific, long term, short term), the size and scope of your overall client relationship with GS, and legal and regulatory constraints. As an example, certain clients may request to receive notifications when research on specific securities is published, and certain clients may request that specific data underlying analysts' fundamental analysis available on our internal client websites be delivered to them electronically through data feeds or otherwise. No change to an analyst's fundamental research views (e.g., ratings, price targets, or material changes to earnings estimates for equity securities), will be communicated to any client prior to inclusion of such information in a research report broadly disseminated through electronic publication to our internal client websites or through other means, as necessary, to all clients who are entitled to receive such reports.

All research reports are disseminated and available to all clients simultaneously through electronic publication to our internal client websites. Not all research content is redistributed to our clients or available to third-party aggregators, nor is Goldman Sachs responsible for the redistribution of our research by third party aggregators. For research, models or other data related to one or more securities, markets or asset classes (including related services) that may be available to you, please contact your GS representative or go to https://research.gs.com.

Disclosure information is also available at https://www.gs.com/research/hedge.html or from Research Compliance, 200 West Street, New York, NY 10282.