Global Smartphones: Shipments at -10%/ +3%/ +1% YoY in 2026-28E: High memory costs weigh on demand; product mix upgrade continues

We cut our smartphone TAM for 2026E / 27E to reflect our global technology analysts' latest estimate changes, with high memory prices continuing to weigh on end-demand, while product mix upgrade continues as end users are less sensitive to price increases. **We reduce our global smartphone volume estimates by 4% / 3% to 1.1bn / 1.2bn in 2026E / 27E, or -10% / +3% YoY (vs. -6% / +2% previously).** We also introduce 2028E estimates. We remain positive on the rising penetration of foldable phones ahead, driven by global leading brands newly entering the market in 2H26, along with new form factors and features bringing new use cases and enhancing the user experience. We model global foldable phone penetration to reach 3.6% / 5.9%/ 6.8% in 2026 / 27E/ 28E in our last update), or 41m / 69m/ 80m units in 2026 / 27/ 28E (-10% / -7% compared to our last update for 2026E / 27E).

We expect smartphone market value to grow +3% / +2%/ +2% YoY to US$596bn/ 606bn/ 621bn in 2026-28E driven by higher memory cost and mix upgrade towards premium phones carrying higher prices at US$600+. We expect market premiumization to continue.

Related reports:

Global Tech: PCs, smartphones, servers: Quantifying market opportunities (Launching Global TAMs on Oct 3, 2023)

China Smartphones: AI phones with more specific answers, smarter AI assistants, and interaction with apps for maps, delivery, social media (Updates on Nov 19, 2023)

Global Smartphones: Foldable: Introducing foldable phone forecasts; hinges and e-paper initiations (Updates on Feb 1, 2024)

Taiwan Technology: Foldable, AI server and satellite early-stage product cycles – initiate SZS, Chenbro, WNC at Buy (August 22, 2024)

Global Tech: Smartphone TAM update: Introducing detailed breakdown by price band (Dec 7, 2024)

Global Tech: Smartphone TAM update: Foldable phones / Premium models better placed; overall market remains in modest growth (Jul 2, 2025)

Global Smartphones: Value TAM raised by 1% / 2% in 2026 / 27E on higher ASP; Foldable iPhones newly included (Oct 13, 2025)

Allen Chang
+852-2978-2930 | allen.k.chang@gs.com
Goldman Sachs (Asia) L.L.C.

Verena Jeng
+852-2978-1681 | verena.jeng@gs.com
Goldman Sachs (Asia) L.L.C.

Michael Ng, CFA
+1(212)902-8618 | michael.ng@gs.com
Goldman Sachs & Co. LLC

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

Timothy Zhao
+852-2978-2673 | timothy.zhao@gs.com
Goldman Sachs (Asia) L.L.C.

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

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

Minami Munakata
+81(3)4587-9830 | minami.munakata@gs.com
Goldman Sachs Japan Co., Ltd.

Chao Wang
+886(2)2730-4195 | kuan-chao.wang@gs.com
Goldman Sachs (Asia) L.L.C., Taipei Branch

Evelyn Yu
+886(2)2730-4187 | evelyn.yu@gs.com
Goldman Sachs (Asia) L.L.C., Taipei Branch

Ting Song
+852-2978-6466 | ting.song@gs.com
Goldman Sachs (Asia) L.L.C.

Katherine Murphy
+1(212)902-1151 | katherine.a.murphy@gs.com
Goldman Sachs & Co. LLC

Zorayda Montemayor
+1(212)357-6403 | zorayda.montemayor@gs.com
Goldman Sachs & Co. LLC

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

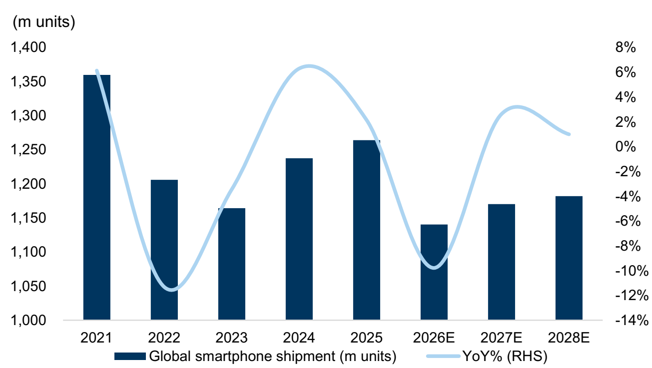
Global Smartphones: Cutting TAM growth to -6% / +2% on memory tightness (Jan 25, 2026)

Global smartphone market outlook

2026E / 27E/ 28E shipment forecast at -10% / +3%/ +1% YoY

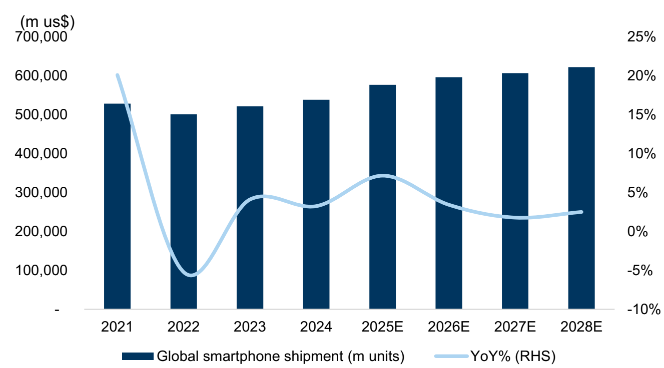
We update our Global Smartphone forecasts as we factor in the latest estimates for Transsion, Apple, Samsung, Xiaomi, Lenovo, HTC and Asus. We remain cautious on smartphone market demand, expecting **volume to fall 10% YoY to 1.14bn units** in 2026E, considering the saturated market and rising memory costs that will depress consumer purchases. We expect the **global smartphone value TAM to sustain growth at 3% YoY to US$596bn** in 2026E, supported by the higher memory cost and mix upgrades towards premium smartphones carrying higher ASP at over US$600. We continue to expect foldable phones to see stronger traction given form factor changes bringing larger screens and differentiation, new use cases, and more affordable prices.

Exhibit 1: We expect global smartphone volumes at -10% / +3%/ +1% YoY to 1.14bn / 1.17bn/ 1.18bn units in 2026E / 27E/ 28E



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

Exhibit 2: We expect global smartphone value to increase +3% / +2%/ +2% YoY to US$596bn / US$606bn/ US$621bn in 2026E / 27E/ 28E



Source: Company data, Goldman Sachs Global Investment Research

Compared to our last update, we reduce our global smartphone shipment estimates by -4% / -3% to 1.14bn / 1.17bn in 2026-27E, and introduce our 2028 estimates at 1.18bn. We adjust our value estimates by 2% / -1% to US$596bn/ 606bn on the back of product mix upgrades and higher memory cost, and introduce our 2028E estimate at $621 bn.

Exhibit 3: Global smartphone estimate changes

Global smartphone shipment	2026E	2027E	2028E
New			
Global smartphone shipment (m units)	1,140	1,170	1,182
YoY	-10%	3%	1%
Old			
Global smartphone shipment (m units)	1,187	1,212	
YoY	-6%	2%	
New vs. Old			
Shipment change (m units)	(47)	(41)	
Shipment change %	-4.0%	-3.4%	

Global smartphone revenues	2026E	2027E	2028E
New			
Global smartphone revenues (m US$)	595,740	606,273	621,389
YoY	3%	2%	2%
Old			
Global smartphone revenues (m US$)	581,307	614,526	
YoY	3%	4%	
New vs. Old			
Revenue change (m UT$)	14,433	(8,253)	
Revenue change %	2%	-1%	

Global foldable shipment	2026E	2027E	2028E
New			
Penetration	3.6%	5.9%	6.8%
Old			
Penetration	3.4%	4.1%	
New vs. Old			
Shipment change (m units)	(4)	(5)	
Shipment change %	-10%	-7%	
Penetration	0.1ppts	1.8ppts	

Source: IDC, Goldman Sachs Global Investment Research

Foldable phones

We are positive on the increasing penetration of foldable phones, supported by new model launches, improving supply chains to support more affordable prices, and innovative designs (e.g. tri-fold phones, thinner battery, lighter casings). We revise our foldable phone volume estimates by -10%/ -7% in 2026/ 27E, bringing our global foldable phones shipments to 41m/ 69m units in 2026-27E, or penetration rates at 3.6%/ 5.9% in 2026E-27E (vs. 3.4%/ 4.1% previously), and introduce 2028E foldable phone estimates at 80m units.

Global smartphone market by price band

We categorize the global smartphone market into three segments based on pricing: **Premium phones** (Selling price > US$600), **Mid-end** (US$200-600) and **Entry level** (<US$200).

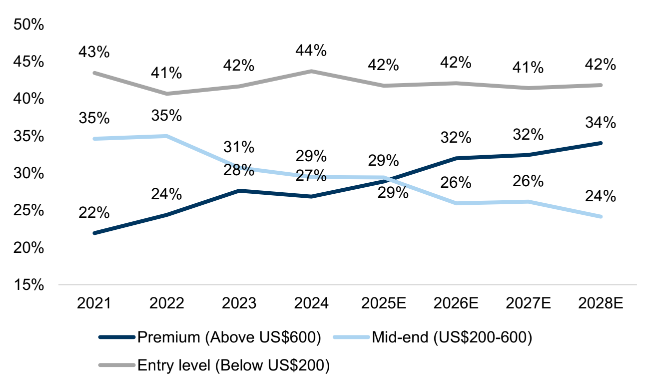
Premium (>US$600) smartphone market volume looks set to outgrow the market average. The purchasing power of premium consumers remains strong despite the dynamic macro environment and increasing memory prices, and continuous technology upgrades in premium models create additional demand. **We expect premium smartphone** market **volume to grow at a 5% CAGR in 2026-28E to 402m units in 2028E**, accounting for 34% of total volume by 2028 (vs. 29% in 2025). By value, we expect the premium segment to contribute 76% of total revenues by 2028E (vs. 66% in

2025), growing at an 8% CAGR.

The mid-end (US$200-600) smartphone market is shrinking due to changes in consumer behavior. While the mid-end segment used to provide a balance between outstanding specifications and a high performance-cost ratio, demand has been declining due to a lack of revolutionary technology upgrades and more conservative consumption behavior among the middle class. **We expect mid-end smartphone market volume** to decline at a -2% CAGR to 285m units in 2026-28E, contributing 24% of the total market in 2028E (vs. 29% in 2025). By value, we expect the mid-end segment to contribute 14% of total revenues by 2028E (vs. 22% in 2025).

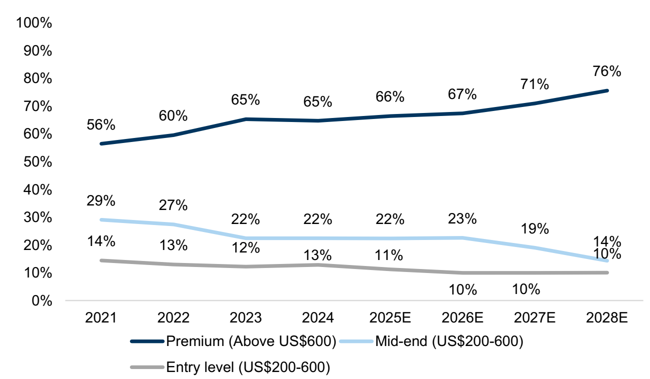
Entry level (<US$200) smartphone demand is likely to sustain, supported by the ongoing 4G to 5G migration in developing markets, as well as consumption downgrading amid macro challenges. However, increasing memory prices will affect the entry level segment most, in our view, considering that purchasers are price sensitive. **We expect entry level smartphone market volume to grow at a 1% CAGR to 494m units in 2026-28E**, accounting for 42% of the total market in 2028E (v.s. 42% in 2025). By value, we forecast the entry level segment will contribute 10% of total revenues by 2028E (vs. 11% in 2025).

Exhibit 4: Global smartphones: shipments by price band



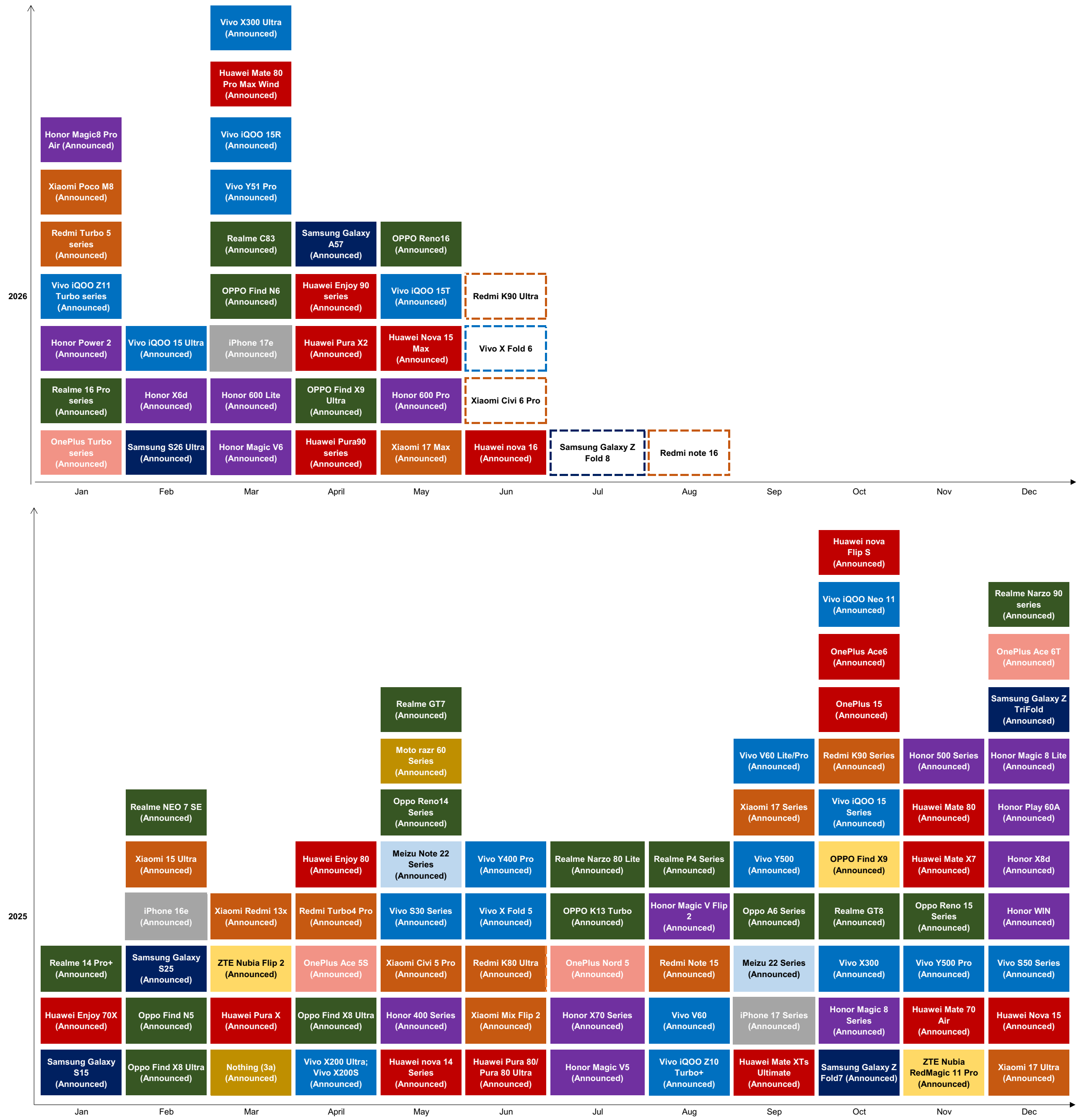
Source: Company data, Goldman Sachs Global Investment Research, IDC

Exhibit 5: Global smartphones: value by price band



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 6: Smartphone models pipeline (announced)



As of Jun 14, 2026.

Source: Company data

Smartphones: Shipments -10% / +3%/ +1% YoY in 2026-28E; Foldable phones at 41m / 69m/ 80m units in 2026-28E

Global Smartphone market opportunity

(Shipments in m units)
(Revenues in m USD)

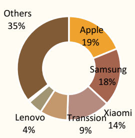
Our Bottom up method

Global smartphone shipments = sum of shipment by brand

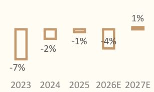
Global smartphone revenues = sum of revenues by brand

Global smartphone revenues = shipments x ASP

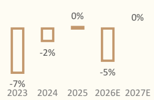
Smartphone shipments by brands (2024)



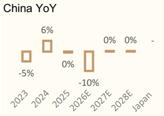
Developed markets YoY



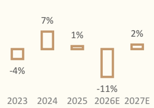
US YoY



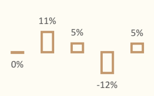
China YoY



BRICs YoY



Rest of emerging mkt YoY



Shipments by vendor	1Q25	2Q25	3Q25	4Q25	1Q26	2Q26E	3Q26E	4Q26E	2023	2024	2025	2026E	2027E	2028E
Global shipments	**303**	**297**	**326**	**338**	**294**	**269**	**284**	**293**	**1,164**	**1,237**	**1,264**	**1,140**	**1,170**	**1,182**
Apple	59	48	60	85	61	53	57	76	234	233	252	246	257	262
Samsung	61	58	61	61	62	59	59	55	226	224	242	235	233	240
Xiaomi	42	39	39	35	34	34	34	33	146	168	155	135	136	140
Transsion	21	25	29	23	21	19	22	17	95	107	98	78	97	102
Lenovo	13	14	16	16	14	11	12	13	47	56	59	50	48	48
ZTE	2	2	2	2	2	2	2	2	6	7	9	9	9	9
Sony	0	0	0	0	0	0	0	0	2	1	1	1	1	1
HTC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0
Asus	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0	0	0	0	0	0
Others	104	110	119	115	99	91	99	96	409	440	448	385	388	380
Shipments YoY	**1Q25**	**2Q25**	**3Q25**	**4Q25**	**1Q26**	**2Q26E**	**3Q26E**	**4Q26E**	**2023**	**2024**	**2025**	**2026E**	**2027E**	**2028E**
Global	**1%**	**2%**	**4%**	**3%**	**-3%**	**-9%**	**-13%**	**-13%**	**-3%**	**6%**	**2%**	**-10%**	**3%**	**1%**
Apple	12%	6%	4%	9%	3%	9%	-5%	-11%	4%	-1%	8%	-2%	5%	2%
Samsung	2%	7%	7%	18%	2%	1%	-4%	-10%	-14%	-1%	8%	-3%	-1%	3%
Xiaomi	3%	-8%	-8%	-18%	-19%	-13%	-13%	-5%	-5%	16%	-8%	-13%	0%	3%
Transsion	-26%	-2%	13%	-16%	-1%	-25%	-25%	-25%	31%	13%	-8%	-20%	24%	5%
Lenovo	2%	2%	5%	12%	6%	-21%	-23%	-21%	4%	20%	5%	-15%	-4%	0%
ZTE	46%	51%	14%	8%	-1%	-1%	-1%	-1%	3%	28%	27%	-1%	-1%	-1%
Sony	-42%	-22%	-66%	-15%	-21%	-21%	-21%	-21%	-38%	-32%	-38%	-21%	-5%	0%
HTC	69%	-6%	-50%	-44%	-62%	42%	141%	128%	27%	-45%	-13%	33%	7%	-5%
Asus	-30%	-45%	-51%	-75%	-36%	9%	116%	199%	-33%	-18%	-48%	26%	1%	0%
Others	0%	1%	4%	2%	-4%	-17%	-17%	-16%	-7%	8%	2%	-14%	1%	-2%
Shipments market share	**1Q25**	**2Q25**	**3Q25**	**4Q25**	**1Q26**	**2Q26E**	**3Q26E**	**4Q26E**	**2023**	**2024**	**2025**	**2026E**	**2027E**	**2028E**
Apple	20%	16%	18%	25%	21%	20%	20%	26%	20%	19%	20%	22%	22%	22%
Samsung	20%	20%	19%	18%	21%	22%	21%	19%	19%	18%	19%	21%	20%	20%
Xiaomi	14%	13%	12%	10%	12%	13%	12%	11%	13%	14%	12%	12%	12%	12%
Transsion	7%	8%	9%	7%	7%	7%	8%	6%	8%	9%	8%	7%	8%	9%
Lenovo	4%	5%	5%	5%	5%	4%	4%	4%	4%	5%	5%	4%	4%	4%
ZTE	1%	1%	1%	1%	1%	1%	1%	1%	0%	1%	1%	1%	1%	1%
Sony	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
HTC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Asus	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Others	34%	37%	36%	34%	34%	34%	35%	33%	35%	36%	35%	34%	33%	32%
Shipments by price band	**1Q25**	**2Q25**	**3Q25**	**4Q25**	**1Q26**	**2Q26E**	**3Q26E**	**4Q26E**	**2023**	**2024**	**2025**	**2026E**	**2027E**	**2028E**
Premium (Above US$600)	29%	24%	28%	34%	30%	26%	32%	40%	28%	27%	29%	32%	32%	34%
Mid-end (US$200-600)	30%	33%	29%	27%	31%	30%	23%	19%	31%	29%	29%	26%	26%	24%
Entry level (Below US$200)	42%	44%	43%	39%	39%	44%	45%	41%	42%	44%	42%	42%	41%	42%
Revenus by vendor	**1Q25**	**2Q25**	**3Q25**	**4Q25**	**1Q26**	**2Q26E**	**3Q26E**	**4Q26E**	**2023**	**2024**	**2025**	**2026E**	**2027E**	**2028E**
Global revenues	**135,893**	**121,581**	**143,664**	**174,953**	**152,364**	**130,682**	**145,390**	**167,304**	**520,767**	**537,641**	**576,091**	**595,740**	**606,273**	**621,389**
Apple	59,982	49,179	61,539	98,704	69,310	60,617	69,001	97,452	244,908	245,107	269,403	296,379	303,875	309,704
Samsung	28,658	24,514	29,064	23,470	31,309	26,328	28,039	22,080	102,181	97,604	105,705	107,757	104,557	109,984
Xiaomi	9,399	8,730	9,413	9,080	8,545	9,285	10,172	9,760	32,183	36,477	36,622	37,763	38,951	41,422
Transsion	2,424	2,946	3,417	2,629	2,848	2,712	2,816	2,170	11,493	12,615	11,415	10,546	13,757	15,403
Lenovo	3,187	3,469	3,725	4,193	3,916	3,108	3,088	3,318	11,608	13,661	14,574	13,430	13,307	14,433
ZTE	358	377	410	349	313	367	400	341	1,089	1,110	1,494	1,422	1,387	1,367
Sony	116	265	107	128	97	221	89	107	1,219	893	617	513	502	517
HTC	4	4	2	2	1	6	5	5	27	16	13	17	17	16
Asus	69	40	20	18	42	42	42	51	317	283	148	176	170	161
Others	31,696	32,058	35,967	36,379	35,983	27,996	31,737	32,020	115,741	129,876	136,101	127,737	129,749	128,381
Revenues by price band	**1Q25**	**2Q25**	**3Q25**	**4Q25**	**1Q26**	**2Q26E**	**3Q26E**	**4Q26E**	**2023**	**2024**	**2025**	**2026E**	**2027E**	**2028E**
Premium (Above US$600)	67%	60%	66%	71%	63%	59%	69%	78%	65%	65%	66%	67%	71%	76%
Mid-end (US$200-600)	21%	27%	22%	20%	28%	30%	21%	14%	22%	22%	22%	23%	19%	14%
Entry level (Below US$200)	12%	13%	12%	9%	10%	11%	11%	9%	12%	13%	11%	10%	10%	10%
Shipments by region	**1Q25**	**2Q25**	**3Q25**	**4Q25**	**1Q26**	**2Q26E**	**3Q26E**	**4Q26E**	**2023**	**2024**	**2025**	**2026E**	**2027E**	**2028E**
Global shipments	**303**	**297**	**326**	**338**	**294**	**269**	**284**	**293**	**1,164**	**1,237**	**1,264**	**1,140**	**1,170**	**1,182**
Developed markets	**62**	**56**	**67**	**82**	**60**	**54**	**64**	**78**	**276**	**270**	**268**	**256**	**257**	**259**
USA	30	25	33	41	28	23	31	39	131	128	128	122	122	122
Western Europe	24	23	24	29	23	22	23	28	106	102	100	96	97	98
BRICs	**124**	**125**	**135**	**135**	**115**	**107**	**119**	**121**	**479**	**512**	**518**	**462**	**470**	**472**
India	33	38	48	38	28	32	41	35	146	151	156	136	142	142
China	72	69	68	76	69	59	62	66	271	286	285	256	257	258
Rest of emerging markets	**116**	**117**	**124**	**121**	**120**	**109**	**101**	**93**	**409**	**456**	**478**	**422**	**443**	**451**
Shipments YoY	**1Q25**	**2Q25**	**3Q25**	**4Q25**	**1Q26**	**2Q26E**	**3Q26E**	**4Q26E**	**2023**	**2024**	**2025**	**2026E**	**2027E**	**2028E**
Global	**1%**	**2%**	**4%**	**3%**	**-3%**	**-9%**	**-13%**	**-13%**	**-3%**	**6%**	**2%**	**-10%**	**3%**	**1%**
Developed markets	**-4%**	**-2%**	**1%**	**1%**	**-4%**	**-4%**	**-4%**	**-5%**	**-7%**	**-2%**	**-1%**	**-4%**	**1%**	**1%**
USA	-3%	-1%	2%	2%	-5%	-5%	-5%	-5%	-7%	-2%	0%	-5%	0%	0%
Western Europe	-5%	-3%	-1%	-1%	-4%	-4%	-4%	-4%	-6%	-3%	-2%	-4%	1%	1%
BRICs	**0%**	**1%**	**3%**	**1%**	**-7%**	**-14%**	**-12%**	**-10%**	**-4%**	**7%**	**1%**	**-11%**	**2%**	**0%**
India	-5%	8%	6%	3%	-15%	-15%	-15%	-8%	1%	4%	3%	-13%	4%	0%
China	3%	-4%	0%	-1%	-4%	-14%	-10%	-13%	-5%	6%	0%	-10%	0%	0%
Rest of emerging markets	**3%**	**4%**	**6%**	**6%**	**3%**	**-7%**	**-19%**	**-23%**	**0%**	**11%**	**5%**	**-12%**	**5%**	**2%**
Shipments market share	**1Q25**	**2Q25**	**3Q25**	**4Q25**	**1Q26**	**2Q26E**	**3Q26E**	**4Q26E**	**2023**	**2024**	**2025**	**2026E**	**2027E**	**2028E**
Global	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Developed markets	**21%**	**19%**	**21%**	**24%**	**20%**	**20%**	**23%**	**27%**	**24%**	**22%**	**21%**	**22%**	**22%**	**22%**
USA	10%	8%	10%	12%	10%	9%	11%	13%	11%	10%	10%	11%	10%	10%
Western Europe	8%	8%	7%	9%	8%	8%	8%	9%	9%	8%	8%	8%	8%	8%
BRICs	**41%**	**42%**	**41%**	**40%**	**39%**	**40%**	**42%**	**41%**	**41%**	**41%**	**41%**	**41%**	**40%**	**40%**
India	11%	13%	15%	11%	9%	12%	14%	12%	12%	12%	12%	12%	12%	12%
China	24%	23%	21%	22%	23%	22%	22%	23%	23%	23%	23%	22%	22%	22%
Rest of emerging markets	**38%**	**39%**	**38%**	**36%**	**41%**	**40%**	**36%**	**32%**	**35%**	**37%**	**38%**	**37%**	**38%**	**38%**
Foldable phones	**1Q25**	**2Q25**	**3Q25**	**4Q25**	**1Q26**	**2Q26E**	**3Q26E**	**4Q26E**	**2023**	**2024**	**2025**	**2026E**	**2027E**	**2028E**
Shipment	**4.2**	**3.3**	**8.0**	**4.7**	**3.8**	**5.9**	**14.1**	**16.9**	**18.2**	**18.7**	**20.2**	**40.6**	**69.1**	**80.4**
Penetration rate	1.4%	1.1%	2.4%	1.4%	1.3%	2.2%	5.0%	5.8%	1.6%	1.5%	1.6%	3.6%	5.9%	6.8%
Xiaomi	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.3	0.8	0.5	0.6	0.8	1.1
Transsion	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.1	0.2	0.1	0.6	1.5	1.7
Lenovo	0.8	0.6	0.6	0.7	0.5	1.2	1.0	0.8	1.2	2.7	2.7	3.6	5.7	10.3
Samsung	0.5	0.4	4.8	1.4	0.8	0.6	4.0	1.8	10.0	6.4	7.0	7.2	8.3	10.0
Apple	-	-	-	-	-	-	4.6	9.5	-	-	-	14.1	34.4	37.2
Others	2.8	2.2	2.5	2.5	2.3	3.8	4.0	4.5	6.5	8.7	10.0	14.7	18.4	20.0

Source: Company data, Goldman Sachs Global Investment Research

PCs: -10% / +2%/ +3% YoY in 2026E-28E

Global PCs market opportunity

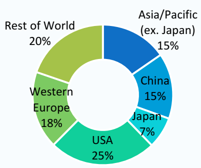
(Shipments in m units)

Our Bottom up method

Global PCs shipments = sum of shipments by brands

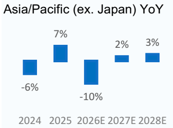
Global PCs revenues = **Desktops** ASP x shipments + **Notebooks** ASP x shipments + **Workstations** ASP x shipments

PCs shipments by region (2025)

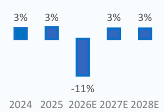


PCs shipments growth by region

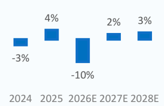
Asia/Pacific (ex. Japan) YoY



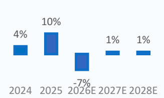
US YoY



China YoY



Western Europe YoY



Shipments by product	1Q25	2Q25	3Q25	4Q25	1Q26E	2Q26E	3Q26E	4Q26E	2023	2024	2025	2026E	2027E	2028E
Global PCs shipments (m units)	64	69	76	76	62	59	68	69	260	264	285	257	261	268
Desktops	18	18	20	21	16	15	19	19	72	70	76	69	67	67
Notebooks	45	49	53	54	44	42	47	48	181	186	200	181	187	194
Workstations	2	2	2	2	2	2	2	2	7	8	8	7	7	8
YoY	6%	7%	9%	10%	-3%	-15%	-10%	-10%	-14%	1%	8%	-10%	2%	3%
Desktops	4%	7%	14%	13%	-8%	-15%	-9%	-9%	-16%	-4%	10%	-10%	-2%	0%
Notebooks	7%	7%	7%	9%	-1%	-15%	-11%	-11%	-13%	3%	8%	-10%	3%	4%
Workstations	13%	5%	4%	-11%	-6%	-14%	-8%	-8%	-9%	11%	2%	-9%	3%	3%
Mix	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Desktops	27%	26%	27%	27%	26%	26%	27%	27%	28%	26%	27%	27%	26%	25%
Notebooks	70%	71%	71%	71%	71%	71%	70%	70%	70%	71%	70%	70%	71%	72%
Workstations	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Revenues by product	**1Q25**	**2Q25**	**3Q25**	**4Q25**	**1Q26E**	**2Q26E**	**3Q26E**	**4Q26E**	**2023**	**2024**	**2025**	**2026E**	**2027E**	**2028E**
Global PCs revenues (US$ m)	58,452	63,666	71,813	73,313	58,976	58,984	70,222	71,663	222,164	237,235	267,244	259,846	272,663	286,173
Desktops	12,335	12,827	14,491	14,338	11,836	11,829	14,422	14,270	49,894	49,329	53,992	52,358	52,749	55,852
Notebooks	42,070	46,638	52,877	54,983	43,179	43,239	51,356	53,402	157,767	172,151	196,568	191,176	202,721	212,504
Workstations	4,046	4,201	4,445	3,992	3,962	3,916	4,444	3,991	14,503	15,755	16,684	16,312	17,193	17,816
YoY	12%	14%	12%	12%	1%	-7%	-2%	-2%	-16%	7%	13%	-3%	5%	5%
Shipments by vendor	**1Q25**	**2Q25**	**3Q25**	**4Q25**	**1Q26E**	**2Q26E**	**3Q26E**	**4Q26E**	**2023**	**2024**	**2025**	**2026E**	**2027E**	**2028E**
Global PCs shipments (m units)	64	69	76	76	62	59	68	69	260	264	285	257	261	268
Lenovo	15	17	19	18	15	13	19	18	59	62	70	65	66	67
HP	13	14	14	15	13	11	11	12	54	51	55	48	47	50
Dell	10	10	9	11	9	9	8	9	37	36	39	35	36	37
Apple	6	6	7	7	6	6	7	7	22	23	26	26	27	28
ASUS	4	5	6	5	4	4	5	4	17	18	20	17	18	19
Samsung	2	2	2	2	2	2	2	2	8	8	8	7	7	7
Microsoft	0	0	0	0	0	0	0	0	2	1	1	1	1	1
LG	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Xiaomi	0	0	0	(0)	0	0	0	(0)	1	1	1	1	1	1
Others	14	14	18	18	12	13	15	16	60	63	64	56	57	58
YoY	6%	7%	9%	10%	-3%	-15%	-10%	-10%	-14%	1%	8%	-10%	2%	3%
Global market share	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Lenovo	24%	25%	26%	24%	24%	23%	28%	27%	23%	23%	24%	25%	25%	25%
HP	20%	20%	18%	20%	21%	19%	16%	18%	21%	19%	19%	19%	18%	19%
Dell	15%	14%	12%	14%	15%	15%	12%	13%	14%	14%	14%	14%	14%	14%
Apple	9%	9%	9%	9%	10%	11%	10%	10%	8%	9%	9%	10%	10%	10%
ASUS	6%	7%	8%	6%	7%	7%	7%	6%	6%	7%	7%	7%	7%	7%
Samsung	3%	3%	3%	2%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Microsoft	1%	0%	0%	0%	1%	1%	0%	1%	1%	1%	0%	1%	1%	1%
LG	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Xiaomi	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Others	22%	21%	23%	24%	20%	22%	23%	23%	23%	24%	23%	22%	22%	22%
ASP	**1Q25**	**2Q25**	**3Q25**	**4Q25**	**1Q26E**	**2Q26E**	**3Q26E**	**4Q26E**	**2023**	**2024**	**2025**	**2026E**	**2027E**	**2028E**
Global PC ASP (US$)	915	924	951	960	953	1,008	1,036	1,045	854	900	939	1,012	1,044	1,066
YoY	6%	7%	3%	2%	4%	9%	9%	9%	-2%	5%	4%	8%	3%	2%
AI PCs	**1Q25**	**2Q25**	**3Q25**	**4Q25**	**1Q26E**	**2Q26E**	**3Q26E**	**4Q26E**	**2023**	**2024**	**2025**	**2026E**	**2027E**	**2028E**
AI PC shipment (m units)	18	22	29	35	33	33	41	43		52	103	150	187	219
YoY		81%	57%	61%	88%	53%	42%	23%			99%	46%	24%	17%
Penetration	28%	32%	38%	45%	54%	57%	60%	62%		20%	36%	59%	72%	81%
AI PC revenues (US$ m)	20,341	25,573	30,226	38,071	33,506	37,576	44,611	48,030		63,383	114,211	163,724	205,718	239,818
YoY		61%	42%	45%	65%	47%	48%	26%			80%	43%	26%	17%
Penetration	35%	40%	42%	52%	57%	64%	64%	67%		27%	43%	63%	75%	84%
Gaming PCs	**1Q25**	**2Q25**	**3Q25**	**4Q25**	**1Q26E**	**2Q26E**	**3Q26E**	**4Q26E**	**2023**	**2024**	**2025**	**2026E**	**2027E**	**2028E**
Gaming PC shipment (m units)	7	7	8	8	6	6	7	7		28	31	26	28	31
YoY	8%	14%	12%	9%	-6%	-21%	-15%	-13%			11%	-14%	8%	9%
Penetration	10%	11%	11%	10%	10%	10%	11%	10%		10%	11%	10%	11%	12%
Gaming PC revenues (US$ m)	10,436	11,855	13,401	12,505	10,435	10,364	12,587	11,898		40,502	48,197	45,284	51,031	56,591
YoY	17%	24%	19%	17%	0%	-13%	-6%	-5%			19%	-6%	13%	11%
Penetration	18%	19%	19%	17%	18%	18%	18%	17%		17%	18%	17%	19%	20%
Shipments by markets	**1Q25**	**2Q25**	**3Q25**	**4Q25**	**1Q26E**	**2Q26E**	**3Q26E**	**4Q26E**	**2023**	**2024**	**2025**	**2026E**	**2027E**	**2028E**
Global PCs shipments (m units)	62	67	74	74	60	57	66	67	253	256	277	250	254	261
Consumer PCs	27	29	36	35	24	26	31	31	118	118	127	111	114	117
Commercial PCs	35	38	38	39	37	31	35	36	135	137	150	138	140	144
YoY	6%	7%	9%	10%	-3%	-15%	-10%	-10%	-14%	1%	8%	-10%	2%	3%
Consumer PCs	4%	9%	8%	7%	-12%	-12%	-12%	-12%	-15%	0%	7%	-12%	3%	3%
Commercial PCs	8%	6%	10%	13%	4%	-17%	-8%	-8%	-13%	2%	9%	-8%	1%	3%
Mix	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Consumer PCs	43%	44%	48%	47%	39%	45%	47%	46%	47%	46%	46%	45%	45%	45%
Commercial PCs	57%	56%	52%	53%	61%	55%	53%	54%	53%	54%	54%	55%	55%	55%
Shipments by region	**1Q25**	**2Q25**	**3Q25**	**4Q25**	**1Q26E**	**2Q26E**	**3Q26E**	**4Q26E**	**2023**	**2024**	**2025**	**2026E**	**2027E**	**2028E**
Asia/Pacific (ex. Japan)	9	10	13	10	9	9	12	9	42	40	43	38	39	40
China	9	10	11	12	8	8	10	11	41	40	42	38	39	40
Japan	5	5	5	6	4	4	5	5	12	14	20	19	19	19
USA	16	18	17	17	15	15	15	15	64	66	68	61	63	65
Western Europe	11	12	13	14	11	10	12	13	44	45	49	46	46	47
Rest of World	12	13	14	16	12	10	13	14	50	51	55	48	48	50
YoY														
Asia/Pacific (ex. Japan)	-6%	2%	14%	16%	-3%	-12%	-12%	-12%	-21%	-6%	7%	-10%	2%	3%
China	6%	12%	2%	-1%	-5%	-17%	-10%	-8%	-15%	-3%	4%	-10%	2%	3%
Japan	36%	55%	47%	50%	-3%	-10%	-8%	-8%	-3%	14%	47%	-7%	2%	2%
USA	15%	1%	0%	0%	-3%	-15%	-12%	-12%	-13%	3%	3%	-11%	3%	3%
Western Europe	3%	8%	11%	15%	-3%	-10%	-8%	-8%	-14%	4%	10%	-7%	1%	1%
Rest of World	0%	6%	9%	14%	-3%	-22%	-10%	-12%	-9%	1%	7%	-12%	0%	4%

Shipments by markets do not include workstations.

Source: Company data, Goldman Sachs Global Investment Research

Disclosure Appendix

Reg AC

We, Allen Chang, Verena Jeng, Michael Ng, CFA, Giuni Lee, Timothy Zhao, James Schneider, Ph.D., Daiki Takayama, Minami Munakata, Chao Wang, Evelyn Yu, Ting Song, Katherine Murphy, Zorayda Montemayor, Taeyong Lee, Eunice Liu, Ryan Huang, CFA and Al Wang, 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.

Contributing Authors: Allen Chang Goldman Sachs (Asia) L.L.C., Verena Jeng Goldman Sachs (Asia) L.L.C., Michael Ng, CFA Goldman Sachs & Co. LLC, Giuni Lee Goldman Sachs (Asia) L.L.C., Seoul Branch, Timothy Zhao Goldman Sachs (Asia) L.L.C., James Schneider, Ph.D. Goldman Sachs & Co. LLC, Daiki Takayama Goldman Sachs Japan Co., Ltd., Minami Munakata Goldman Sachs Japan Co., Ltd., Chao Wang Goldman Sachs (Asia) L.L.C., Taipei Branch, Evelyn Yu Goldman Sachs (Asia) L.L.C., Taipei Branch, Ting Song Goldman Sachs (Asia) L.L.C., Katherine Murphy Goldman Sachs & Co. LLC, Zorayda Montemayor Goldman Sachs & Co. LLC, Taeyong Lee Goldman Sachs (Asia) L.L.C., Seoul Branch, Eunice Liu Goldman Sachs (Asia) L.L.C., Ryan Huang, CFA Goldman Sachs (Asia) L.L.C., Taipei Branch, Al Wang Goldman Sachs (Asia) L.L.C., Taipei Branch.

Unless otherwise stated, the individuals listed in the Contributing Authors disclosure 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

The rating(s) for Transsion is/are relative to the other companies in its/their coverage universe: AAC, ACM Research, AMEC, ASMPT, AVC, AccoTest, Anji Micro, Asus, Auras, BOE, BYDE, Biren, CR Micro, Cambricon, Chenbro, China Mobile (HK), China Telecom, China Tower Corp., China Unicom, Chinasoft Intl, Compal, Desay SV, E Ink, E-Town Semis, EHang, Empyrean, Eoptolink, Fositek, Foxconn Industrial Internet, Gigabyte, Gigadevice, Glodon Co., HTC Corp., Hikvision, Hon Hai, Horizon Robotics, Hua Hong, Huace Navigation, Huaqin Co.(A), Huaqin Co.(H), Hwatsing, Innolight, Inspur, Insta360, Inventec, JCET, Kematek, King Slide, Kingdee, Kingsoft Office, LandMark, Largan, Lenovo, Lingyi, Luxshare, Maxscend, Meitu, MetaX, Mitac, Montage (A), Montage (H), NAURA, NSIG, Nexchip, OmniVision, Pegatron, Pony AI Inc. (ADR), Pony AI Inc. (H), Quanta, RoboTechnik, Ruijie Networks, SG Micro, SICC, SMIC (A), SMIC (H), SZS, Sangfor, SenseTime, Shengyi Tech, Shennan Circuits, StarPower, Sunny Optical, TFC Optical, Thundersoft, Tongyu Communication, Transsion, UMT, UNIS, VPEC, Vanchip, VeriSilicon, Victory Giant, WNC, WUS, WeRide, Wistron, Wiwynn, YJ Semitech, YOFC, Yonyou, ZTE (A), ZTE (H), iFlytek

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 expects to receive or intends to seek compensation for investment banking services in the next 3 months: Transsion (Rmb53.51)

Goldman Sachs had an investment banking services client relationship during the past 12 months with: Transsion (Rmb53.51)

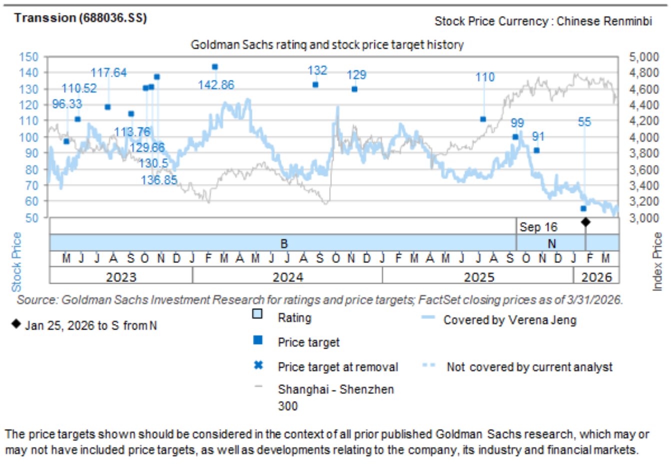
Distribution of ratings/investment banking relationships

Goldman Sachs Investment Research global Equity coverage universe

	Rating Distribution			Investment Banking Relationships		
	Buy	Hold	Sell	Buy	Hold	Sell
Global	50%	34%	16%	65%	60%	45%

As of April 1, 2026, Goldman Sachs Global Investment Research had investment ratings on 3,074 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)



Target price history table(s)

Transsion (688036.SS)

Date of report	Target price (Rmb)	Closing price (Rmb)
25-Jan-26	55.00	63.75
28-Oct-25	91.00	75.78
16-Sep-25	99.00	89.61
16-Jul-25	110.00	73.90
13-Nov-24	129.00	98.34
29-Aug-24	132.00	80.06
19-Feb-24	200.00	111.29
31-Oct-23	191.59	95.83
19-Oct-23	182.70	99.27
08-Oct-23	181.52	-
10-Sep-23	159.27	97.66
26-Jul-23	164.69	89.79

Price targets shown in table(s) are unadjusted for corporate actions.

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, and Investment Management Association of Japan. 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 has neither 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.