July 14, 2024 10:00 PM GMT

Global Technology – Dawn of the AI Smartphone Era

Edge AI – Apple Intelligence Fuels Innovation

Apple Intelligence is likely to significantly accelerate Edge AI development in the smartphone industry, integrating different apps' function, providing a one-stop solution and a better user experience – and spurring development of more killer apps, thereby accelerating AI smartphones' penetration.

Key takeaways:

- The AI Smartphone Era will kick off in 2H24 thanks to Apple Intelligence's official launch.
- Smartphone shipments and ASP will both increase, which will boost the industry TAM.
- Both smartphone OEMs and supply chain companies with spec upgrades will benefit.
- The smartphone industry market cap is likely to be boosted from US$4.9tn to US $5.8tn within 12 months.
- Our rank of preference is Apple > Apple supply chain > Android smartphone OEMs > Android supply chain.

Our key stock ideas include:

Apple (AAPL.O)	TSMC (2330.TW)	SK hynix (000660.KS)	Hon Hai (2317.TW)
Luxshare (002475.SZ)	Largan (3008.TW)	Genius (3406.TW)	LG Innotek (011070.KS)
AAC (2018.HK)	BYDE (0285.HK)	TDK (6762.T)	MediaTek (2454.TW)
LG Display (034220.KS)	Xiaomi (1810.HK)	Transsion (688036.SS)	STM (STMPA.PA)
Advantest (6857.T)	Disco (6146.T)	Novatek (3034.TW)	

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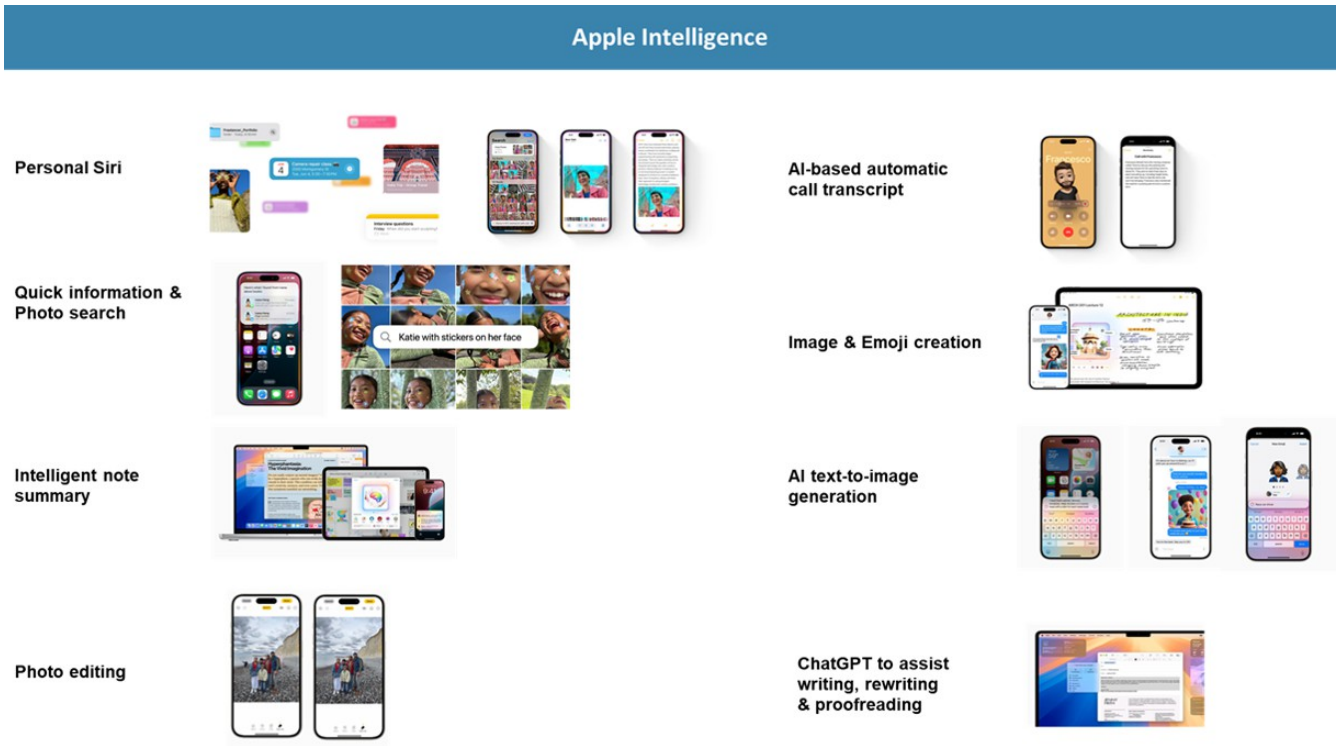
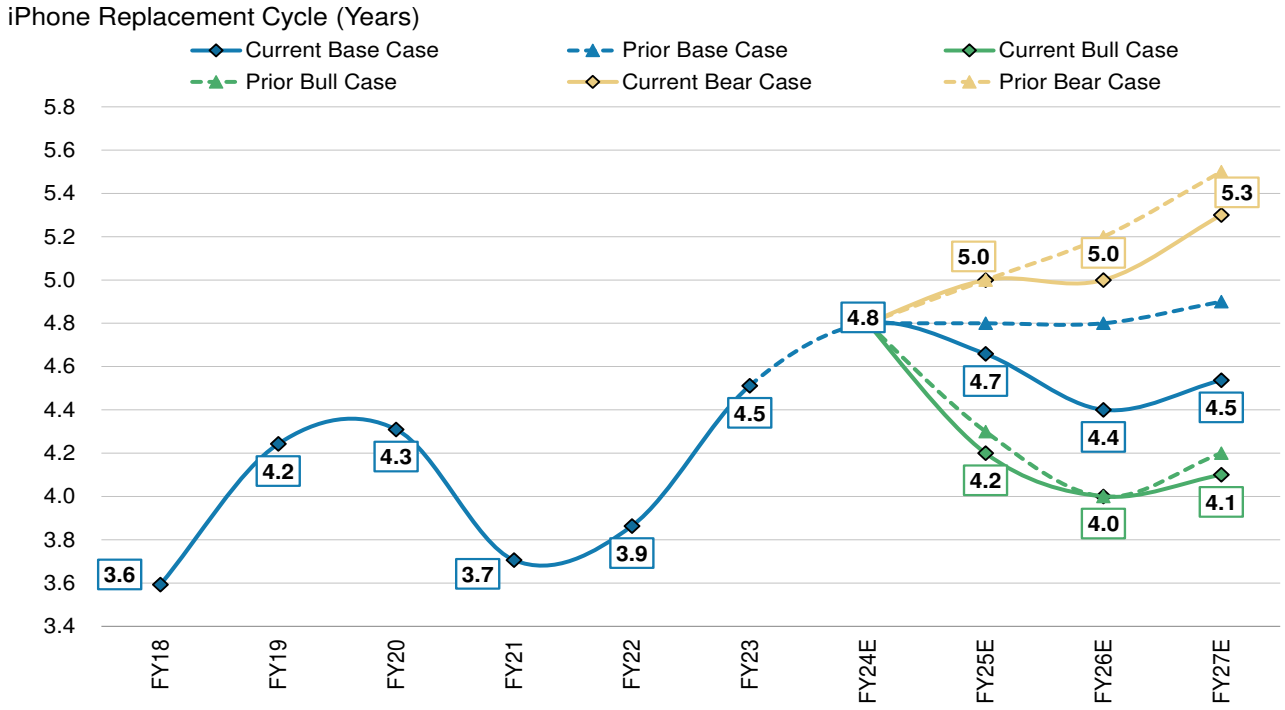
The Story in Charts

Exhibit 1: Apple Intelligence highly likely to become a killer app



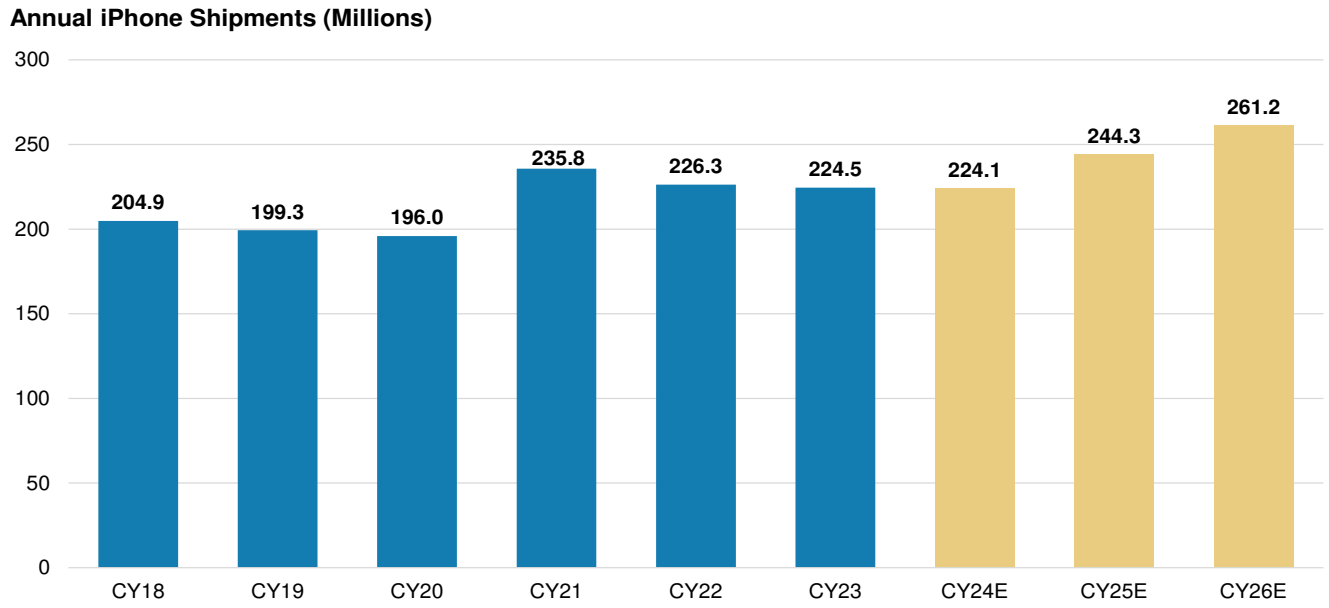
Source: Apple, Morgan Stanley Research

Exhibit 2: We now forecast iPhone replacement cycles shortening 0.1 years Y/Y in FY25, to 4.7 years (vs. 4.8 years prior) and another 0.3 years Y/Y in FY26, to 4.4 (vs. 4.8 years prior).



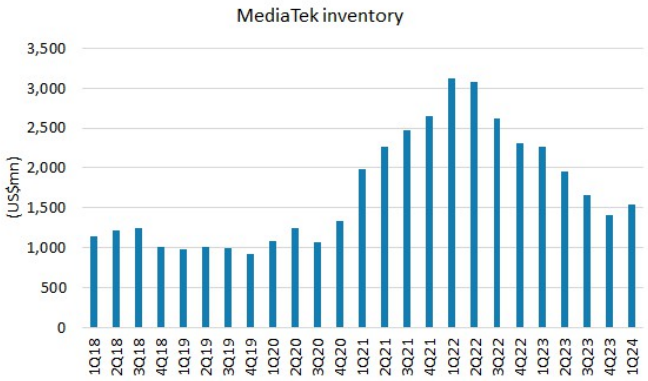
Source: Morgan Stanley Research

Exhibit 3: iPhone shipments to exceed historical highs in 2025



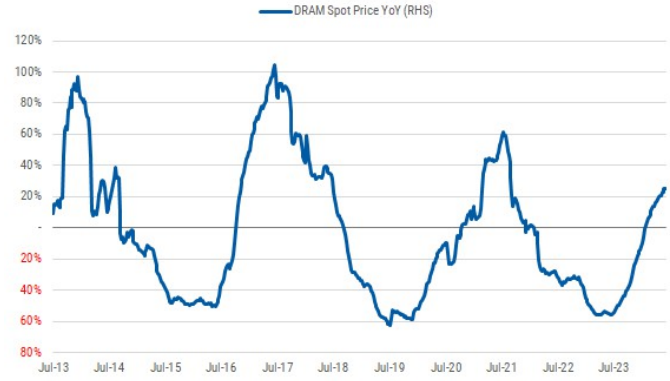
Source: IDC, Morgan Stanley Research Estimates

Exhibit 4: MediaTek's inventory is back to a healthier level



Source: Company data, Morgan Stanley Research

Exhibit 5: The memory price decline reversed since 3Q23



Source: Company data, Morgan Stanley Research

Executive Summary

We published our first Edge AI industry report on November 9, 2023: Global Technology: Edging Into a Smartphone Upcycle. This new report is part of our Edge AI research series.

We have engaged in ongoing debate about whether Edge AI could trigger the next new product cycle in the past 7-8 months. Consensus remains skeptical about AI smartphones. Investors believe there is a lack of killer apps and that as a result, end users are unlikely to buy AI smartphones that lack incremental benefits.

However, we believe the inflection point is right ahead. With Apple Intelligence's debut, we are becoming more confident.

Apple Intelligence to initiate the AI Smartphone Era

We expect Apple to officially launch Apple Intelligence during its upcoming iPhone 16 series debut in September/October 2024. We believe Apple Intelligence will become the killer app that initiates the AI Smartphone Era. We cite the following:

- LLM and other AI related technologies are mature enough to support Edge AI applications.
- Hardware development was initiated in late 2023 with a solid foundation to support smartphones' new AI features,
- We believe the launch of Apple Intelligence, with a smarter Siri, could significantly improve the user experience and offer a seamless "Edge+Cloud" AI service. Apple Intelligence will be the first integrated platform to access the data on a user's iPhone and integrate with multiple apps to not only help execute daily tasks but also proactively provide suggestions, take action, and effectively become an intelligent layer between Apple's iOS and the applications.
- What's more, Apple's most valuable consumer app distribution platform could attract software developers to innovate with new killer apps, including but not limited to more efficient code development, integrating AI into Apple's native productivity apps, AI-powered health, financial, and fitness assistants, etc. This could further 更多资料关注公众号/知识星球-讯息社accelerate AI smartphones' penetration.

Raising our global smartphone shipment forecasts

We raise our iPhone shipment growth forecasts to 224mn units in 2024 (up from 215mn) and 244mn units for 2025 (up from 225mn). We are much more positive than consensus, which sees limited growth upside.

We also expect high-end Android smartphones to benefit from the AI Smartphone Era, with an accelerated replacement cycle.

Combining both positive drivers, we forecast global smartphone shipment growth to reach 4.5% in 2024 and 5.5% in 2025.

For more details, please see the report from our Apple analyst, Erik Woodring: Apple, Inc.: Elevating To Top Pick As Apple Intelligence Catalyzes Record Upgrade Cycle.

AI smartphones are likely to trigger component spec upgrades

Thanks to AI smartphones' higher computing requirements, we expect spec upgrades at the component level, including:

- AI SoC
- Memory
- Microphones
- PCBs
- Batteries
- Thermal control
- Metal casings

See Exhibit 38 .

We expect TSMC, SK hynix, MediaTek, LG Innotek, AAC, Yageo, and TDK to become the key beneficiaries amid this component spec upgrade.

Despite this positive outlook, we believe the stock market has not priced in the impact of AI smartphones

We have identified 22 stocks globally with a combined market cap of US$4.9 trillion. By market cap, 71% are based in the US, 22% in Taiwan, 3% in Korea, 2% in Japan, 2% in China, and 1% in Europe. Most are well positioned to capture the AI smartphone growth opportunities. The AI smartphone set includes Apple, TSMC, SK hynix, LG Innotek, LG Display, Hon Hai, MediaTek, WIN Semi, KYEC, Largan, Genius, BYDE, Xiaomi, Transsion, Skyworks, Qorvo, Novatek, Yageo, Advantest, DISCO, TDK, and STMicro.

As of July 4, the AI Smartphone set has risen 107% since November 1, 2022, but that's still much weaker vs. the cloud AI set (+331%). Compared with the AI PC set (+127%), the AI Smartphone set has also underperformed, implying that the market consensus hasn't fully recognized the large growth potential of AI smartphones, although this set has still considerably outperformed the Hang Seng Index (+17%). If we use the latest share prices and our price targets as the benchmark, the aggregate market cap of the AI Smartphone set is likely to increase from US$4.9 trillion now to US$5.8 trillion within 12 months.

The AI PC set includes HP, Dell, Acer, and Asustek.

The cloud AI set refers to Nvidia, Wistron, Gold Circuit, Giga-Byte, TFC Optical, Wiwynn, Quanta, Eoptolink, Chroma, and King Slide.

How to position for the AI Smartphone Era

Our segment preference is Apple > Apple supply chain > Android smartphone OEMs > Android supply chain.

Driven by the global smartphone shipment growth we forecast, we expect these developments:

1. Apple should lead the industry rally – it's likely to become the largest company in the world by market cap.
2. Apple supply chain companies should become the key beneficiaries thanks to the stronger-than-expected shipments;.
3. Components companies with spec upgrades during the AI Smartphone Era are more likely to outperform peers.
4. The Android camp is likely to face market share loss in the high-end segment (US $750 and above), but still has good opportunity to gain market share in the midrange to low-end segments because it can offer similar AI features with more attractive retail prices.

See the following sections:

- Debate 1: OEM vs. Supply Chain – Which Segments Are Better Positioned?
- Debate 2: Will Android Underperform Apple and Lose Market Share in the AI Smartphone Era?

Key stocks we like on this basis

Apple, TSMC, SK hynix, Hon Hai, Luxshare, Largan, Genius, LG Innotek, AAC, BYDE, TDK, MediaTek, LG Display, Xiaomi, Transsion, Novatek, STM, Advantest and Disco.

Where we could be wrong

In our base case, we assume that Apple Intelligence triggers an iPhone replacement cycle in 2H24, followed by high-end Android phones catching up.

However, smartphone shipments could miss our base case forecasts if:

1. The replacement cycle triggered by Apple Intelligence is weaker than expected;
2. There's a lack of new innovation between the Worldwide Developers Conference and formal iPhone launch in September; and
3. Interest rates rise or other macro headwinds emerge.

Of the three risk factors outlined above, we think Apple Intelligence's trigger effect will be the most critical driver to monitor. We see LLM/Edge AI as revolutionary – it could introduce numerous creative features in smartphone applications and change user habits in future. However, if this arrives later than expected, it could delay the smartphone product cycle and recovery could be only lackluster.

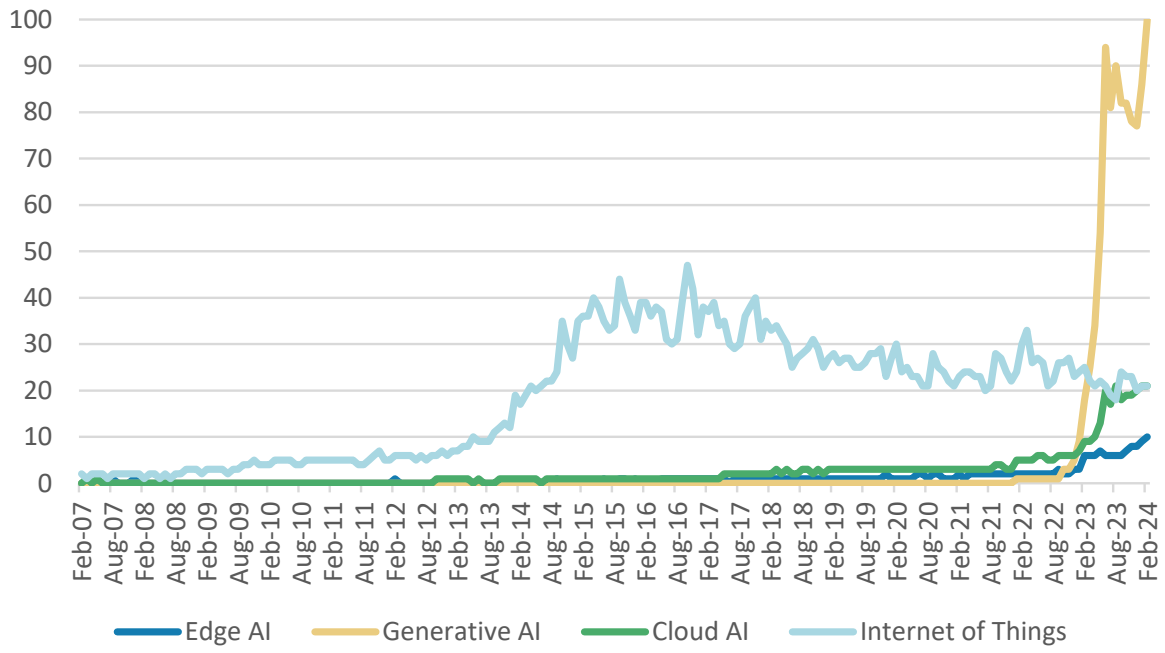
Generative AI and Cloud AI in spotlight, Edge AI likely to be next

According to Google search interests (Exhibit 6), Generative AI has been the most popular topic with surging interest in the past 6-12 months. There has also been a significant increase in searches for Cloud AI. We believe this is consistent with the development of AI. The chart also shows that the search interest for Edge AI is increasing.

Edge AI currently lacks a "killer app" or compelling product like ChatGPT or Sora. However, we think Edge AI – which deploys AI algorithms and AI models directly on local edge devices such as sensors or Internet of Things (IoT) devices – , is likely to become a key theme as new products are released, including smartphones, PCs, and AR/VR.

Bolstering this view, we regard the launch of Apple Intelligence as a milestone in Edge AI's development, which is likely to accelerate the industry's innovation.

Exhibit 6: Breakthrough of Gen AI has triggered surging interest in Edge AI and Gen AI in 2024



Source: GoogleTrends, Morgan Stanley Research

AI Smartphone Era to Kick Off from 2H24

We believe the AI Smartphone Era will kick off in 2H24 for four reasons:

- Large language models (LLM) and other AI-related technologies are mature enough to support Edge applications.
- Hardware development initiated in late 2023 should provide a solid foundation to support smartphones' AI new features.
- Apple Intelligence's official launch in September/October 2024 could drive the industry to accelerate Edge AI development.
- AI smartphone customers are likely to enjoy an improved user experience.

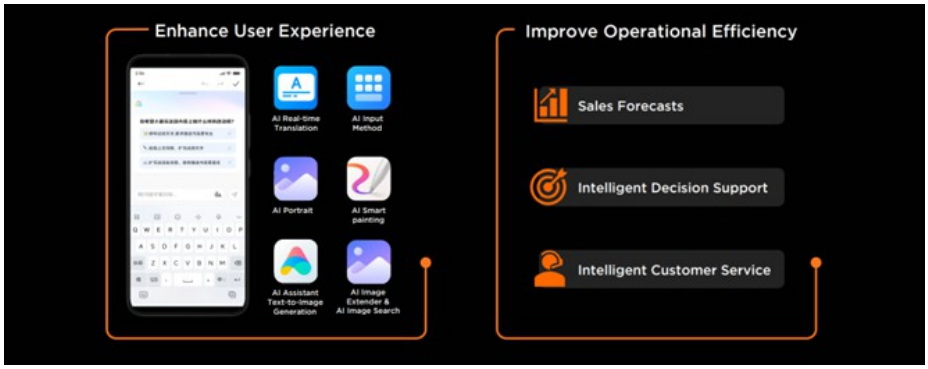
Phase I: Emerging Edge AI applications on smartphone

From late 2023 to early 2024, there has been a series of applications released for AI smartphones backed by LLMs, with AI chat assistants, AI text-to-image generation, AI photo editing, and AI portraits as mainstream applications. These include:

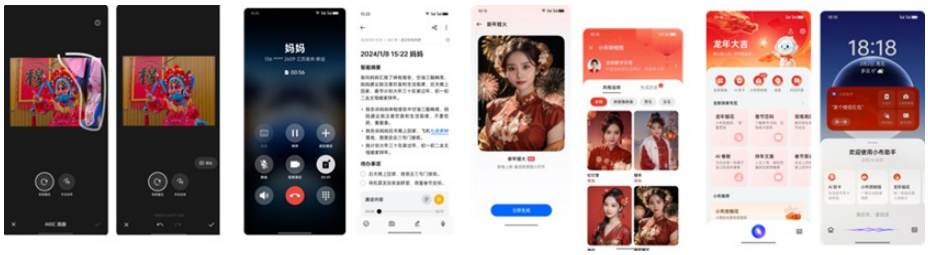
- Vivo X100's BlueLM-based assistant offers AI search, AI writing, AI painting, and AI intelligent note summary.
- Xiaomi 14's MiLM-based assistant offers AI Real-time Translation, AI Portrait, and AI Text-to-Image Generation.
- Oppo's FindX7 offers AndesGTP-based photo editing, call transcript generation, AI portrait, and AI assistant.
- Samsung's Galaxy 24 offers Gemini-based real-time translation while on a call, AI-enabled Chat Assist, in-app "Circle to Search," and AI intelligent note summary.

Vivo X100's BlueLM-based assistant offers AI search, AI writing, painting, intelligent note summary etc

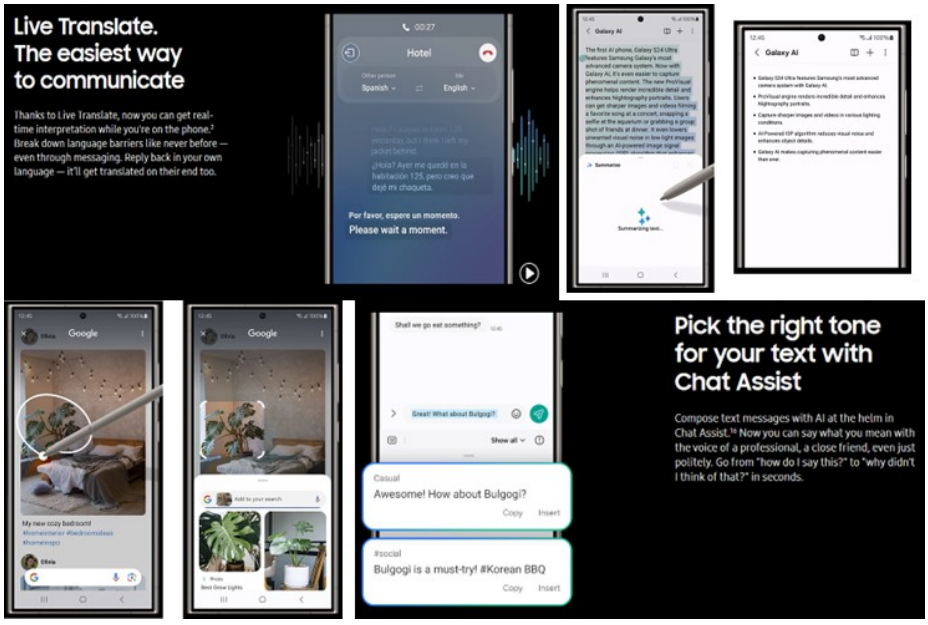
Xiaomi 14's MiLM-based assistant offers AI Real-time Translation, AI Portrait, Text-to-Image Generation, etc



Oppo's FindX7 offers AndesGTP-based photo editing, call transcript generation, AI portrait and AI assistant



Samsung Galaxy 24 offers Gemini-based real-time translation while on a call, AI-enabled Chat Assist, in-app "Circle to Search", etc



Source: Vivo, Oppo, Xiaomi, Samsung

In January, we saw AI smartphone product releases including the launch of Oppo FIND X7 and Samsung Galaxy S24 . Both models have been well received by the market with Oppo FIND X7's first five-day sales and first five-minute sales volume more than triple vs. its last series, and Samsung's Galaxy S24's pre-orders were up 11% from its last series.

Exhibit 7 AI smartphone launches have achieved strong sales performance

Launch Date	OEM	Model	Chipset	AI features	Sales performance
11/13/2023	Vivo	Vivo X100	Mediatek's D9300	1) AI portrait; 2) AI Note Assist intelligently summarizing notes; 3) AI Photo Assist for photo editing; 4) Smart AI Voice Assistant for AI smart painting, etc	The first-day sales of Vivo X100 were 7.4x those of its previous smartphone, the X90.
11/20/2023	Xiaomi	Xiaomi14	Snapdragon 8 Gen 3	1) AI real-time translation; 2) AI portrait; 3) AI text-to-image generation; 4) AI smart painting; and 5) AI imaging extender and search	Sales volume 6x those of the last series in the first five minutes of the sales launch and shipment volume exceeding 1 mn units in the shortest time in its history.
1/8/2024	Oppo	Oppo FIND X7	Mediatek's D9300	1) AI photo editing for removing unwanted objects; 2) AI Note Assist intelligently summarizing notes; 3) AI text-to-image generation; 4) AI call transcript generation	The first five-day sales of Oppo Find X7 were 3.2x those of the last series, and sales volume were 4x of the last series in the first five minutes.
1/18/2024	Samsung	Samsung Galaxy S24	Snapdragon 8 Gen 3	1) AI Live Translate calls; 2) AI Note Assist intelligently summarizing notes; 3) AI Photo Assist for photo editing; 4) in-app "Circle to Search"	Preorders in South Korea increased to 1.2mn units, up by 11% vs. the last series. Samsung said it has sold 173,000 Galaxy S24 smartphones a day on average during the period, surpassing the previous record daily sales of 125,000 units for the Galaxy Note 10 in 2019.

Source: Vivo, Xiaomi, Oppo, Samsung, Morgan Stanley Research

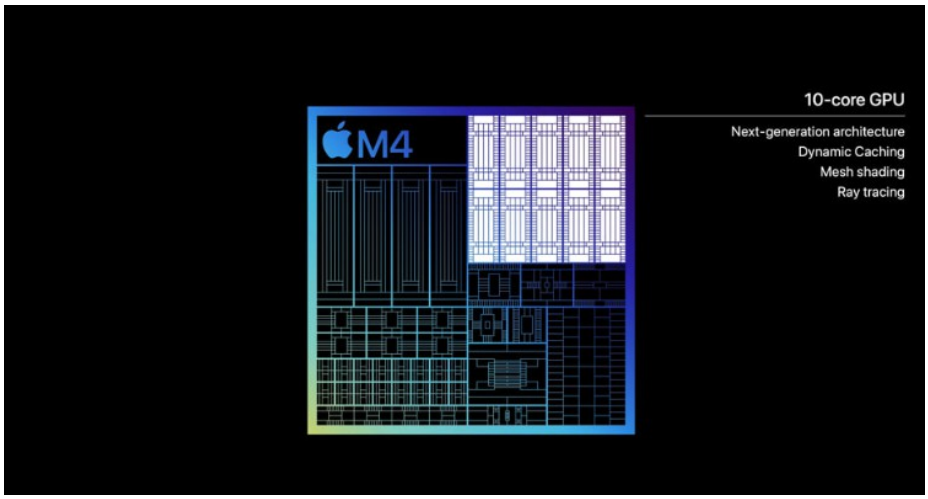
Phase 2: Apple is accelerating its Edge AI development

In 2023, Apple launched its first AI server chips – M2 Ultra, which was part of Mac Pro and Mac Studio computers. It has said it is planning to release future versions based on the M4 chip, which it introduced on May 7. Apple said it enabled a breakthrough in design of the new iPad Pro to enable the precision, color, and brightness of the Ultra Retina XDR display while delivering a significant improvement in performance.

Apple has said that handling AI features on devices will be a big part of its AI strategy, but some of those capabilities will require its most recent chips, such as the A17 Pro launched in last year's iPhone Pro/Pro Max models and M-series chips. Those processors include significant upgrades to the so-called neural engine, which is the part of the chip that handles AI tasks.

These hardware foundations are important to Apple's Edge AI development. Relatively simple AI tasks – like providing users a summary of their missed iPhone notifications or incoming text messages – can be handled by the chips inside Apple devices. We believe more complicated jobs, such as generating images or summarizing lengthy news articles and creating long-form responses in emails, would likely require a cloud-based approach – as would an upgraded version of Apple's Siri voice assistant.

Exhibit 7: Apple's newly launched M4 chip enables multiple AI features

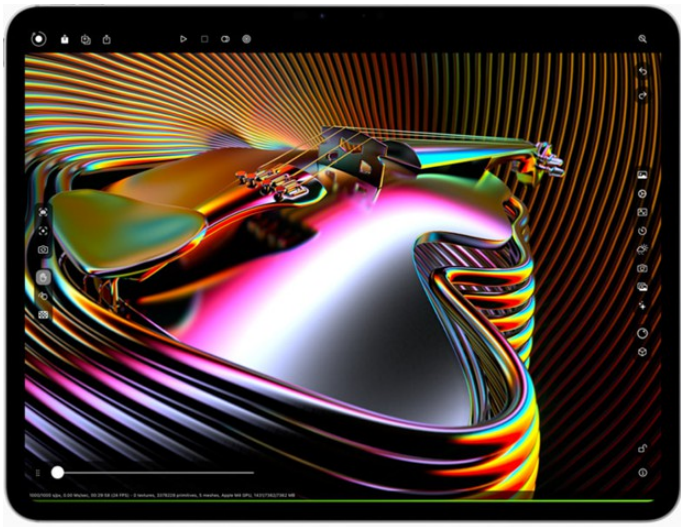


Source: Apple, Morgan Stanley Research

Exhibit 8: Dynamic caching

Source: Apple, Morgan Stanley Research

Exhibit 9: Hardware-accelerated ray tracing



Source: Apple, Morgan Stanley Research

Exhibit 10: Powerful neural engine

Source: Apple, Morgan Stanley Research

Exhibit 11: M4 boosts sound performance

Source: Apple, Morgan Stanley Research

At the Worldwide Developer Conference (WWDC, June 10, 2024), Apple launched a number of new GenAI features. including better natural language processing (seamlessly switching between text and voice to communicate with Siri) and on-screen awareness, more widely integrated automation, and new in-app command/control actions that make all of Apple's default apps better/more useful.

Phase 3: iPhone 16 launch in late September 2024

We expect the Edge AI journey to start following the iPhone 16's official launch. We expect a hybrid "Edge" approach to offer its first-generation Generative AI features in iOS18 through an upgraded (and voice-activated) Siri smart assistant.

Apple has said the integration of Siri and Apple Intelligence will initially be limited to first-party apps in this rollout. However, software development kits have been updated with new APIs that will allow developers to integrate Apple Intelligence into third-party apps as early as this fall.

According to our Apple analyst, Erik Woodring, given that Apple has the most valuable consumer app distribution platforms, we believe software developers are likely to leverage these APIs to differentiate more clearly vs. peers, which should ultimately benefit Apple through a better user experience.

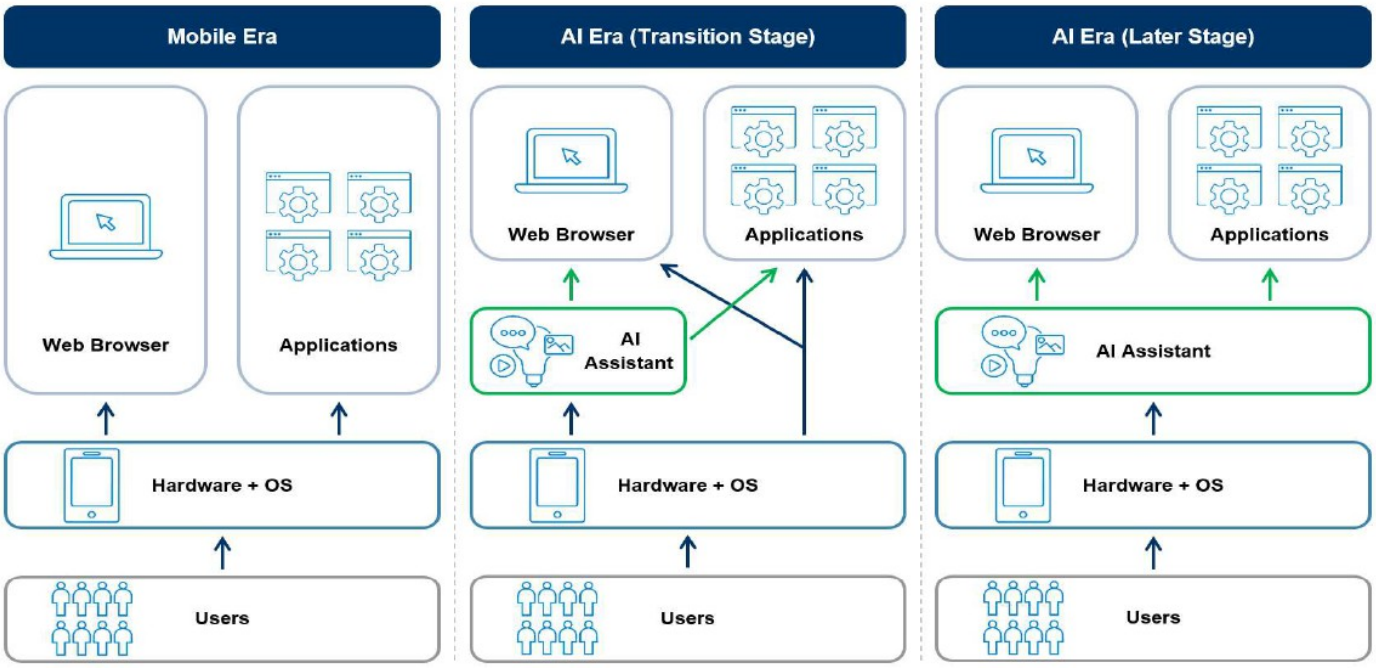
What's more, we believe users' daily feedback could also help Apple improve its AI features rapidly, making it more competitive than other AI smartphone players.

What's Next: AI Smartphones Set to Evolve Rapidly

We believe Apple Intelligence and Siri's new version – due to be launched in September 2024 – will be a good foundation for iPhone to accelerate its AI evolution. AI could help Siri become a smart virtual assistant, accessing data on a user's iPhone and integrations with multiple apps not only to help execute daily tasks but also proactively provide suggestions, take action, and effectively become an intelligent layer between Apple's iOS and applications. Other edge AI use cases that are likely to emerge on Apple devices include more efficient code development, integrating AI into Apple's native productivity apps, and AI-powered health, financial, and fitness assistants, among others.

Ultimately, we think user behavior will change completely. Today, most smartphone users click different apps to get what they want in the smartphone. In future, we believe Siri/ Apple Intelligence will have full access to all the apps and help users to get what they want in a one-stop solution mode.

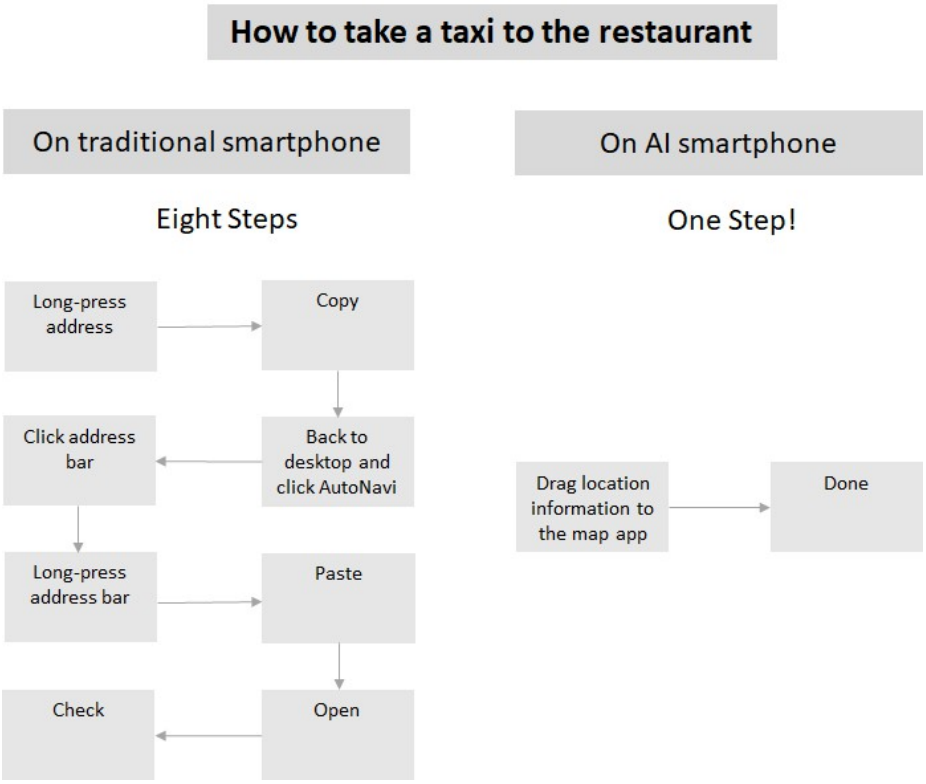
Exhibit 12: We believe Siri could become an "intelligent layer" between a user and the websites and applications they access today.



Source: Morgan Stanley Research, Various Sites

As illustrated in Exhibit 13 , one potential use case for a smarter AI assistant is to save users time in getting a taxi. Another potential use case is that an AI assistant can help users search photos and memos stored locally with a simple and basic prompt. We have illustrated two cases of how a smarter AI assistant could complete a task more efficiently. We believe those are the preliminary functions an AI smartphone can deliver. With continuous training, we believe AI smartphones will generate more value-added services in future.

Exhibit 13: A smarter AI assistant to save time in getting a taxi

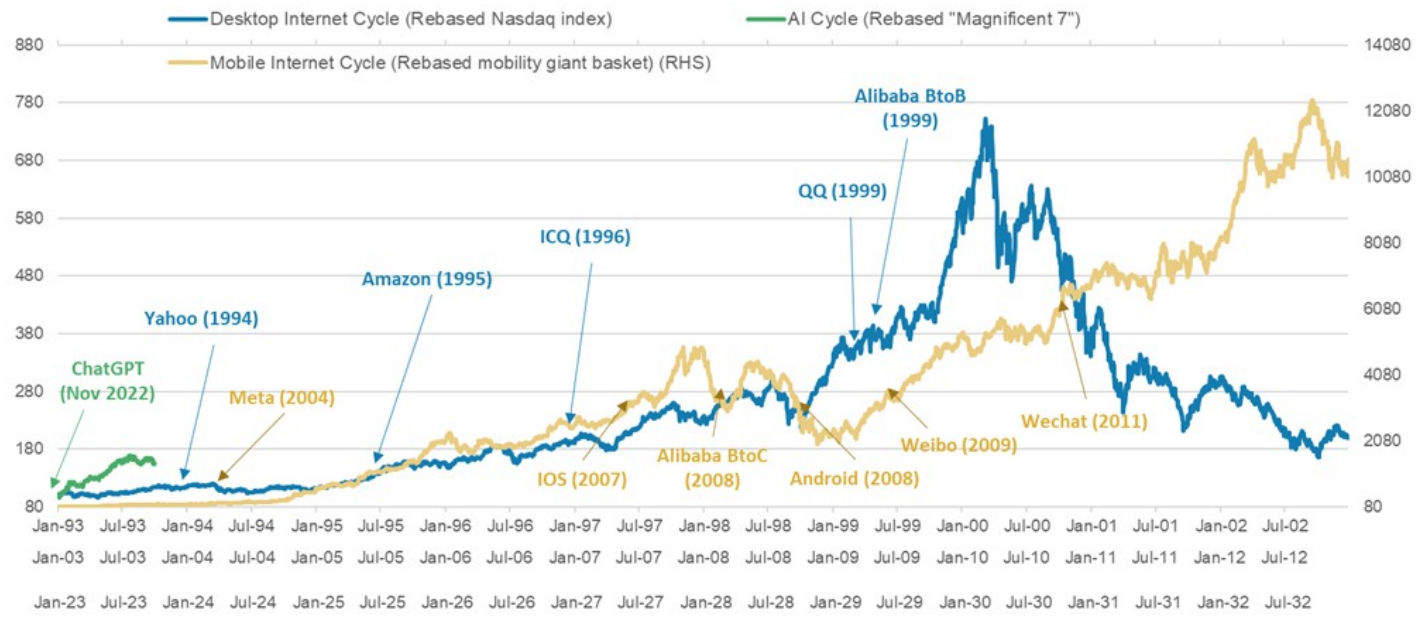


Source: 36kr, Morgan Stanley Research

More killer apps on AI smartphones set to emerge

The Desktop Internet and Mobile Internet cycles suggest that the emergence of new killer apps is usually faster than expected, coming only 1-2 years after the initial breakthrough (Exhibit 14). There is no guarantee that killer apps in Edge AI will follow the same timetable – but the emerging AI smartphone apps (Apple Intelligence), Microsoft's Copilot, and Nvidia's Chat With RTX have already demonstrated the potential to do so. We believe more killer apps are being developed, and will become more prevalent in the next few years.

Exhibit 14: The Desktop Internet and Mobile Internet Cycle indicate that the emergence of new killer apps is usually 1-2 years after the initial breakthrough



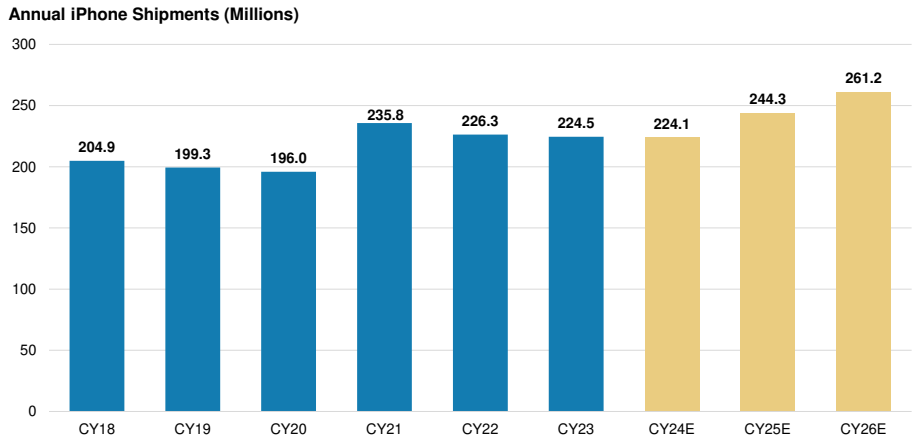
Source: FRED, Factset, Morgan Stanley Research. Note: We include Apple, Google, Meta, and Tencent into our mobility giant set as a proxy for the stock price performance of the Mobile Internet Cycle; "Magnificent 7" refers to Alphabet, Amazon, Apple, Meta Platforms, Microsoft, NVIDIA, and Tesla.

Raising Smartphone Shipment Forecasts

iPhone shipments to reach 224mn units in 2024 and 244mn units in 2025, exceeding historical high

Our Apple analyst, Erik Woodring, has raised our iPhone shipment forecast to 224mn units in 2024 and 244mn units in 2025. This implies that shipments over the next 12-18 months are likely to exceed the number of shipments during the 2021 5G upgrade cycle, marking a new historical high. For more details, please refer to Apple, Inc.: Elevating To Top Pick As Apple Intelligence Catalyzes Record Upgrade Cycle..

Exhibit 15: Annual iPhone shipments and forecasts

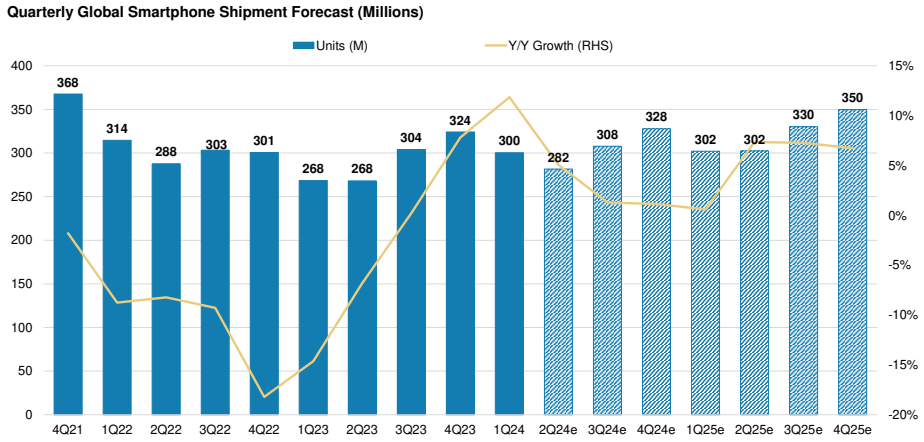


Source: IDC, Morgan Stanley Research Estimates

Raising global smartphone shipment forecast to 1.22bn in 2024 and 1.28bn in 2025

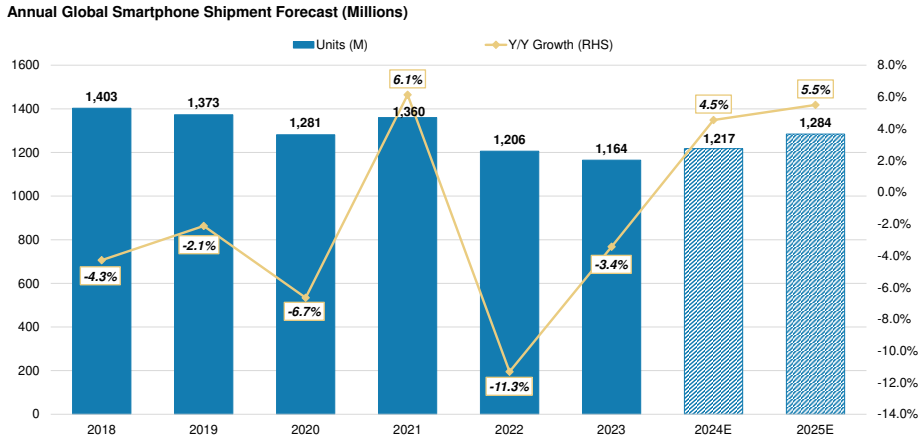
We believe Android smartphones will also benefit from the AI smartphone era. We believe Apple is more likely to take market share in the high-end segment (US$750 and above), while Android will take more market share in the <US$750 range. Android's high-end products could also offer new AI features with OEMs' proactive strategy in Edge AI function development and support from Google's Gemini (a large language model developed by Google, similar to ChatGPT). Considering those factors, we also raise our global smartphone shipments forecasts to 1.22bn in 2024 (+4.5% YoY) and 1.28bn in 2025 (+5.5% YoY).

Exhibit 16: Global smartphone shipment forecasts



Source: IDC, e = Morgan Stanley Research estimates

Exhibit 17: We model the global smartphone market returning to growth in 2024 at +4.5% Y/Y, with growth accelerating in F25, to +5.5% Y/Y.



Source: IDC, e = Morgan Stanley Research estimates

Our Playbook for the AI Smartphone Era: Segment Preference

(1) Apple to lead the sector rally

After growing by double digits in F21, iPhone shipment growth decelerated in F22 and inflected to Y/Y declines in F23, and we believe the market has low expectations for the upcoming refresh cycle. According to Yahoo Finance and Reuters in January, consensus iPhone shipment forecasts were cut 15% in early 2024, citing China's 30% YoY decline in shipments in January as one of the key reasons. However, if Apple Intelligence can trigger a new product cycle as we expect, iPhone shipments are likely to beat consensus estimates significantly. We think this could lead to a sector rally for the Apple supply chain.

Taking into account a large and aged iPhone installed base, and the limited backwards compatibility of Apple Intelligence, we believe that Apple has the building blocks in place to drive a multi-year device refresh cycle starting in F25, similar to the iPhone 12 5G cycle in F21. Using an iPhone "upgradable base" of ~700mn devices (3+ years old or ~65% of the installed base), we assume iPhone upgrade intentions will reach 31% in FY25, which assumes upgrade intentions in the US reach 36%, up from 31% in our 2023 Smartphone Survey – an all-time high given the emergence of Apple Intelligence and lack of backwards compatibility.

Outside of the US we assume that upgrade rates average 29% for F25, below upgrade intentions in the US given the initial limited rollout of Apple Intelligence to US English devices. Furthermore, we assume:

1. That iPhone retention rates reach 83% globally (US at 94% and ROW at 76%, consistent with what we've seen in our survey data) and
2. That Apple adds ~55M new iPhone users in F25, a magnitude similar to the F21 iPhone 12 cycle.

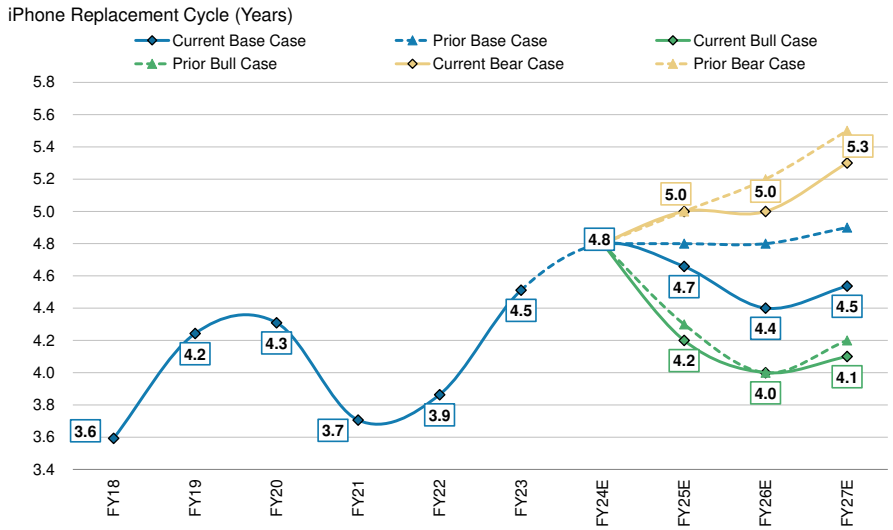
Taken together, we now estimate that Apple will ship 235mn iPhones in F25, 4% above our prior 227mn forecast, and 2% above consensus at 231mn. This implies that the iPhone replacement cycle will contract from 4.8 years in F24 to 4.7 years in F25 (Exhibit 18).

As we look to F26, we assume further acceleration in the iPhone replacement cycle for two reasons:

1. A "true AI iPhone" comes to market with the launch of the iPhone 17 family, and
2. Apple Intelligence rolls out to new languages/regions, is integrated with more third-party apps, and expands partnerships to other foundational model providers.

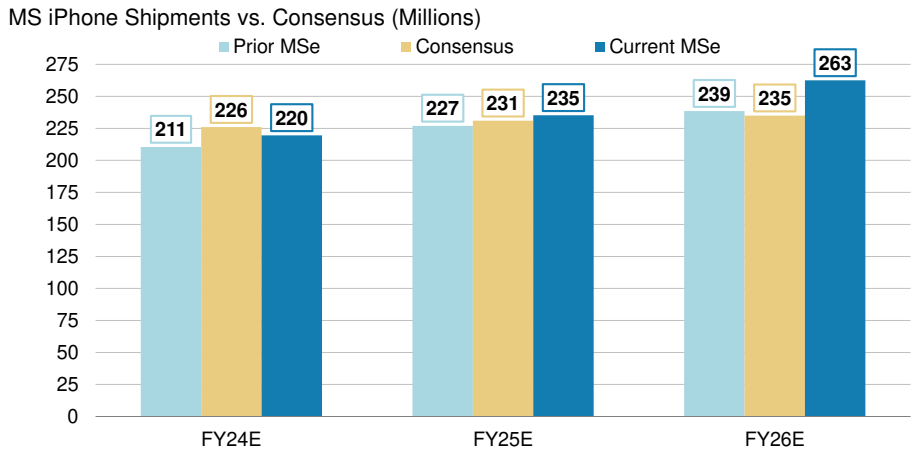
As a result, we estimate that the iPhone replacement cycle contracts 0.3 years Y/Y, to 4.4 years in F26. This, implies that iPhone shipments reach 262.5mn in F26, 10% above our prior forecast of 239mn, and 12% above consensus at 235mn units (Exhibit 19).

Exhibit 18: We now forecast iPhone replacement cycles shortening 0.1 years Y/Y in FY25, to 4.7 years (vs. 4.8 years prior) and another 0.3 years Y/Y in FY26, to 4.4 (vs. 4.8 years prior).



Source: Morgan Stanley Research

Exhibit 19: We now model 235mn iPhone shipments in F25, growing to 262.5mn in F26, 4% and 10% above our prior forecasts and 2-12% above consensus.



Source: Morgan Stanley Research

(2) Apple supply chain likely to outperform Android supply chain

Between the Apple and Android supply chains, we believe Apple's supply chain is more likely to outperform given that iPhone shipments are likely to surprise positively thanks to the official launch of Apple Intelligence. iPhone shipments have been in decline since 2021, and thus a consensus view has formed that the Apple supply chain will no longer show volume upside, which has resulted in de-rating for the past few years. However, once those Apple supply chain stocks resume positive growth, we see material potential for earnings estimate increases and re-rating.

Exhibit 20: iPhone supply chain

Apple Product	Company	Ticker	Product	Rating	Share price (LC)	2024e sales contribution				
						Total iPhone	iPhone (Low-end)	iPhone Pro (High-end)	iPhone SE	Legacy iPhones
	Zhen Ding	4958.TW	FPC/PCB	E	153.00	**70-75%**	20-25%	20-25%	5-10%	10-15%
	Pegatron	4938.TW	Assembly	E	105.50	**50-55%**	15-20%	0-5%	5-10%	20-25%
	Hon Hai	2317.TW	Assembly	O	225.50	**40-45%**	10-15%	15-20%	<5%	5-8%
	Largan	3008.TW	Lens	O	3,200.00	**40-45%**	10-15%	15-20%	0-5%	5-10%
	Genius	3406.TW	Lens	O	600.00	**30%**	5-10%	10-15%	0-5%	5-10%
	Kinsus	3189.TW	IC substrate/PCB	U	109.00	**20-25%**	5-10%	10-15%	0-5%	0-5%
	NYPCB	8046.TW	IC substrate/PCB	U	186.50	**~5%**				
	Unimicron	3037.TW	IC substrate/PCB	U	189.50	**15-20%**	5-10%	5-10%	0-5%	0-5%
	GIS	6456.TW	Touch module	E	72.10	**0-5%**	0%	0%	0%	0-5%
	Wistron	3231.TW	LCM	O	108.00	**0-5%**	0%	0%	0-5%	0-5%
	TSMC	2330.TW	AP foundry	O	1,080.00	**15-20%**	10%	5-8%	1%	1%
	Tong Hsing	6271.TW	3D sensor wafer processing	E	159.50	**10-12%**	3-5%	0-3%	3-5%	3-5%
	Delta	2308.TW	Power choke	O	434.00	**~10%**				
	Yageo	2327.TW	Passive components	O	797.00	**~5%**	0-5%	0-5%	0-5%	0-5%
	Win Semi	3105.TWO	VCSEL and PA foundry	O	180.00	**35-40%**	20%	10-15%	0-3%	3-5%
	AAC	2018.HK	Acoustics/haptics	O	34.35 HKD	**25-30%**	5-10%	10%	2%	5-10%
	Lingyi Itech	002600.SZ	Precision components	E	7.56	**30%**				
	Luxshare	002475.SZ	Acoustics/wireless charging/cable	O	41.78	**35-40%**	10-15%	5-10%	1-3%	8-10%
	FII	601138.SS	Metal casing	O	28.76	**25%**	5-10%	10-15%	<3%	<5%
	USI	601231.SS	UWB/WiFi/ALS/mmWave modeuls	O	17.02	**25-30%**	10-15%	8-10%	2%	2%
	Goertek	002241.SZ	Acoustics	E	21.95	**10-15%**	5%	5%	1%	3-5%
	Lens Tech	300433.SZ	Cover glass/casing	E	19.86	**35%**	15%	5%	7%	8%
	BOE	000725.SZ	OLED display	O	4.31	**~5%**	3%	0%	0%	2%
	Sunny Optical	2382.HK	Lens	O	48.20 HKD	**<5%**	1-2%	1-2%	<1%	1-2%
	LG Innotek	011070.KS	Camera module	O	286,500.00	**70-80%**	20-30%	20-30%	10%	0-10%
	LG Display	034220.KS	LCD display	E	12,940.00	**20-30%**	0%	5-10%	0%	0%
	Samsung SDI	006400.KS	Battery	E	389,500.00	**5-10%**	4-5%	4-5%	4-5%	4-5%
	Samsung	005930.KS	OLED display	O	87,600.00	**5-10%**	10%	5-10%	0%	5-10%
	JAE	6807.T	Connector	E	2,692.00	**20%**	7%	10%	2%	2%
	Minebea Mitsumi	6479.T	LED backlight/camera actuator	E	3,588.00	**20%**	3%	5%	6%	6%
	Murata	6981.T	MLCC/MetroCirc/WLAN	O	3,697.00	**20%**	5-10%	5-10%	2%	3%
	Alps Alpine	6770.T	Camera actuator/haptics	+	1,601.50	**20%**	5-10%	5-10%	2%	3%
	Sony	6758.T	CMOS sensor	O	15,380.00	**4-5%**				
	TDK	6762.T	Battery/sensor	O	10,985.00	**20%**	5-10%	5-10%	2%	3%
	Hirose	6806.T	Connectors	O	19,235.00	**10%**	4%	2%	1%	2%
	Taiyo Yuden	6976.T	MLCC	E	4,769.00	**10%**	4%	3%	1%	2%
	Kyocera	6971.T	MLCC/connector/cristal	E	1,985.50	**5%**	1-2%	1-2%	1%	1%

Source: Company data, Morgan Stanley Research; Priced as of July 11, 2024.

Exhibit 21: iPad supply chain

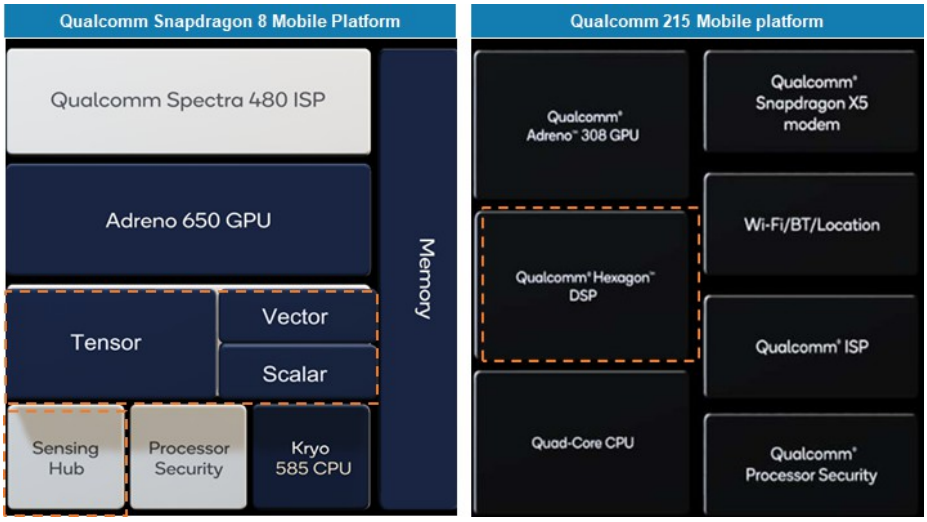
Apple Product	Company	Ticker	Product	Rating	Share price (LC)	2024e sales contribution
iPad	ASE	3711.TW	Fingerprint	E	193.50	Less than 1%
	TSMC	2330.TW	A/P foundry	O	1,080.00	~2%
	Win Semi	3105.TWO	VCSEL foundry	O	180.00	Less than 5%
	GIS	6456.TW	Touch module	E	72.10	60-65%
	Radiant	6176.TW	Backlight module	E	186.00	50-55%
	Unimicron	3037.TW	PCB/IC substrate	U	189.50	0-5%
	ZDT	4958.TW	FPC	E	153.00	10-15%
	Foxconn Tech	2354.TW	Casing	U	73.00	~10%
	Luxshare	002475.SZ	Casing/antenna	O	41.78	~5%
	Tong Hsing	6271.TW	CIS RW	E	159.50	Less than 5%
	Largan	3008.TW	Lens	O	3,200.00	Less than 5%
	Sunny Optical	2382.HK	Lens	O	48.20 HKD	<2%
	Compal	2324.TW	Assembly	E	35.30	10-15%
	Yageo	2327.TW	IC substrate	O	797.00	0-5%
	Hon Hai	2317.TW	Assembly	O	225.50	5-10%
	BYDE	0285.HK	Assembly, casing	O	37.15 HKD	35-40%
	BOE	000725.SZ	LCD DIsplay	O	4.31	0-5%
	Lens Tech	300433.SZ	Cover glass/casing	E	19.86	10-15%
	Parade	4966.TWO	T-con	U	883.00	10-15%
	AAC	2018.HK	Acoustics	O	34.35 HKD	Less than 5%
	GoerTek	002241.SZ	Acoustics	E	21.95	Less than 5%
	Lingyi Itech	002600.SZ	Precision components	E	7.56	5-10%
	LG Display	034220.KS	OLED Display	E	12,940.00	Less than 5%
	Nissha	7915.T	Touch sensor	O	2,039.00	22%
	TDK	6762.T	Battery	O	10,985.00	3%
	NDK	6779.T	Quartz unit	E	1,509.00	Less than 5%

Source: Company data, Morgan Stanley Research; Priced as of July 11, 2024.

(3) Supply chain companies with AI spec upgrades to outperform peers

Besides the potential positive surprise from smartphone shipment increases, we believe supply chain stocks with spec upgrades during the AI smartphone era are likely to outperform those who don't undertake spec upgrades. As illustrated in Exhibit 22 , AI smartphones require a new generation of SoC with customized AI modules such as tensor, vector, scalar, and sensing hubs. Current SoC products will not be able to support most new AI features.

Exhibit 22: Traditional smartphone SoC vs. AI SoC: Tensor was added to Qualcomm's Hexagon DSP, giving it a dedicated, always-on, low-power AI sensing hub



Source: Qualcomm

We also expect memory players to be key beneficiaries, because LLMs used in AI require much larger data processing capability. As a result, the minimum RAM requirement for AI-enabled smartphones will be 12GB or 16GB, compared with 8GB in most smartphones today. We believe RAM spec upgrades are another theme to play.

Relative to SoC, memory, and cameras, however, other components such as displays, acoustics, PMIC, and MLCC are less likely to enjoy significant upgrades. We think related stocks are more likely to perform in line with smartphone OEMs.

(4) Mixed performance among Android OEMs

While iPhone can benefit from Apple Intelligence's launch, we believe high-end Android phones can also benefit, because they offer similar AI feature, but are often cheaper than iPhones. However, in the Android camp, we expect a more divergent fundamental performance:

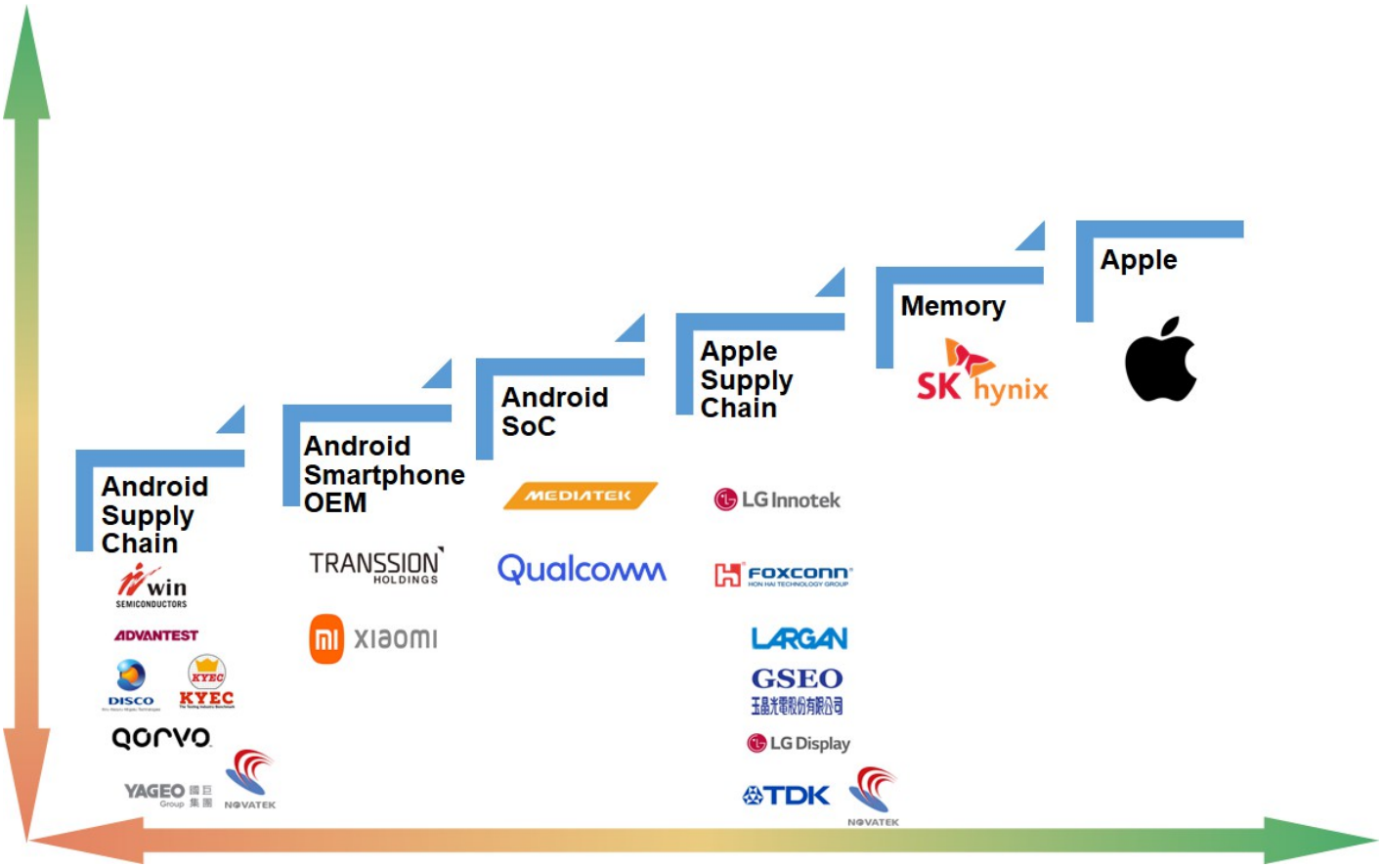
1. Samsung might lose some market share in the high-end segment; therefore, it is less likely to benefit from the upcoming AI Smartphone Era.
2. Xiaomi is well positioned for market share gains in the midrange to low-end segment.
3. Transsion could sustain its leading market share in the low-end segment.

We therefore maintain our positive views on Xiaomi and Transsion, based on market share gain potential in the Android camp.

Our Playbook for the Global Smartphone Recovery

We summarize our segment preferences as follows:

Exhibit 23: Segment preference: Apple > Memory > Apple Supply Chain > Android SoC > Android Smartphone OEM > Android Supply Chain



Source: Company website, Morgan Stanley Research

Note: The horizontal axis refers to our segment preference order ranked from the right (as the segment most likely to benefit from a global smartphone recovery) to the left (as the segment least likely to benefit from a global smartphone recovery).

The vertical axis refers to our company preference order ranked from upper-end (as the segment most likely to benefit from a global smartphone recovery) to lower-end (as the segment least likely to benefit from a global smartphone recovery).

Key stocks we like include Apple, TSMC, SK Hynix, LG Innotek, LG Display, Hon Hai, MediaTek, Win Semi, Novatek, KYEC, Largan, Genius, BYDE, Xiaomi, Transsion, Skyworks, Qorvo, Yageo, Advantest, Disco, TDK, and STMicro.

Exhibit 24: Key beneficiaries amid AI Smartphone Era

Company	Ticker	Rating	Analyst	Key Products	Reason	TP (LoC)	Upside
Apple	AAPL.O	OW	Erik Woodring	Smartphone OEM	Market leadership with Apple Intelligence drives a multi-year iPhone cycle, leading to a new annual high of 260mn+ iPhone shipments in F26.	273	20%
LG Innotek	011070.KS	OW	Shawn Kim	Apple supply chain	LG Innotek has over 80% revenue exposure to Apple and is considered one of the key beneficiaries of iPhone tailwinds.	330,000	15%
SK hynix	000660.KS	OW	Shawn Kim	Memory	SK hynix will be a key beneficiary of Edge AI given its leadership in AI memory business. It will continue on a path to recovery with DRAM turning to profit and laying the foundation for a sharp recovery into 2024 driven by AI DRAM. We expect the AI growth story to support a re-rating of the stock above its previous peak.	300,000	24%
LG Display	034220.KS	EW	Shawn Kim	Smartphone supply chain	LG Display will be a key beneficiary of smartphone recovery. OLED panels for iPhone 16 Pro and Pro Max should account for 25mn units this year. While both Samsung and LGD secured more than 80% of all iPhone 16 OLED, LGD's 30% share is mainly for Pro and Pro Max.	10,000	-23%
MediaTek	2454.TW	OW	Charlie Chan	SoC	MediaTek is well positioned to monetize the coming AI-driven product cycle. We expect AI to bring ~US$8bn in additional revenue over 2024-26 (a 22% revenue CAGR), or a >32% contribution to the company's 2026e revenue.	1,588	12%
WIN Semi	3105.TWO	OW	Ray Wu	Smartphone supply chain	We now see signs of a turnaround for WIN Semi's business from Samsung shifting its smartphone supply chain, the iPhone 16 replacement cycle, and the upcoming WiFi 7 migration. We believe market expectations for WIN Semi remain low and see the risk-reward as attractive.	200	11%
TSMC	2330.TW	OW	Charlie Chan	Smartphone supply chain	We like TSMC given its thorough exposure to the AI smartphone supply chain, including Apple and Android smartphone SoCs and other peripheral chips. Smartphones currently account for 38% of TSMC's total revenue (as of 1Q24); we expect any upside from AI smartphoned would bode well for TSMC's growth.	1,180	9%
KYEC	2449.TW	OW	Charlie Chan	Smartphone supply chain	We are also constructive on KYEC, a semiconductor testing house. MediaTek and Will Semi are both big customers of KYEC, and stronger testing demand from smartphone customers should be positive for KYEC's revenue and margin outlook. KYEC's gross margin has already improved structurally thanks to its sustainable pricing outlook as well as being a key beneficiary of AI demand.	140	7%
Novatek	3034.TW	OW	Daniel Yen	Smartphone supply chain	We believe Novatek could enter the iPhone supply chain starting from 2024. This is because of its superior design on the OLED DDI, along with competitive cost structure. We also believe Novatek could achieve more sustained market share in Android smartphones, via the compact design of DDI. We believe the Street's concerns about competition and GM erosion are overdone.	666	15%
Hon Hai	2317.TW	OW	Sharon Shih	Apple supply chain	We like Hon Hai the most for dual growth drivers (iPhone assembly + AI servers). We expect Hon Hai to retain its iPhone assembly share at ~63%, given its solid time-to-market delivery and accelerated output from new production sites in India. The rise in the mix of iPhone Pro/Pro Max, for which Hon Hai is the major assembler, will also lift blended ASP.	270	20%
Largan	3008.TW	OW	Andy Meng	Smartphone supply chain	Largan is the largest lens supplier to Apple, thus benefiting from the new product cycle.	3,800	19%
Genius	3406.TW	OW	Andy Meng	Smartphone supply chain	Genius is the second-largest lens supplier to Apple.	800	33%
BYDE	0285.HK	OW	Andy Meng	Smartphone supply chain	We believe BYDE will benefit from AI smartphones' spec upgrade in metal casings - the company has large exposure to both iPhone and Android. What's more, BYDE is also engaging with the assembly business with good potential for market share gain.	50	35%
Xiaomi	1810.HK	OW	Andy Meng	Smartphone OEM	With smartphone shipments as its key share price driver, we believe the potential demand recovery could be a positive catalyst. More importantly, we believe Xiaomi's strong R&D input in on-device LLM could help it establish a competitive edge within the Android camp.	26	53%
Transsion	688036.SS	OW	Andy Meng	Smartphone OEM	Transsion is a key beneficiary of AI smartphone recovery given its leading profile in the low-end segment and strong potential to gain share in emerging markets.	112	36%
Skyworks Solutions	SWKS.O	EW	Joseph Moore	Smartphone supply chain	Skyworks is a key RF supplier to Apple, with 68% of its revenue in F2024 from Apple. Despite the higher iPhone exposure, we remain EW because it has continuously lost content in new iPhones and we expect content headwinds to persist into 2025.	118	7%
Qorvo	QRVO.O	OW	Joseph Moore	Smartphone supply chain	Qorvo is a supplier of RF components and will be a beneficiary of a stronger smartphone up-cycle. We are OW because we see a clear path to earnings recovery as long as demand holds up, and we see positive risk/reward with its content growth remaining strong.	138	13%
Yageo	2327.TW	OW	Howard Kao	Smartphone supply chain	We believe Yageo will benefit from increased passive component content from Edge AI, from both the PC and smartphone angle thanks to its comprehensive product portfolio.	710	-11%
Advantest	6857.T	OW	Tetsuya Wadaki	Smartphone supply chain	AI smartphones will boost demand for processor and memory testers. With strong focus on AI device testing, Advantest will greatly benefit from this trend.	7,300	7%
DISCO	6146.T	OW	Tetsuya Wadaki	Smartphone supply chain	Since known good die (KGD) selection will be more important, the tester market could grow further as bare die testing gains traction. We expect DISCO to benefit with its grinders being used in the stacking process.	62,100	-9%
TDK	6762.T	OW	Shoji Sato	Smartphone supply chain	More than 50% market share at Apple. Shipments of higher-value-added silicon anode-type batteries will increase in the future.	9,700	-12%
STMicro	STMPA.PA	OW	Lee Simpson	Smartphone supply chain	STMicro could get a boost from the iPhone replacement cycle, contingent on price negotiations. A key customer for STM in personal electronics is Apple, to which STM provides a range of chips relating to power management, wireless charging, and motion sensing, as well as microcontrollers. These chips are used in Apple products.The forecasted (AI-driven) enhanced iPhone demand has the potential to boost STM's iPhone-related revenue.	48	24%

Source: Morgan Stanley Research

Note: Upside is calculated as the difference between Morgan Stanley's price target and current price as of July 11, 2024.

US IT Hardware (Erik Woodring)

Apple (AAPL.O, OW)

Elevating Apple to our Top US IT Hardware Pick as Apple Intelligence-driven upgrade cycle remains underappreciated: Never in history has 1) Apple's iPhone installed base been so large (1.3bn users), 2) iPhone replacement cycles been so extended (4.8 years), and 3) Apple forced iPhone (and iPad) upgrades on over 90% of its installed base to gain access to its next-gen software technology (Apple Intelligence). It is for this reason that we believe Apple is entering a robust, multi-year iPhone refresh cycle, where we estimate Apple will ship nearly 500mn units over the next two years (235mn in FY25, 262mn in FY26), 6% higher than the record FY21-FY22 upgrade cycle. Alongside sustained low double-digits Services growth, we forecast that this Apple Intelligence upgrade cycle can drive nearly $485bn of revenue and $8.70 of earnings power by FY26, 7-10% above consensus expectations, supporting our new $273 price target (31x P/E).

In addition to upside estimate revision pressure, we see three key factors arising from this upgrade cycle that give us the confidence to make Apple our Top US IT Hardware Pick: 1) accelerating iPhone replacement cycles, which historically strongly correlate to Apple stock outperformance, 2) expanding gross margins, also historically a driver of outperformance, and 3) growing Services mix shift of gross profit dollars (to 40% of total company GP$), the single most important historical factor in driving multiple expansion. Alongside a number of near-term stock catalysts, including August 1 earnings, the mid-September iPhone launch, and the potential for positive iPhone build revisions in mid-October, we believe Apple will continue to outperform, even after outperforming the S&P by 21 points since March quarter earnings.

In short, the introduction of Apple Intelligence represents not only a key, but still underappreciated, catalyst that can drive sustained outperformance for Apple, but also the "killer app" that can catalyze the AI Smartphone Era, which has much wider ramifications for the Apple supply chain and broader global smartphone ecosystem, many of which we detail below.

South Korea Technology (Shawn Kim)

LG Innotek (011070.KS , OW)

LG Innotek has over 80% revenue exposure from Apple and we consider it to be one of the key beneficiaries of iPhone tailwinds: After three years of shipment declines, we raise our forecast of iPhone shipments to a historical high of 250mn in 2025 (up 8.7% from 230mn). Apple Intelligence, introduced at the recent Worldwide Developers Conference, could drive a replacement cycle for iPhone 16. We learned from recent supply chain checks that there has been an increase of 4-5mn for 2024 for iPhone 16 new models following the WWDC event and see content upside for folded zoom and 48MP ultra-wide camera modules for the Pro/Pro Max.

We are well above consensus for 2025 and see further share price upside for LG Innotek here. We expect consensus EPS estimate upgrades from 2H24 into 2025 and a return to double-digit growth in 2025. We like the risk-reward and upgrade to OW with a W330,000 price target.

SK hynix (000660.KS, OW)

The memory cycle has been on a recovery path since 2Q23 – in terms of rate of change with pricing power returning from 4Q23. In 2Q24, we already saw server DRAM and enterprise NAND lead all memory contract price hikes, and a resumption of mobile/server demand should drive significant content via 1b based DDR5/LPDDR5x and mobile NAND penetration. With supply discipline maintained, we expect the smartphone demand recovery and iPhone increase mobile DRAM content growth (8GB iPhone 16/Plus vs. 6GB iPhone 15) and 256GB NAND minimum storage to strengthen pricing further from 2H24. With additional tailwinds from HBM demand for AI servers, we expect memory shares to continue outperform greatly.

LG Display (034220.KS, EW)

LED panels for iPhone 16 Pro and Pro Max should account for 25mn units this year: Together, Samsung and LGD have secured more than 80% of all iPhone 16 OLED – but LGD's 30% share is mainly for Pro and Pro Max. This and the potential sale of LGD's Guangzhou China 8.5G LCD fab can boost the company's balance sheet to support further penetration of OLED panels for tablet PCs as well as desktop PCs.

However, we stay Equal-weight on the stock because we expect an earlier decline in LCD TV panel pricing owing to significantly weaker TV demand from China.

Greater China Semiconductors (Charlie Chan, Daniel Yen, Ray Wu)

Regarding the development of AI smartphones in China, we spoke with both MediaTek and key LLM developers in China. Since the Gemini Nano is not available in the Chinese domestic market, our sense is that China's Android ecosystem is aggressively introducing GenAI local apps to compete with Apple Intelligence. For example, ByteDance has formed a partnership with Xiaomi by offering its Beanbao LLM, while Tencent is developing multimodality LLM by leveraging its portfolio of apps such as WeChat. We also expect AI smartphone to require more powerful APU computing capabilities, which will further increase the flagship smartphone penetration rate.

MediaTek (2454,TW, OW)

MediaTek is expected to introduce its Dimensity 9400 chip with AI demo in late 3Q24 to showcase more applications for the Chinese market. However, whether all these can be integrated remains to be seen.

We think MediaTek is really well positioned to monetize the coming AI-driven product cycle. We expect AI to bring ~US$8bn in additional revenue over 2024-26 (22% revenue CAGR), or a >32% contribution to the company's 2026e revenue, which is mainly driven by demand for AI smartphones and AI PCs (WoA partnership with NVIDIA)

TSMC (2330.TW, OW)

We also like TSMC given its market-leading position in the foundry supply chain, especially the leading edge nodes, with thorough exposure to the AI smartphone supply chain, including Apple and Android's smartphone SoCs and other peripheral chips such as WiFi

and CIS. Smartphones currently accounts for 38% of TSMC's total revenue (as of 1Q24), and we expect any upside from AI smartphones would bode well for TSMC's growth.

WIN Semi (3105.TWO, OW)

WIN Semi is also one of our preferred smartphone plays, as we see turnaround for the company's business on several fronts in the near term.

1. *New Samsung opportunities:* We think Samsung's smartphone direct RF component purchases will switch more to the Asian supply chain (from global IDMs), which will open up a new door for WIN Semi.
2. *iPhone:* After three years of continuous Y/Y shipment declines, we finally expect iPhone shipment growth in 2025. We view WIN Semi as an iPhone replacement play, because it has ~40% revenue exposure to Apple.
3. *WiFi 7 spec upgrade:* We expect to see more GaAs wafer consumption amid migration into the WiFi 7 era. WiFi 7 has three bands (2.4 GHz, 5 GHz, and 6 GHz) vs. WiFi 6 with just two (2.4 GHz, 5 GHz).

Novatek (3034.TW, OW)

We believe Novatek could enter the iPhone supply chain starting from 2024. This is because of its superior design on the OLED DDI, along with its competitive cost structure. We also believe Novatek could achieve more sustained market share in Android smartphones, via the compact design of DDI. We believe the Street's concerns about competition and GM erosion are overdone.

King Yuan Electronics (2449.TW, OW)

Finally, we are also constructive on KYEC, a semiconductor testing house. MediaTek and Will Semi are both big customers of KYEC, and stronger testing demand from smartphone customers should be positive to KYEC's revenue and margin outlook. KYEC's gross margin has already improved structurally thanks to its sustainable pricing outlook as well as being a key beneficiary of AI demand.

Greater China Technology Hardware (Sharon Shih)

Apple's iPhone shipments have been more resilient vs. its smartphone peers over the past three years, thanks to an enlarged ecosystem and steady feature upgrades. This has been the key source of support for revenue and margin performance for the iPhone supply chain. We expect certain iPhone suppliers will continue to outperform, especially those leading in product upgrades and share gains.

If iPhone shipments can improve in the following quarters, we think Hon Hai, Largan, Luxshare, Genius, AAC and FII could be among the key beneficiaries given large revenue exposures to iPhone (Exhibit 20).

Hon Hai (2317.TW, OW)

Among iPhone supply chain stocks we cover, we like Hon Hai the most for dual growth drivers (iPhone assembly + AI servers). We expect Hon Hai to retain its iPhone assembly share at ~63%, given its solid time-to-market delivery and accelerated output from new

production sites in India. The rise in the mix of iPhone Pro/Pro Max, for which Hon Hai is the major assembler, will also lift blended ASP.

Pegatron (4938.TW, EW – covered by Howard Kao)

We think Pegatron may also benefit slightly, because it has had dual model exposure, iPhone Plus and iPhone Pro models, in the past. Pegatron may also benefit from new a new iPhone SE 4 that could come out in spring 2024, based on a recent news article. While overall volumes will ultimately benefit Pegatron, a higher share of Pro/Pro Max models will benefit Hon Hai more than Pegatron, because Pegatron is the main source for the iPhone Plus model, but only a second source for the iPhone Pro model. So we raised earnings forecasts (link) because we believe Pegatron will benefit from higher volumes and larger scale and scale leverage, but stay EW on the stock.

Greater China Technology Hardware (Andy Meng)

We believe Apple Intelligence will mark the start of the AI Smartphone Era and see Apple supply chain companies as key beneficiaries in Asia. For Android, we think high-end smartphones can offer similar AI features with more attractive retail prices.

In the Apple supply chain, we like Largan, Genius, AAC, and BYDE: They all have relatively higher revenue exposure to Apple. Stronger shipments from 2H24 are likely to become a key re-rating catalyst for these stocks.

In the Android camp, we believe Xiaomi and Transsion are likely to be the key beneficiaries:

- Xiaomi is taking market share continuously in the midrange to high-end smartphone segment. Amid the AI smartphone opportunity, we believe Xiaomi will leverage its R&D strength in AI to accelerate its market share gains.
- We think Transsion will become the only smartphone OEM to offer AI features in the low-end segment. As a result, it could also take market share.

Greater China Technology Hardware (Derrick Yang)

Displays – BOE Technology (000725.SZ, OW)

For AI smartphones, though displays are not directly associated with computing power and AI function, we believe that they will need to be more power-efficient and carry thinner form factors to help enhance battery life and/or leave precious room for larger battery capacity. In that sense, we think high-end display technology such as OLED (Organic Light Emitting Diodes) should be the preferred solution, given its simpler structure than the traditional LCD displays. Moreover, within OLED displays, offerings based on LTPO (Low Temperature Poly Oxide) based offerings should gain more traction, since it can deliver better power efficiency over the LTPS (Low Temperature Poly Silicon) based displays.

Within our coverage, we think BOE should be one of the key beneficiaries. It is leading peers in China in both OLED capacity and technology.

Cover lenses – Lens Technology (300433.SZ, EW)

We believe that cover lenses could also benefit from AI smartphone proliferation – they are what consumers will touch every time they pick up the device. We believe that premium feel, good surface treatment for better viewing experience (e.g., anti-glare, anti-grease, etc.) and strengthened structure to withstand shocks and scratches are all important features. As one of the leading cover lens suppliers, Lens Tech should ride the tailwind. However, we think growth potential already appears priced in.

Greater China Technology Hardware (Howard Kao)

Within our coverage, Yageo is within the Apple and Android smartphone supply chains.

Yageo (2327.TW, OW)

We think Yageo is well positioned as a global passive component supplier with a comprehensive product portfolio. Stronger smartphone replacement demand should bode well for Yageo's passive component business, coming from iPhone and Android, especially now that inventory digestion has ended.

Japan – Semiconductor Production Equipment (Tetsuya Wadaki)

Advantest (6857.T, OW) and Disco (6146.T, OW)

Application Processors (AP) for AI smartphones are becoming bigger and require more testers: Processors for AI smartphones will have more cores, such as Nuro Core, than traditional processors. As a result, yield decreases because of the increased area of the device. Increasing the number of cores leads to longer test times. Therefore, in the SPE industry in Japan, Advantest will benefit greatly.

AP for AI smartphones need more memory: Also, the area of the device is even larger because memory capacity is required to perform AI processing, and memory inside the processor needs to be increased to perform processing at high speed.

Memory could be stacked with AI AP: In order to prevent device area expansion, it is also possible to stack the processor and memory with hybrid bonding. We think a promising option for next-gen DRAM for AI is stacked architectures using Cu hybrid bonding with processors via the wafer-on-wafer (WoW) or chip-on-wafer (CoW) process.

3D-IC is about to ready for AI AP: Powerchip Semiconductor Manufacturing (PSMC, covered by Ray Wu) is working on commercializing such technology. In 3D-stacked memory and processors, AMD (covered by Joseph Moore) has rolled out products that use 3D V-cache technology using hybrid bonding to stack MPUs and SRAM.

Impact on Japan's SPE industry: Known good die (KGD) selection will be more important, so the tester market could grow further as bare die testing gains traction. This is also positive for Advantest, which handles memory testers. We expect DISCO's grinders to be used in the stacking process.

US Semiconductors (Joseph Moore)

Qualcomm (QCOM.O, EW)

Qualcomm provides key AI semi blocks needed for on-device AI smartphones, and the edge AI theme has been central to QCOM's relative multiple expansion over the last six months: While AI features like voice control, face recognition, and photo tagging have been on phones for years, most of the features thus far have been cloud-based. Smartphone vendors are eager to drive a hardware replacement cycle, and implementing LLM inference in local phones will require much more expensive processors and hardware. We see the potential here for Qualcomm, and the re-rating around this theme is appropriate because any features that can shorten replacement cycles would be positive. However, we highlight that this is an evolution that has been in progress for several years, and enthusiasm for more powerful processors in flagship tier phones has already driven strong content gains that are a persistent feature of the market.

Apple has consistently been a +20% customer, and we see Qualcomm as well positioned in the near term to monetize the coming cycle as a provider of Apple's baseband and RF components. Apple is a key customer for Qualcomm, and we expect the stronger iPhone replacement cycle to be a positive catalyst for the stock.

In the longer term, we remain somewhat cautious as Qualcomm's messaging remains that it will lose Apple's baseband business. Reports on this are conflicting and Apple has struggled in the past, but our base case remains that Qualcomm will lose 80% share in 2026.

Qorvo (QRVO.O, OW) and Skyworks Solutions (SWKS.O, EW)

As suppliers of key RF modules, Qorvo and Skyworks will also be beneficiaries of a stronger smartphone cycle: Both companies have spoken about how higher RF performance is needed to meet the latency, power, and connectivity requirements of AI. While we have been more skeptical on the AI-RF relationship, and see the opportunity as more on the processor side, we think AI could be a meaningful tailwind to the extent that it drives a significant upgrade cycle.

Skyworks is the most Apple-exposed company in our coverage, with Apple being 68% of its revenue last quarter. However, we rate the stock EW because we continue to be disappointed by its content growth. Skyworks has lost meaningful content in the iPhone 16, and headwinds are expected to last into 2025. Our preferred RF play is Qorvo – we continue to see a clearer path to earnings recovery and content growth remains strong.

We raised our price targets for our US smartphone plays in our weekly report.

Europe – Tech Hardware (Lee Simpson, Nigel van Putten)

ARM (ARM.O, EW) and STMicroelectronics (STMPA.PA, OW)

Arm's Edge AI focus is emerging fast: Apple's recent WWDC24 event underlined our belief that Arm's AI strategy is centred on leveraging its leadership in mobile devices to become the architecture of choice for Edge AI applications. We think Arm's introduction of new scalable matrix extensions (SMEs) in the application processor (as part of Armv9.2)

will be adopted by Apple, across iOS devices at least, this year. These SMEs enable enhanced parallel processing capabilities along with power and computing optimisation, which are crucial for performing AI functions on-device. We believe the use of such extensions to perform a greater portion of AI-related workloads on Arm-designed application processors may be the future direction of travel going , therefore embedding Arm's value proposition/importance within hardware designed for edge AI functionality. Should our forecasted AI-driven growth in smartphone sales materialise, this could represent a meaningful boost to royalty revenue for Arm, both in terms of greater volume and greater complexity providing the opportunity to charge a higher royalty rate. However, we think growth potential already appears priced in.

STMicro could get a boost from the iPhone replacement cycle, contingent on price negotiations: As of 1Q24, STM's personal electronics business made up c. 20% of group revenue. A key customer for STM in personal electronics is Apple, with STM providing a range of chips relating to power management, wireless charging, and motion sensing, as well as microcontrollers. These chips are used in Apple products such as iPhones, iPads, AirPods, and Apple Watches (with iPhones representing the lion's share at c. 70%). In 2023, we estimate that Apple revenue represented c. 60% of STM's personal electronics business, thus contributing c. 12% of total group sales. The forecasted (AI-driven) enhanced iPhone demand has the potential to boost STM's iPhone-related revenue. We do note, however, that our estimates of the dollar content of STM chips in the iPhone have declined since the launch of the iPhone 15.

Ultimately, the extent to which STM can realise greater iPhone-related revenue growth will depend on negotiations around the ASP for STM's chip content in the iPhone 16 series.

Soitec should benefit from a pickup in high-end smartphone volumes: Soitec's mobile communications business accounts for c. 60% of fiscal 2024 revenue and should benefit from stronger volumes of smartphones sold, especially at the premium end. Soitec has exposure to both the IOS and Android supply chains, although we get the sense that the near-term opportunity in Android is slightly larger (given adoption of POI and higher RF-SOI content). However, Soitec should not only benefit from higher volumes but also enjoy a content increase as the (potential) explosion of mobile data traffic requires more and more sophisticated, filters and antennas that are enabled by Soitec's RF-SOI and POI technologies.

Is the AI PC Stock Rally a Good Leading Indicator for AI Smartphone Plays? We Think So

Why Copilot is a significant positive driver of AI PCs

We believe Copilot, a generative artificial intelligence chatbot developed by Microsoft, will be a significant driver for AI PCs. It could materially enhance creativity and productivity, and is integrated into most Microsoft office apps, including Word, PowerPoint, Excel, Outlook, and Teams.

Microsoft provided some early Copilot feedback at our March 2024 TMT Conference, including:

1. Users running Copilot are already seeing evidence of productivity time savings (over 10 hours per month).
2. 70% of users are saying it is helping them become more productive.
3. Copilot is helping users become almost 30% faster in their work,
4. 77% of users who use Copilot for more than three weeks say they don't want to go without it.
5. Copilot is still being tested within a small group of users, but Microsoft is engaging with customers to help to deploy it at an organizational level (to see which functions need to use it and how to allocate budget to this, etc).

Currently the three most common use cases for Copilot are: 1) integrating chat into improved information retrieval, 2) transcript creation for Teams meetings, and 3) summarizing reading/writing emails in Outlook.

To date, Copilot has run on the cloud, but as of June 18, Microsoft has brought Copilot to the Edge with Microsoft Copilot+ via its own Surface-branded devices as well as devices from most major non-Apple PC OEMs, including Acer, ASUS, Dell, HP, and Samsung. With the extension from Cloud AI to Edge AI, Microsoft says it should remove previous limitations on things like latency, cost, and even privacy to help productivity, creativity, and more effective communication.

On a Copilot+ PC ,users will get access to:

1. Recall, which allows users to access an AI assistant to find locally stored data/ information across different applications, websites to documents;
2. Cocreator, a photo and image tool that uses AI algorithms to generate and/or enhance images;
3. Live Captions, allowing audio translation in real time; and
4. GPT-4o, among a number of other features and integrations with Adobe (Photoshop, Lightroom, Express, Illustrator and Premiere Pro), DaVinci Resolve, CapCut, Cephable, LiquidText and djay.

Why Apple Intelligence is a significant positive driver for AI smartphones

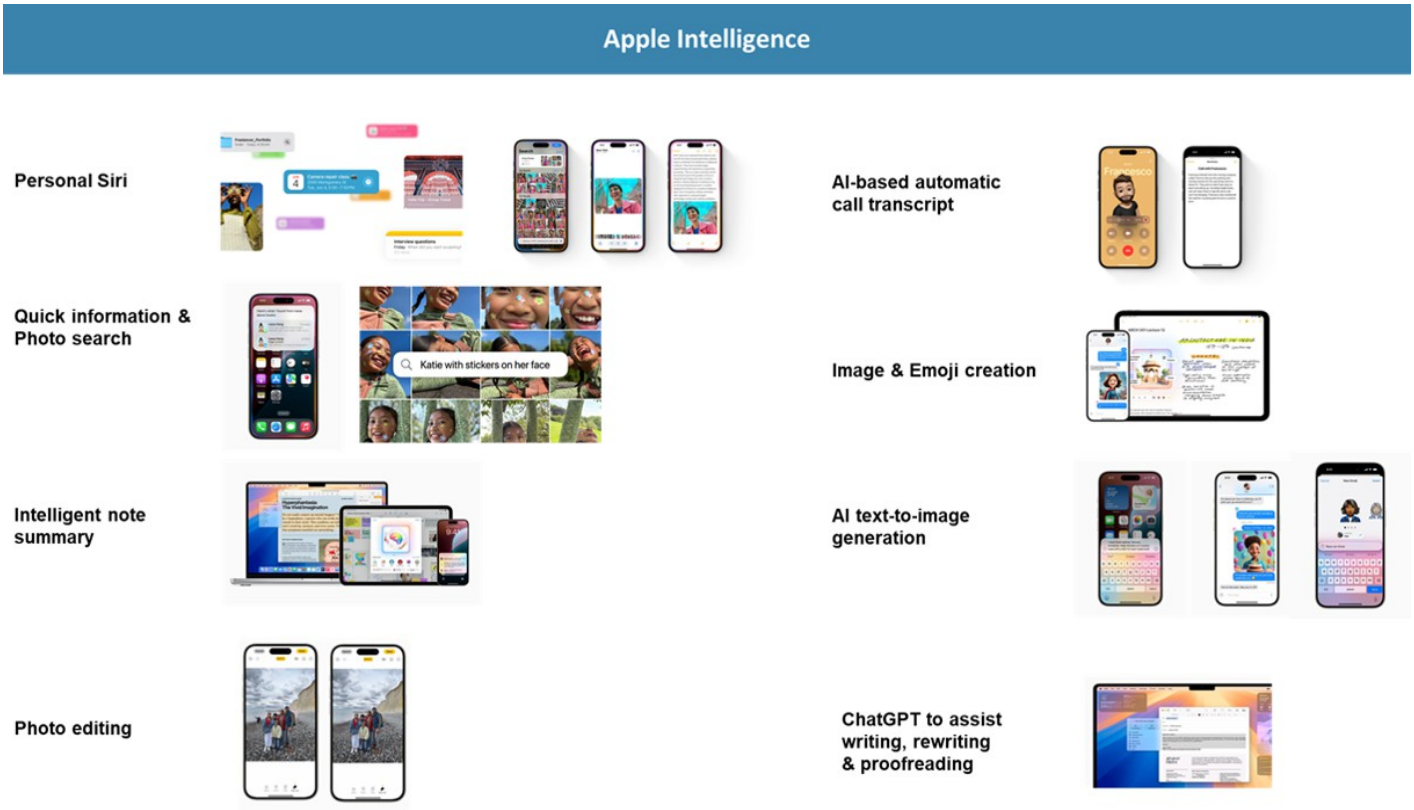
For AI smartphones, most investors are asking what the killer app will be. We believe the upcoming Apple Intelligence, to be launched in Sep/Oct 2024, is likely to become the killer app and initiate the AI Smartphone Era. This is because Apple Intelligence is powered by Apple's in-house, on-device LLMs, though in the case of more complex queries that require greater computing power, Apple Intelligence will utilize Apple's Private Cloud Compute, a new and more secure cloud powered by Apple Silicon.

In addition to Apple's new in-house-developed GenAI features, Apple announced the integration of OpenAI's ChatGPT into Apple Intelligence for the most broad and complex user queries. We believe those innovations could bring a more natural, relevant and voice-activated personal experience to users. The new GenAI-enabled Siri features (powered by Apple Intelligence) include better natural language processing (seamlessly switching between text and voice to communicate with Siri) and on-screen awareness, more widely integrated automation, and new in-app command/control actions that should make all of Apple's default apps better/more useful.

While integration of Siri and Apple Intelligence is initially limited to first-party apps this fall, software development kits have been updated with new APIs that should allow developers to integrate Apple Intelligence into third-party apps as early as this fall.

According to our Apple analyst, Erik Woodring, given that Apple has the most valuable consumer app distribution platforms, we believe software developers are likely to leverage these APIs to better differentiate vs. peers, which should ultimately benefit Apple through a better user experience.

Exhibit 25: Apple Intelligence highly likely to become a killer app and initiate the AI Smartphone Era



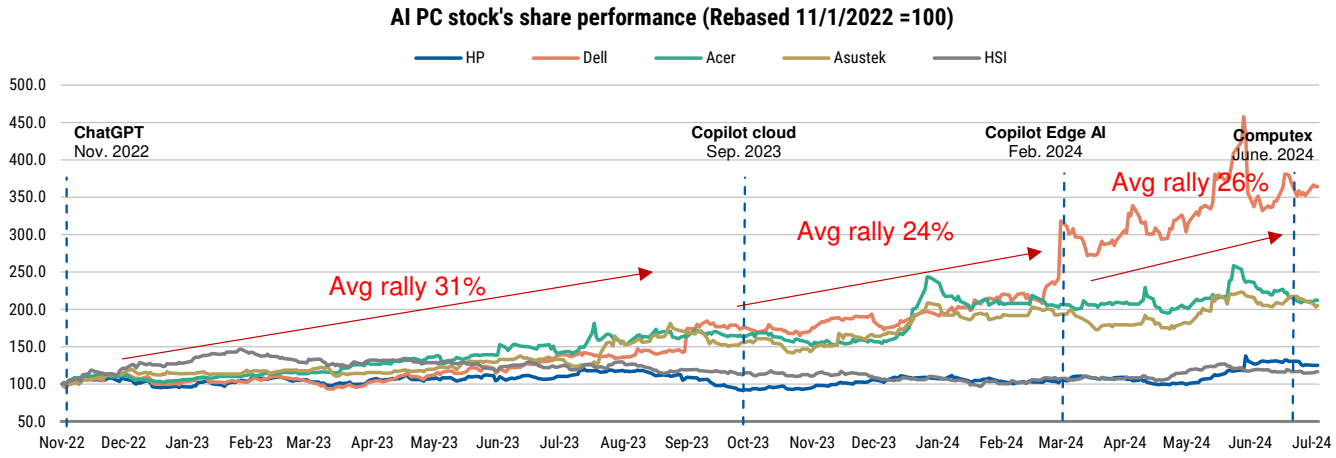
Source:Apple, Morgan Stanley Research

Why AI PC stocks' rally is a good leading indicator for AI Smartphone plays

By tracking the performance of AI PC stocks in our coverage since November 1, 2022, AI PC stocks have rallied 127% (Exhibit 26).

- From the ChatGPT launch in November 2022 to Copilot cloud's debut in September 2023, they rose 31% on average.
- From Copilot cloud's debut to CoPilot Edge release in February 2024, these stocks gained a further 24%.
- From Copilot Edge's release to Computex in June 2024, they rose a further 26%.

Exhibit 26: AI PC stocks' performance (rebased November 1, 2022=100)



Source: Factset, Morgan Stanley Research

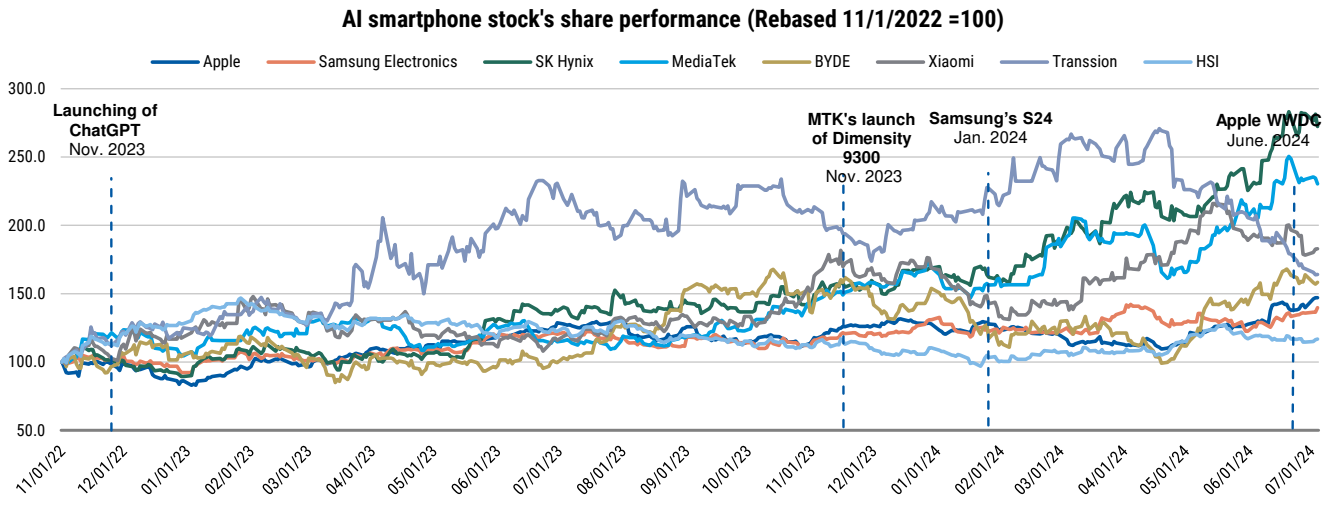
Note: Share prices of the AI smartphone stocks are indexed based on the share price of respective stocks on November 1, 2022 (Rebased November 1, 2022=100). Therefore, the absolute value in the vertical axis refers to the share price outperformance or underperformance measured against the share price on November 1, 2022.

AI Smartphone stocks have relatively underperformed given a lack of killer apps, but we think they are likely to outperform thanks to Apple Intelligence's debut

Looking at the stock performance of AI smartphone stocks in our coverage over the past two years, they have shown better performance since the ChatGPT launch (+40% return on average). However, AI Smartphone stocks had relatively weaker performance following MediaTek's first AI SoC launch.

Given that we expect Apple Intelligence to become the killer app for AI smartphones, it could have a similar or even more significant positive impact on the stock performance vs. Copilot's impact on AI PC stocks. As a result, we expect AI smartphone stocks to show material upside from the current level.

Exhibit 27: AI smartphone stocks' performance (rebased November 1, 2022=100)



Source: Factset, Morgan Stanley Research

Note: Share prices of the AI smartphone stocks are indexed based on the share price of respective stocks on November 1, 2022 (rebased November 1, 2022=100). Therefore, the absolute value in the vertical axis refers to the share price outperformance or underperformance measured against the share price on November 1, 2022.

Exhibit 28: AI smartphone stocks' performance

Event	Apple	Samsung Electronics	SK Hynix	MediaTek	BYDE	Xiaomi	Transsion	HSI	Average
Launching of ChatGPT	21%	14%	56%	20%	43%	51%	71%	-3%	40%
MTK's launching of first AI smartphone SoC	5%	1%	2%	2%	-15%	-14%	1%	-14%	-3%
Samsung's S24	2%	6%	53%	42%	15%	32%	-11%	19%	19%
Apple WWDC	15%	11%	10%	8%	6%	-4%	-13%	-2%	4%

Source: Factset, Morgan Stanley Research

Note: This table measures the share price performance followig the event. For example, launch of ChatGPT triggered share price rallies of 21% for Apple, 14% for Samsung Electronics, 56% for SK Hynix, etc.

Raising Global Smartphone Shipment Forecast

We now embed the impact of AI smartphones into our smartphone model, and continue to forecast a return to shipment growth in CY24: Alongside our AI smartphone analysis, we update our smartphone model for: 1) better-than-expected 1Q24 results, and 2) stronger refresh demand driven by the emergence of AI smartphones.

In 1Q24, global smartphone shipments totaled 300mn units (+12% Y/Y), 9% ahead of our estimate. These regions outperformed our expectations:

- EMEA (+20% Y/Y vs. +2% Y/Y MSe),
- Asia ex-China/India (+11% Y/Y vs. +6% Y/Y MSe),
- LatAm (+23% Y/Y vs. +6% Y/Y MSe),
- China (+6% Y/Y vs. -3% Y/Y MSe), and
- India (+11% Y/Y vs. +10% Y/Y MSe)

However, shipments in North America (-4% Y/Y vs. +3% Y/Y MSe) came in below MSe (Exhibit 29).

At the OS level, Android shipments grew 16% Y/Y in 1Q24, while iPhone shipments were down 5% Y/Y.

In the March quarter, the five largest global smartphone unit share gainers were:

1. Transsion (+3.8 points Y/Y),
2. Xiaomi (+2.2 points Y/Y),
3. Huawei (+1.7 points Y/Y),
4. Honor (+0.8 points Y/Y), and
5. Lenovo (+0.4 points Y/Y).

Within the Chinese market specifically, Huawei was the largest share gainer at +8.4 points Y/Y, bringing its unit share to a three-year high of 17.0%. Oppo ceded the largest share at -3.7 points Y/Y, bringing its total smartphone share in China to 13.5% (Exhibit 30).

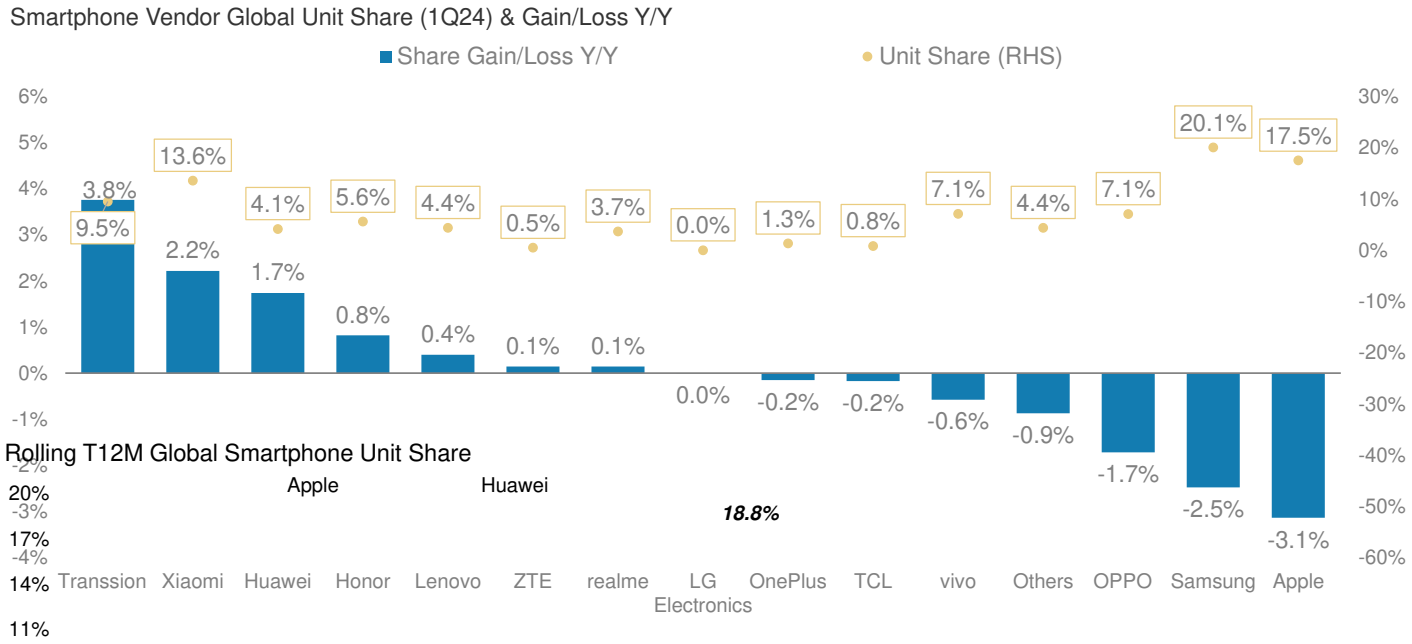
We continue to expect a modest recovery in the smartphone market in 2024 and forecast 4.5% Y/Y unit growth, up from our prior forecast of +3% Y/Y, and an improvement from the 3% Y/Y declines observed in 2023, with Android vendors outperforming Apple, in line with our Fall 2023 Global Smartphone Survey.

Our stronger 2024 outlook is driven by the 9% beat in 1Q, a slightly more positive outlook for China (+2% Y/Y vs. flat Y/Y previously), and the emergence of AI smartphones, which we expect to be a more material driver in 2025.

For 2025, we forecast smartphone shipments to reach nearly 1.3bn units, up 5.5% Y/Y (vs. +4.4% Y/Y previously), a ~1 point acceleration from 2024. Our new 2025 Smartphone forecast assumes iPhone shipments grow 9% Y/Y in CY25, to 244M while Android smartphone shipments grow 5% Y/Y, to 1,040M.

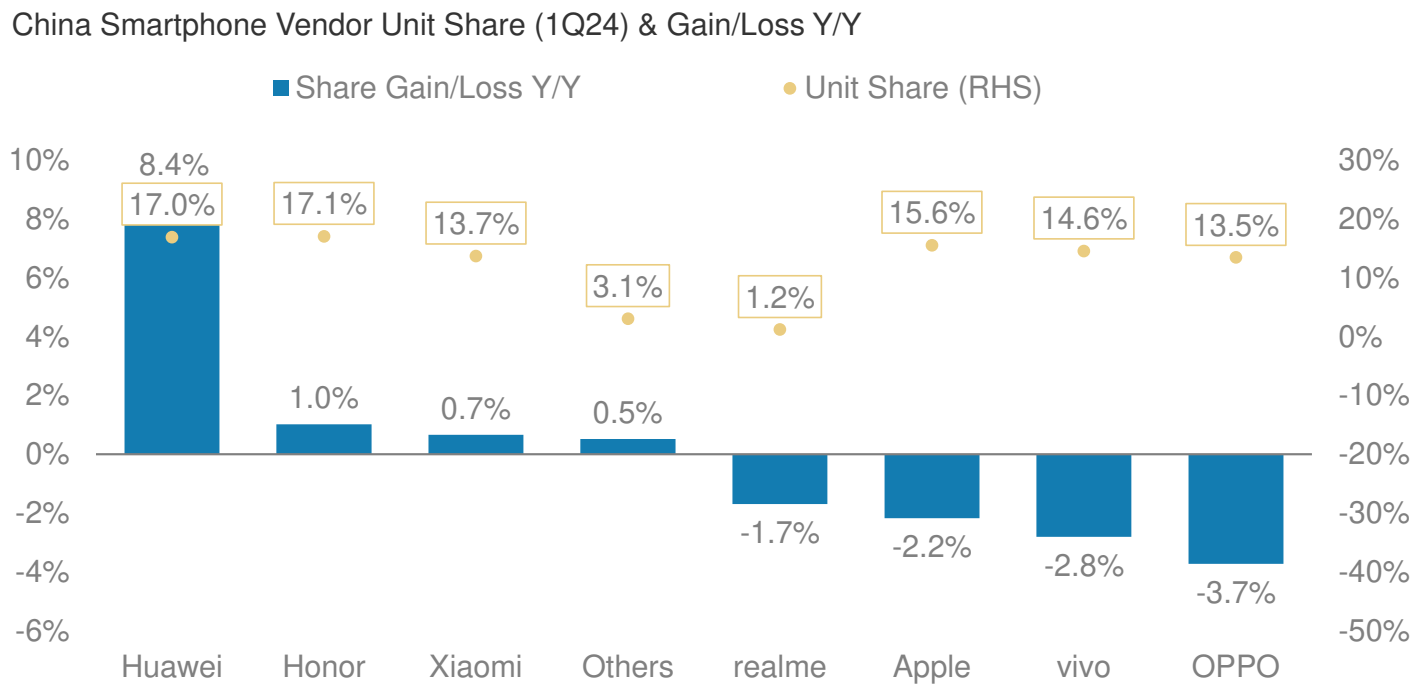
We believe that AI smartphones will become critical to smartphone market growth, driving stronger refresh demand and supporting a multi-year upgrade cycle, while also supporting higher blended ASPs. As a result, we now model total smartphone ASPs growing 6% Y/Y in CY25, up from just 2% Y/Y growth in our prior forecast, which combined with our stronger unit growth outlook (+5.5% Y/Y vs. +4.4% Y/Y previously), drives our $605B smartphone TAM (+11% Y/Y vs. +6% Y/Y previously; Exhibit 31).

Exhibit 29: In the March quarter, Transsion, Xiaomi, Huawei and Honor were the largest market share gainers, while Apple and Samsung were the largest share losers.



Source: IDC, Morgan Stanley Research.

Exhibit 30: In the March quarter, Huawei regained 8 points of share Y/Y in the Chinese market, bringing unit share to 17%.



Source: IDC, Morgan Stanley Research

Exhibit 31: We raise our CY24 and CY25 smartphone shipment growth forecasts 1-1.5 points, to +4.5% Y/Y and 5.5% Y/Y, respectively.

SMARTPHONE MODEL	1Q24 Act.		CY24 Est.		CY25 Est.	
Units (M)	Act.	Est.	New	Old	New	Old
Rest of Asia/Pacific	44	42	172	171	180	178
PRC	69	63	276	270	289	280
EMEA	86	73	338	324	351	331
North America	32	35	143	144	150	147
Latin America	35	30	133	129	138	133
India	34	34	155	161	177	183
Global Total	**300**	**276**	**1,217**	**1,199**	**1,284**	**1,252**

SMARTPHONE MODEL	1Q24 Act.		CY24 Est.		CY25 Est.	
Y/Y Unit Growth	Act.	Est.	New	Old	New	Old
Rest of Asia/Pacific	11%	6%	5%	4%	4%	4%
PRC	6%	-3%	2%	0%	5%	4%
EMEA	20%	2%	6%	2%	4%	2%
North America	-4%	3%	2%	3%	5%	2%
Latin America	23%	6%	7%	4%	3%	3%
India	11%	10%	7%	11%	14%	14%
Global Total	**11.8%**	**2.8%**	**4.5%**	**3.0%**	**5.5%**	**4.4%**

SMARTPHONE MODEL	1Q24 Act.		CY24 Est.		CY25 Est.	
	Act.	Est.	New	Old	New	Old
ASPs	**$435**	**$450**	**$446**	**$445**	**$471**	**$452**
Y/Y ASP Growth	-5%	-2%	0%	-1%	6%	2%
Revenue (M)	**$ 130,749**	**$ 124,161**	**$ 543,383**	**$ 533,444**	**$ 605,405**	**$ 565,667**
Y/Y Revenue Growth	6%	1%	4%	2%	11%	6%

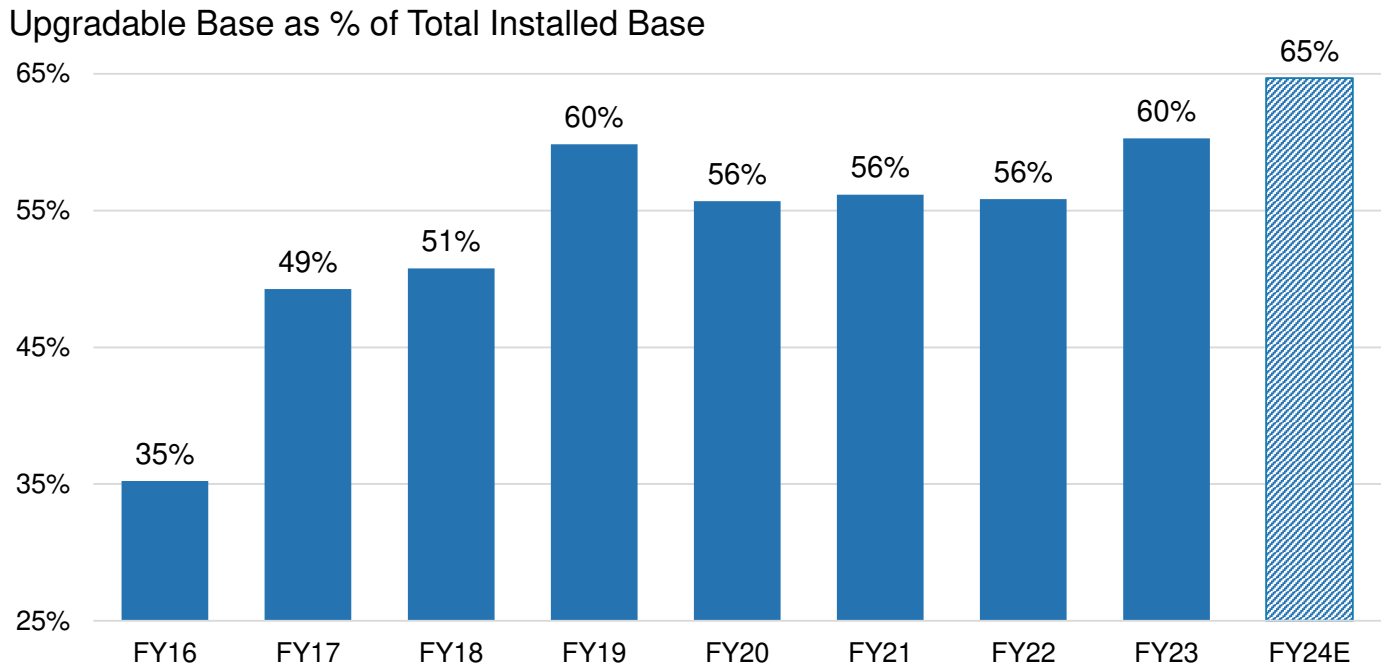
Source: IDC, Morgan Stanley Research estimates

iPhone replacement cycle to accelerate with Apple Intelligence

Pent-up demand and Apple Intelligence, Apple's new personal intelligence system, are key drivers of accelerating iPhone replacement cycles: We estimate that there is pent-up demand entering the iPhone 16 cycle later this year – iPhone replacement cycles exiting F24 will reach an estimated all-time high of 4.8 years, with the primary iPhone installed base nearly 30% higher than F20 levels but annual iPhone shipments ~10% lower than the F22 peak.

Furthermore, we estimate that of the iPhone installed base, nearly 700mn iPhones (or 65%) are 3+ years old (iPhone 13 family and older), implying the largest iPhone upgradable base in history, ripe for refreshing (Exhibit 32).

Exhibit 32: We estimate that 65% of Apple's iPhone installed base exiting F24 will be three or more years old...



Source: IDC, Morgan Stanley Research Estimates

At WWDC in June, Apple officially unveiled Apple Intelligence, Apple's new personal intelligence system powered by in-house developed LLMs and complemented by an OpenAI partnership/Chat GPT-4o integration.

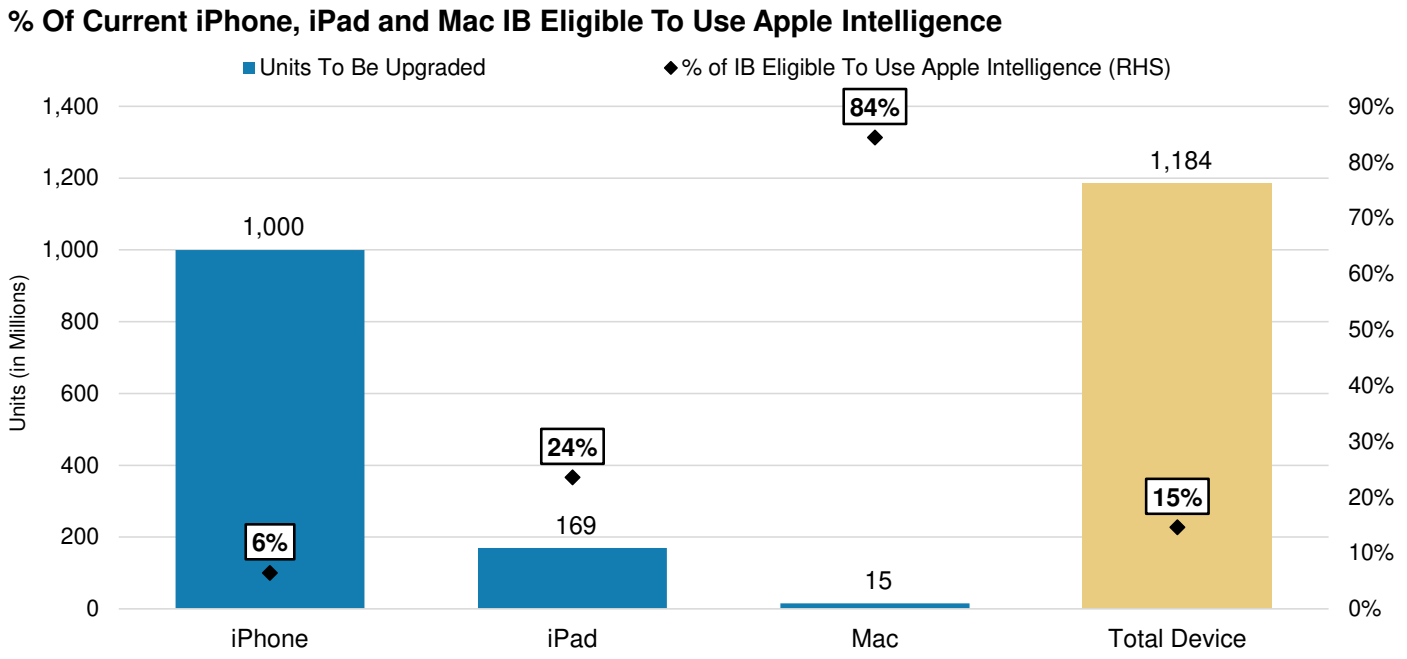
Apple Intelligence will be available only to US English users this year, with a broader rollout of new language updates to come in future, which we see as key to broader adoption/device refreshes.

We also learned that Apple Intelligence will be available only on devices with the A17 Pro and M-series chips, making this cycle the first time Apple has limited backwards compatibility to this important and broad-based set of hardware features.

While over 80% of the Mac installed base runs on the M-series chip, there are only 52mn iPads (25% of the iPad installed base) and 69mn iPhones (6% of the iPhone installed base) in the world today that can power Apple Intelligence.

This means that ~1,200mn iPhones, iPads, and Macs would need to be upgraded to support Apple intelligence, over 4x larger than the total iPhone, iPad, and Mac shipments we estimate Apple will reach in F24 (Exhibit 33).

Exhibit 33: We estimate that only 15% of the current Apple device installed base is capable of supporting Apple Intelligence.



Source: IDC, Morgan Stanley Research

We raise our F25 and F26 iPhone shipment forecasts 4% and 10%, respectively: Taking into account a large and aged iPhone installed base in need of refresh and the limited backwards compatibility of Apple Intelligence, we believe that Apple has the building blocks in place to drive a multi-year device refresh cycle starting in F25, similar to the iPhone 12 5G cycle in F21. Using an iPhone "upgradable base" of ~700mn devices (3+ years old or ~65% of the installed base), we assume iPhone upgrade intentions will reach 31% in FY25, which assumes upgrade intentions in the US reach 36%, up from 31% in our 2023 Smartphone Survey, and an all-time high given the emergence of Apple Intelligence and lack of backwards compatibility.

Outside of the US, we assume that upgrade rates average 29% for F25, below upgrade intentions in the US given the initial limited rollout of Apple Intelligence to US English devices. Furthermore, we assume:

1. That iPhone retention rates reach 83% globally (US at 94% and ROW at 76%, consistent with what we've seen in our survey data) and
2. That Apple adds ~55M new iPhone users in F25, a magnitude similar to the F21 iPhone 12 cycle.

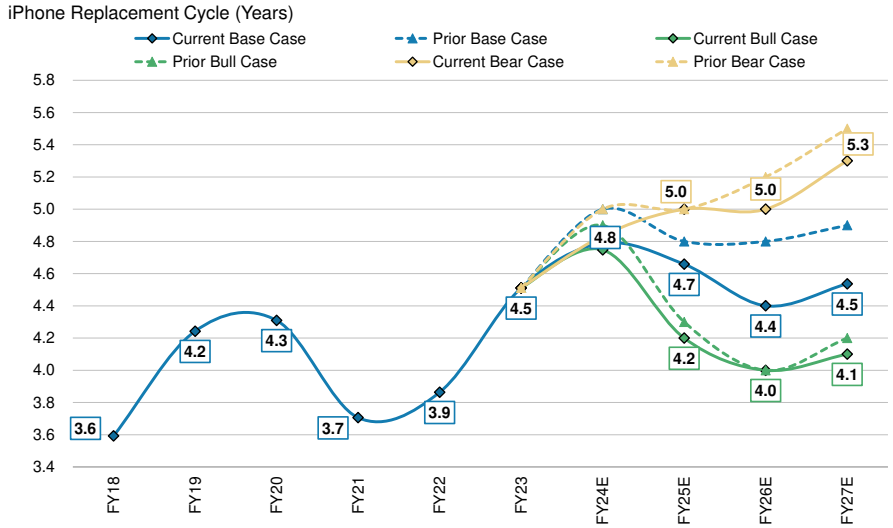
Taken together, we now estimate that Apple ships 235mn iPhones in F25, 4% above our prior 227mn forecast, and 2% above consensus at 230mn. This implies that the iPhone replacement cycle contracts from 4.8 years in F24 to 4.7 years in F25 (Exhibit 34).

As we look to F26, we assume the iPhone replacement cycle accelerates further as:

1. A "true AI iPhone" comes to market with the launch of the iPhone 17 family, and
2. Apple Intelligence rolls out to new languages/regions, is integrated with more third-party apps, and expands partnerships to other foundational model providers.

As a result, we estimate that the iPhone replacement cycle contracts 0.3 years Y/Y in F26, to 4.4 years. This implies that iPhone shipments reach 262mn in F26, 10% above our prior forecast of 239mn and 12% above consensus at 235mn units.

Exhibit 34: We now forecast iPhone replacement cycles shortening 0.1 years Y/Y in FY25, to 4.7 years (vs. 4.8 years prior) and another 0.3 years Y/Y in FY26, to 4.4 (vs. 4.8 years prior).



Source: Morgan Stanley Research

Debate 1: OEM vs. Supply Chain – Which Segments Are Better Positioned?

Market view – supply chain > smartphone OEMs: Thanks to the incremental AI features, smartphone supply chain companies will be able to capture the spec upgrade opportunity with better revenue and earnings growth outlook. However, in view of rising BOM cost, smartphone OEMs will face challenges in passing through rising costs. As a result, supply chain companies will be better positioned than smartphone OEMs.

Our view – we partially disagree: We agree that supply chain companies that can benefit from spec upgrades will enjoy upside. However, we disagree that smartphone OEMs will face challenges in passing through the costs. In our view, when new features are attractive to consumers, rising ASP is unlikely to have a negative impact on shipment volumes. Our analysis of the 2021 5G upgrade cycle suggests that smartphone OEMs jointly raised ASPs to pass through the higher BOM cost, but their gross margins didn't show industry-wide deterioration. Instead, Apple, Samsung, and Xiaomi achieved margin improvement together with higher ASPs.

In the upcoming AI Smartphone Era, we believe smartphone OEMs will be able to pass through the rising BOM cost. As a result, they are less likely to underperform supply chain companies because of cost concerns. Besides this, smartphone OEM companies are likely to establish new ecosystems via the AI smartphone products, so they could have more significant upside potential than the supply chain companies during the new product cycle.

Apple's supply chain players are well positioned to benefit from the AI Smartphone Era

If iPhone shipments can improve in the following quarters, we think Hon Hai, Largan, Luxshare, Genius, AAC and FII could be among the key beneficiaries given large revenue exposures to iPhone (Exhibit 35).

Among iPhone supply chain stocks we cover, we like **Hon Hai** the most for dual growth drivers (iPhone assembly + AI servers). We expect Hon Hai to retain its iPhone assembly share at ~63%, given its solid time-to-market delivery and accelerated output from new production sites in India. The rise in the mix of iPhone Pro/Pro Max, for which Hon Hai is the major assembler, should also lift blended ASP.

We think **Pegatron** may also benefit slightly – it has had dual model exposure, iPhone Plus and iPhone Pro models, in the past. Pegatron may also benefit from new a new iPhone SE 4 that could come out in spring 2024, based on a recent news article. While overall volumes should ultimately benefit Pegatron, a higher proportiom of Pro/Pro Max models would benefit Hon Hai more than Pegatron, because Pegatron is the main source for the iPhone Plus model, but only a second source for the iPhone Pro model. So we

raised earnings estimates because we believe Pegatron will benefit from higher volumes and larger scale and scale leverage, but stay EW on the stock.

Exhibit 35: iPhone supply chain

Apple Product	Company	Ticker	Product	Rating	Share price (LC)	2024e sales contribution				
						Total iPhone	iPhone (Low-end)	iPhone Pro (High-end)	iPhone SE	Legacy iPhones
	Zhen Ding	4958.TW	FPC/PCB	E	153.00	**70-75%**	20-25%	20-25%	5-10%	10-15%
	Pegatron	4938.TW	Assembly	E	105.50	**50-55%**	15-20%	0-5%	5-10%	20-25%
	Hon Hai	2317.TW	Assembly	O	225.50	**40-45%**	10-15%	15-20%	<5%	5-8%
	Largan	3008.TW	Lens	O	3,200.00	**40-45%**	10-15%	15-20%	0-5%	5-10%
	Genius	3406.TW	Lens	O	600.00	**30%**	5-10%	10-15%	0-5%	5-10%
	Kinsus	3189.TW	IC substrate/PCB	U	109.00	**20-25%**	5-10%	10-15%	0-5%	0-5%
	NYPCB	8046.TW	IC substrate/PCB	U	186.50	**~5%**				
	Unimicron	3037.TW	IC substrate/PCB	U	189.50	**15-20%**	5-10%	5-10%	0-5%	0-5%
	GIS	6456.TW	Touch module	E	72.10	**0-5%**	0%	0%	0%	0-5%
	Wistron	3231.TW	LCM	O	108.00	**0-5%**	0%	0%	0-5%	0-5%
	TSMC	2330.TW	AP foundry	O	1,080.00	**15-20%**	10%	5-8%	1%	1%
	Tong Hsing	6271.TW	3D sensor wafer processing	E	159.50	**10-12%**	3-5%	0-3%	3-5%	3-5%
	Delta	2308.TW	Power choke	O	434.00	**~10%**				
	Yageo	2327.TW	Passive components	O	797.00	**~5%**	0-5%	0-5%	0-5%	0-5%
	Win Semi	3105.TWO	VCSEL and PA foundry	O	180.00	**35-40%**	20%	10-15%	0-3%	3-5%
	AAC	2018.HK	Acoustics/haptics	O	34.35 HKD	**25-30%**	5-10%	10%	2%	5-10%
	Lingyi Itech	002600.SZ	Precision components	E	7.56	**30%**				
	Luxshare	002475.SZ	Acoustics/wireless charging/cable	O	41.78	**35-40%**	10-15%	5-10%	1-3%	8-10%
	FII	601138.SS	Metal casing	O	28.76	**25%**	5-10%	10-15%	<3%	<5%
	USI	601231.SS	UWB/WiFi/ALS/mmWave modeuls	O	17.02	**25-30%**	10-15%	8-10%	2%	2%
	Goertek	002241.SZ	Acoustics	E	21.95	**10-15%**	5%	5%	1%	3-5%
	Lens Tech	300433.SZ	Cover glass/casing	E	19.86	**35%**	15%	5%	7%	8%
	BOE	000725.SZ	OLED display	O	4.31	**~5%**	3%	0%	0%	2%
	Sunny Optical	2382.HK	Lens	O	48.20 HKD	**<5%**	1-2%	1-2%	<1%	1-2%
	LG Innotek	011070.KS	Camera module	O	286,500.00	**70-80%**	20-30%	20-30%	10%	0-10%
	LG Display	034220.KS	LCD display	E	12,940.00	**20-30%**	0%	5-10%	0%	0%
	Samsung SDI	006400.KS	Battery	E	389,500.00	**5-10%**	4-5%	4-5%	4-5%	4-5%
	Samsung	005930.KS	OLED display	O	87,600.00	**5-10%**	10%	5-10%	0%	5-10%
	JAE	6807.T	Connector	E	2,692.00	**20%**	7%	10%	2%	2%
	Minebea Mitsumi	6479.T	LED backlight/camera actuator	E	3,588.00	**20%**	3%	5%	6%	6%
	Murata	6981.T	MLCC/MetroCirc/WLAN	O	3,697.00	**20%**	5-10%	5-10%	2%	3%
	Alps Alpine	6770.T	Camera actuator/haptics	+	1,601.50	**20%**	5-10%	5-10%	2%	3%
	Sony	6758.T	CMOS sensor	O	15,380.00	**4-5%**				
	TDK	6762.T	Battery/sensor	O	10,985.00	**20%**	5-10%	5-10%	2%	3%
	Hirose	6806.T	Connectors	O	19,235.00	**10%**	4%	2%	1%	2%
	Taiyo Yuden	6976.T	MLCC	E	4,769.00	**10%**	4%	3%	1%	2%
	Kyocera	6971.T	MLCC/connector/cristal	E	1,985.50	**5%**	1-2%	1-2%	1%	1%

Source: Company data, Morgan Stanley Research; Priced as of July 11, 2024..

Exhibit 36: iPad supply chain

Apple Product	Company	Ticker	Product	Rating	Share price (LC)	2024e sales contribution
iPad	ASE	3711.TW	Fingerprint	E	193.50	Less than 1%
	TSMC	2330.TW	A/P foundry	O	1,080.00	~2%
	Win Semi	3105.TWO	VCSEL foundry	O	180.00	Less than 5%
	GIS	6456.TW	Touch module	E	72.10	60-65%
	Radiant	6176.TW	Backlight module	E	186.00	50-55%
	Unimicron	3037.TW	PCB/IC substrate	U	189.50	0-5%
	ZDT	4958.TW	FPC	E	153.00	10-15%
	Foxconn Tech	2354.TW	Casing	U	73.00	~10%
	Luxshare	002475.SZ	Casing/antenna	O	41.78	~5%
	Tong Hsing	6271.TW	CIS RW	E	159.50	Less than 5%
	Largan	3008.TW	Lens	O	3,200.00	Less than 5%
	Sunny Optical	2382.HK	Lens	O	48.20 HKD	<2%
	Compal	2324.TW	Assembly	E	35.30	10-15%
	Yageo	2327.TW	IC substrate	O	797.00	0-5%
	Hon Hai	2317.TW	Assembly	O	225.50	5-10%
	BYDE	0285.HK	Assembly, casing	O	37.15 HKD	35-40%
	BOE	000725.SZ	LCD DIsplay	O	4.31	0-5%
	Lens Tech	300433.SZ	Cover glass/casing	E	19.86	10-15%
	Parade	4966.TWO	T-con	U	883.00	10-15%
	AAC	2018.HK	Acoustics	O	34.35 HKD	Less than 5%
	GoerTek	002241.SZ	Acoustics	E	21.95	Less than 5%
	Lingyi Itech	002600.SZ	Precision components	E	7.56	5-10%
	LG Display	034220.KS	OLED Display	E	12,940.00	Less than 5%
	Nissha	7915.T	Touch sensor	O	2,039.00	22%
	TDK	6762.T	Battery	O	10,985.00	3%
	NDK	6779.T	Quartz unit	E	1,509.00	Less than 5%

Source: Company data, Morgan Stanley Research; Priced as of July 11, 2024.

What will Android do on the component side?

As for Android smartphone OEMs, we believe the spec upgrades will mainly focus on: 1) SoC; 2) memory, and 3) metal casings. We believe less effort will be spent on battery and thermal control given those OEMs have already made a lot of effort on performance improvement in the past.

SoC: We believe Android will accelerate the development of AI SoC. Qualcomm will likely launch the SnapDragon 8 Gen 4 in late 2024. MediaTek will launch its new AI SoC Dimensity 9400 in 2H24. Both have the ability to to support Android smartphone's new Edge AI features.

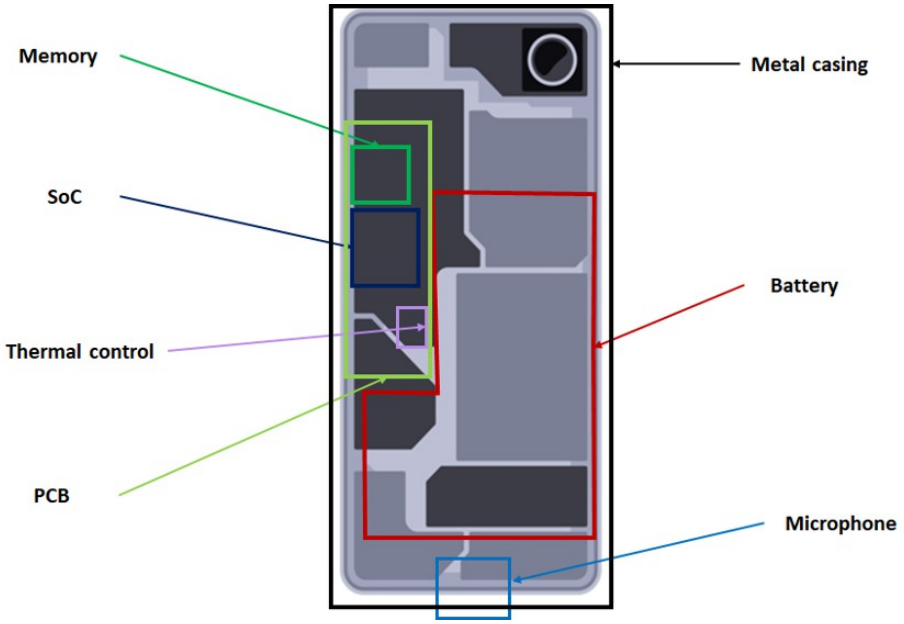
Memory: We believe Android is likely to be more aggressive on memory upgrades to ensure that AI smartphones can offer strong computing power in the new product cycle. We believe most Android OEMs will upgrade their memory benchmark from 8G to 12/16G. This should ensure a good user experience – good SoC + memory implies timely response from the device.

Metal casings: We believe Android is also likely to make some upgrades because they would improve thermal control. AI smartphones have more frequent computing tasks, so they generate more heat than traditional smartphones. Therefore, metal casing upgrades could offer support to the operation of AI smartphones.

Which components are likely to enjoy spec upgrades

We believe the following components are likely to get spec upgrades in the following 12-18 months: 1) SoC; 2) memory; 3) microphones; 4) PCB; 5) batteries, 6) thermal control, 7) metal casings; and 8) CIS.

Exhibit 37: Components that can be upgraded

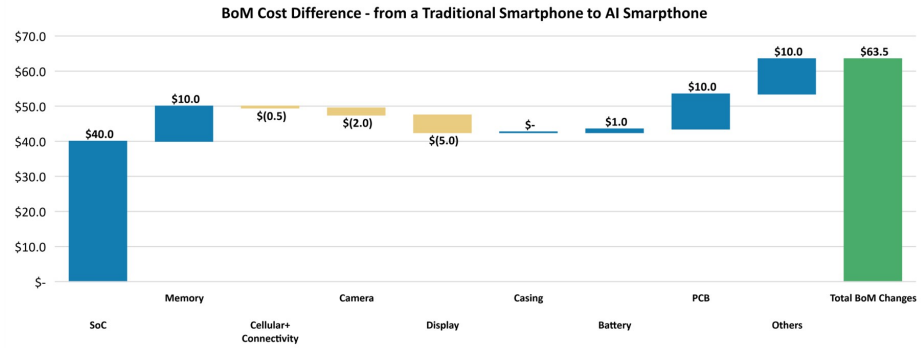


Source: Shutterstock, Morgan Stanley Research

Which components are likely to face BOM cost pressure

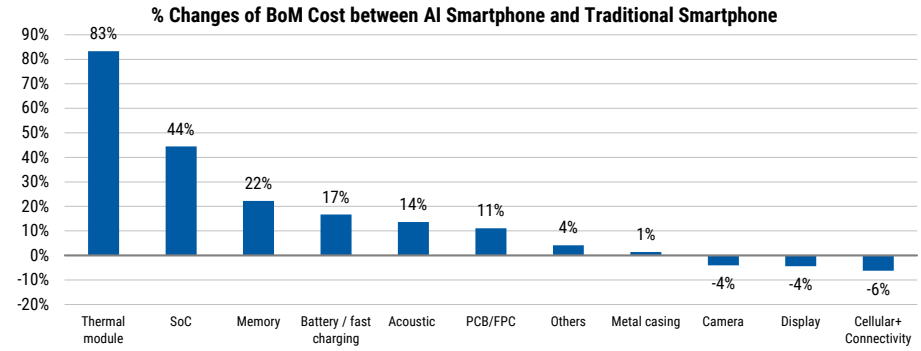
Assuming the component spec upgrades as above, we believe the smartphone BOM cost will increase. As illustrated in Exhibit 38 , if those key components show 5-20% cost increases due to spec upgrades, the overall BOM cost of an AI smartphone could be US $50-70 higher. This implies that components companies are likely to capture this growth opportunity and generate better earnings via higher ASP and shipment volume.

Exhibit 38: AI smartphones will carry higher BOM cost vs. traditional smartphones



Source: Morgan Stanley Research

Exhibit 39: AI smartphone BOM cost changes (%)



Source: Morgan Stanley Research

However, we also believe some components could face pressure because AI-related components' cost increase could squeeze other non-AI related components' space. We believe some components, such as cameras/lenses, displays, and cellular and connectivity are likely to delay some spec upgrades to allow AI-related component's spec upgrades.

A list of companies with potential positive and negative impact

In Exhibit 40 and Exhibit 41, we summarized a list of companies which can benefit from the potential spec upgrade. Meanwhile, we have also highlighted those components which cannot benefit from the AI upgrade in the near-term. They might either have neutral impact from spec upgrade or even face some downside pressures if other AI-related components' upgrades introduce overall BOM cost pressures.

Exhibit 40: Supply chain companies which can see positive or negative impact

Company	Ticker	Rating	Analyst	Positive/Neutral/Negaive	Is this Spec Upgrade a Signicant Positive Driver?	TP (LoC)	Upside
SoC							
MediaTek	2454.TW	OW	Charlie Chan	Positive	We expect AI smartphones to require more powerful APU computing capabilities, which will further increase the flagship smartphone penetration rate. As a result, it is a positive driver for MediaTek.	1,588	12%
Qualcomm	QCOM.O	EW	Joseph Moore	Positive	The majority of Qualcomm's handset revenue is from its SoCs. Qulacomm's new Snapdragon 8 Gen 4 will be its most powerful processor yet, and is expected to broaden on-device AI capabilities. The proliferation of AI smartphones will be a positive catalyst for Qualcomm as a key supplier to OEMS.	220	10%
TSMC	2330.TW	OW	Charlie Chan	Positive	TSMC is the key beneficiary of Edge AI demand, including AI smartphones. We believe any technology and node advance would be a positive growth driver for TSMC.	1,180	9%
Memory							
SK hynix	000660.KS	OW	Shawn Kim	Positive		300,000	24%
Samsung Electronics	005930.KS	OW	Shawn Kim	Positive	AI SOC requires higher DRAM content - positive for mobile DRAM. In the cae of Samsung Galaxy AI smartphones, increased on-device parameters from current 7bn to 35bn in the near future would require 4GB of additional DRAM content to support on-device computing.	105,000	20%
Nanya Tech	2408.TW	UW	Charlie Chan	Neutral	We think AI smartphone demand might not be able to generate a significant revenue contribution - Nanya Tech currently still has limited DDR5 production output.	58	-17%
PCB							
Zhen Ding	4958.TW	EW	Howard Kao	Positive	Key vendor for flexible PCBs, likely to benefit from increased F-PCB layer count to accommodate any changes to the design of the AP.	136	-11%
Unimicron	3037.TW	UW	Howard Kao	Positive	Key vendor for M2/M3 Ultra ABF substrates. If Apple's AI smartphone cycle is stronger than expected, there might be stronger need for Apple servers equipped with own M-series chip. Also may benefit from higher demand for mobile DRAM BT substrates.	120	-37%
Kinsus	3189.TW	UW	Howard Kao	Positive	One of the key vendors for BT substrates; may benefit from higher demand for mobile DRAM BT substrates.	75.5	-31%
NYPCB	8046.TW	UW	Howard Kao	Positive	Supplier of SiP substrates for iPhone camera modules and PCB interposers. Would benefit slightly from stronger-than-expected replacement cycle driven by Apple Intelligence.	135	-28%
Microphone							
AAC	2018.HK	OW	Andy Meng	Positive	Key vendor of MEMS microphones; thus, is well positioned to benefit from the industry spec upgrade. However, as the revenue exposure is <10%, we believe this upgrade is less likely to become a significant positive driver.	45	31%
GoerTek	002241.SZ	EW	Sharon Shih	Neutral	GoerTek has <5% revenue exposure to iPhone, but should be well positioned to benefit from overall acoustic design upgrade for AI applications in smartphones.	24	8%
Battery							
TDK	6762.T	OW	Shoji Sato	Positive	More than 50% market share at Apple. Shipments of higher-value-added silicon anode-type batteries will increase in the future.	9,700	-12%
Thermal Control							
Lingyi Itech	002600.SZ	EW	Sharon Shih	Positive	Lingyi handles processing work for graphite film into iPhone and supplies vapor chamberd (VC) for Android smartphones. If AI smartphones require further upgrade of thermal solutions, it will be positive for Lingyi's revenue and earnings.	7	-2%
Metal Casing							
FII	601138.SS	OW	Sharon Shih	Positive	FII is the major metal casing supplier for iPhone, with exposure highly geared to premium models (Pro/Pro Max). FII will thus benefit from iPhone replacement demand increase and model SKU upgrade for Apple Intelligence adoption.	34	19%
BYDE	285.HK	OW	Andy Meng	Positive	BYDE is the key metal casing partner of Apple. If AI smartphones require further upgrade of metal casing, it could increase the manufacturing complexity, which would be positive for BYDE's revenue and earnings. The revenue exposure is >10%, so we believe such a development is likely to become a significant positive driver on BYDE.	50	35%

Source: Morgan Stanley Research
Note: Upside is calculated as the difference between Morgan Stanley's price target and current price as of July 11, 2024.

Exhibit 41: Supply chain companies which can see positive or negative impact (cont'd)

Company	Ticker	Rating	Analyst	Positive/Neutral/Negaive	Is this Spec Upgrade a Signicant Positive Driver?	TP (LoC)	Upside
Assembly							
Hon Hai	2317.TW	OW	Sharon Shih	Positive	Hon Hai is the largest assembler for iPhone, and would benefit from a stronger-than-expected replacement cycle for Apple Intelligence. The rise in the mix of iPhone Pro/Pro Max, for which Hon Hai is the major assembler, will also lift blended ASP.	270	20%
Luxshare Precision	002475.SZ	OW	Sharon Shih	Positive	Luxshare is the second largest assembler for iPhone models and handles various key components (connectors, SiP modules, camera modules, wireless charging, etc). It will benefit from increased iPhone replacement demand.	49	17%
Pegatron	4938.TW	EW	Howard Kao	Positive	Pegatron is the second largest assembler for iPhone, and would benefit from a stronger-than-expected replacement cycle driven by Apple Intelligence, particularly if Apple Intelligence is also adopted on iPhone SE.	101	-4%
Lens/Camera							
LG Innotek	011070.KS	EW	Shawn Kim	Neutral	LGI benefits from higher adoption of folded zoom and super wide camera module upgrade to 48MP. This upgrade is not driven by AI features.	330,000	15%
Largan	3008.TW	OW	Andy Meng	Neutral	Largan is the largest lens supplier to Apple. However, we haven't observed significant spec upgrade driven by AI features.	3,800	19%
Genius	3406.TW	OW	Andy Meng	Neutral	Genius is the second-largest lens supplier to Apple. However, we haven't observed significant spec upgrade driven by AI features.	800	33%
Sunny Optical	2382.HK	OW	Andy Meng	Neutral	Sunny's lens exposure to Apple is much smaller vs. Largan and Genius.	59	22%
OFILM	002456.SZ	UW	Andy Meng	Negative	OFILM is the key partner of Huawei. If iPhone takes market share from Huawei, it is likely to face negative impact.	7	-24%
Glass component							
Lens Technology	300433.SZ	EW	Derrick Yang	Neutral	Major supplier for the iPhone cover lens, so it could benefit if iPhone sell-through is better, but no major change needed for the AI features.	19	-7%
CIS							
Sony	6758.T	OW	Kazuo Yoshikawa	Positive	Sony is the key image sensor supplier to iPhone. However, we don't expect significant spec upgrades driven by AI features.	16,000	4%
Will Semi	603501.SS	OW	Charlie Chan	Positive	Will Semi is the leading CIS module supplier to Huawei, Vivo, Oppo. and Xiaomi. AI will be a new feature for smartphone camera systems; thus, we believe Will Semi will supply AI smartphones with upgraded CIS.	120	14%
Display							
LG Display	034220.KS	EW	Shawn Kim	Positive	We estimate that LGD will capture 43% share of the iPhone 16 Pro/Pro Max OLED screens, driving higher utilization and margins.	10,000	-23%
BOE	000725.SZ	OW	Derrick Yang	Positive	Displays need to adopt more advanced technology like LTPO to be more power-efficient.	5	23%
Samsung Electronics	005930.KS	OW	Shawn Kim	Neutral	Samsung takes more than 50% share of the iPhone 16 OLED screens, but display revenues/profits are relatively small and less of a driver for overall earnings and the stock. Higher iPhone gains may be offset by Galaxy share loss.	105,000	20%
Wistron	3231.TW	OW	Howard Kao	Positive	Wistron is a key supplier for LCM (LCD Module Assembly) for iPhone SE, and will benefit from a stronger-than-expected replacement cycle driven by Apple Intelligence, particularly if Apple Intelligence is also adopted on iPhone SE.	168	56%
Semi Components							
Universal Scientific	601231.SS	OW	Daisy Dai	Positive	USI is an industry leader in SiP (System in Package) and a key partner of Apple. SiP technology enables product features such as high efficiency, light weight, low power consumption, and low latency. We view USI as a beneficiary if Apple gains share.	19	9%
Maxscend	300782.SZ	UW	Charlie Chan	Neutral	Maxscend is a Chinese RF supplier. We think Maxscend it may lose share with Samsung. Also, AI smartphones may provide limited benefits to Maxscend owing to intensified competition.	66	-13%
WIN Semi	3105.TWO	OW	Ray Wu	Positive	We see signs of business turnaround from Samsung smartphone supply chain shift, iPhone 16 replacement cycle, and upcoming WiFi 7 migration, which will benefit WIN Semi.	200	11%
AWSC	8086.TWO	OW	Ray Wu	Positive	We think AWSC will benefit from the AI smartphone migration because the company may win more share allocation for Qulacomm's Snapdragon 7 and 8 RF supply.	170	23%
Novatek	3034.TW	OW	Daniel Yen	Positive	Novatek is the key supplier for OLED DDIC. We expect AI smartphones to further spur OLED smartphone penetration rate, vs. 60-70% of the mix currently.	666	15%
KYEC	2449.TW	OW	Charlie Chan	Positive	We are also constructive on KYEC, a semiconductor testing house. MediaTek and Will Semi are both big customers of KYEC, and stronger testing demand from smartphone customers should be positive for KYEC's revenue and margin outlook.	140	7%
Passive Components							
Yageo	2327.TW	OW	Howard Kao	Positive	Yageo is a key supplier to Apple for chip resistors, and even though design and content may not increase meaningfully, Yageo is well positioned to benefit from a stronger-than-expected replacement cycle driven by Apple Intelligence.	710	-11%

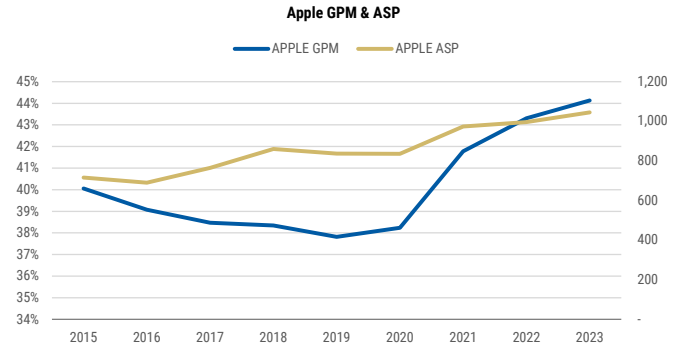
Source: Morgan Stanley Research
Note: Upside is calculated as the difference between Morgan Stanley's price target and current price as of July 11, 2024

Smartphone OEMs can pass through rising costs with stable margin outlook

While the consensus expects rising BOM costs to squeeze smartphone OEMs' margins, our analysis offers different conclusions. As illustrated in Exhibit 42 - Exhibit 45 , observed a continuous ASP increase at the four listed smartphone OEM companies in 2015-2023: Apple, Samsung, Xiaomi, and Transsion. During the 2021 5G upgrade cycle, the whole industry also faced rising BOM cost pressures, however, all of them were able to raise ASPs and pass through higher costs. As a result, margins remained stable or even improved. Apple's gross margin went from 38% in 2020 to 42% in 2021. Samsung's smartphone OPM improved from 11% to 12%. Xiaomi's margin increased from 15% to 18%, and while Transsion's GPM declined from 26% to 21%, this was mainly because of accounting reclassification, instead of real margin decline.

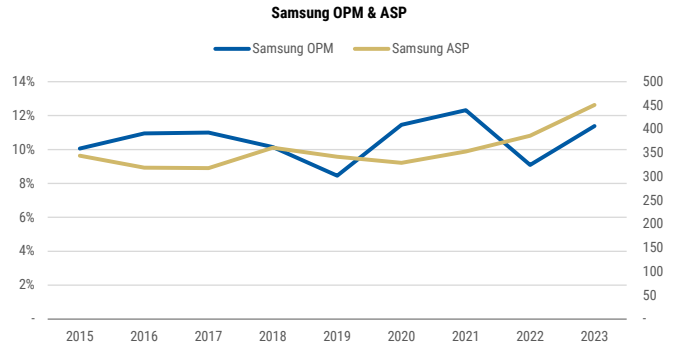
We believe smartphone OEMs will apply a similar strategy to pass through the BOM cost for AI smartphones. These are mainly targeted at high-end users initially, customers who have stronger consumption power, which is less sensitive to smartphone price increases.

Exhibit 42: Apple GPM & ASP



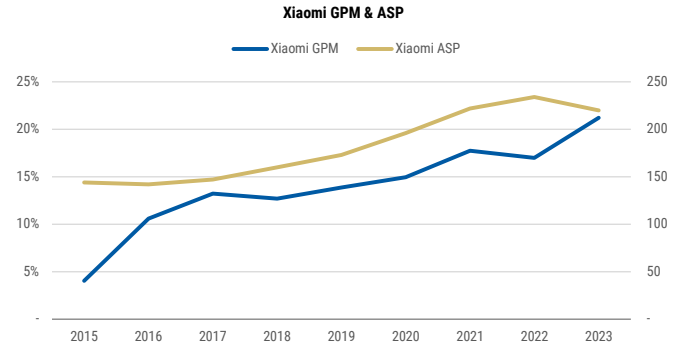
Source: Company data

Exhibit 43: Samsung mobile division OPM & ASP



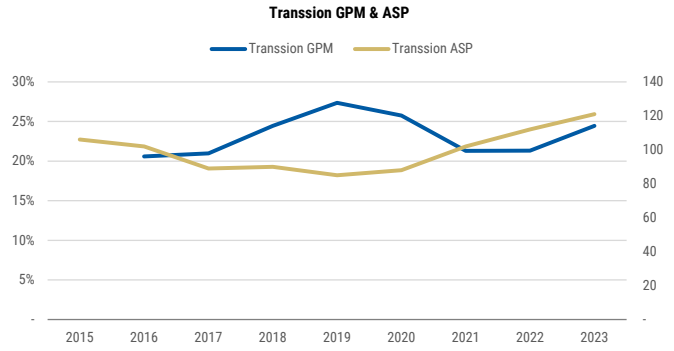
Source: Company data

Exhibit 44: Xiaomi GPM & ASP



Source: Company data

Exhibit 45: Transsion GPM & ASP



Source: Company data

Debate 2: Will Android Underperform Apple and Lose Market Share in the AI Smartphone Era?

Market view – yes: Apple Intelligence is set to trigger an iPhone replacement cycle, so iPhone will enjoy significant market share gain. As a result, Android will lose market share to Apple amid AI Smartphone Era.

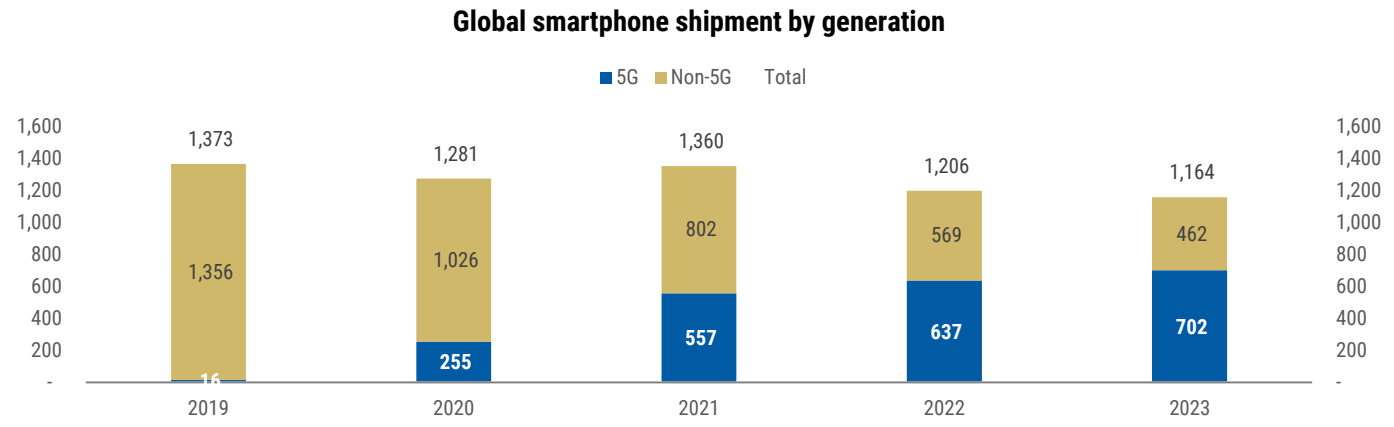
Our view – we disagree: Our analysis of the 2021 5G upgrade cycle suggests that Apple has taken market share mainly in price bands above US$750. For the price band between US$500-750, Apple lost market share because models in this price range did not offer 5G. Android's high-end products were mainly in the US$500-750 range, and offered the more advanced 5G features to consumers, which made them more attractive vs. iPhones at this time.

In the upcoming AI Smartphone Era, we also expect Apple to take market share in the high-end segments (US$750 and above) – but look for Android to take more market share in the <US$750 range. Android's high-end products could also offer new AI features with OEMs' strategy to incorporate Edge AI functions and Gemini's support.

What occurred during the 2021 5G upgrade cycle

The smartphone industry went through a 5G upgrade cycle in 2021, which led global smartphone shipments to increase 6% YoY. However, if we break down the shipments into 5G and non-5G, we find that 5G smartphone shipment volume surged from 255mn units in 2020 to 557mn units in 2021 up 118% YoY.

Exhibit 46: The global smartphone industry enjoyed a significant 5G upgrade cycle in 2021

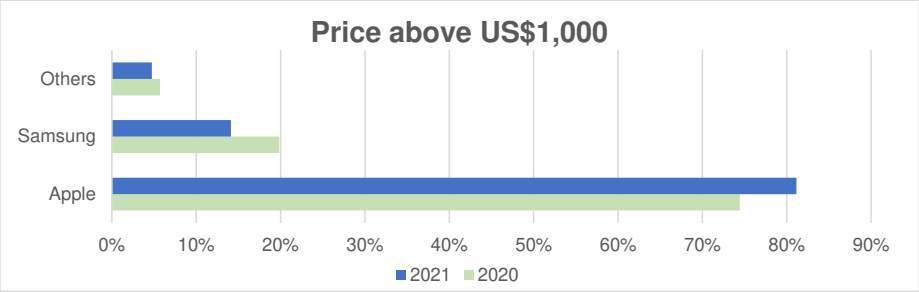


Source: IDC

When we further checked the market share change during the 2021 cycle, we found that:

- For the price band above US$1,000, iPhone achieved significant market share gains, moving from 74% in 2020 to 81% in 2021, while Samsung's market share declined from 20% to 14%. The other brands had limited exposure in this high-end segment.

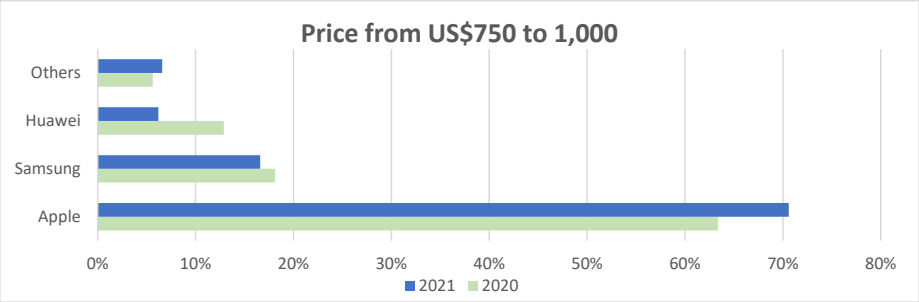
Exhibit 47: In the >US$1,000 price band, Apple gained market share in the 2021 cycle



Source: IDC

- For the US$750-1,000 price band, iPhone's market share also increased from 63% in 2020 to 71% in 2021, while Samsung's market share declined from 18% to 17%. Huawei recorded significant market share losses from 13% to 6% owing to component shortages, while Xiaomi's market share increased from 1% to 2%.

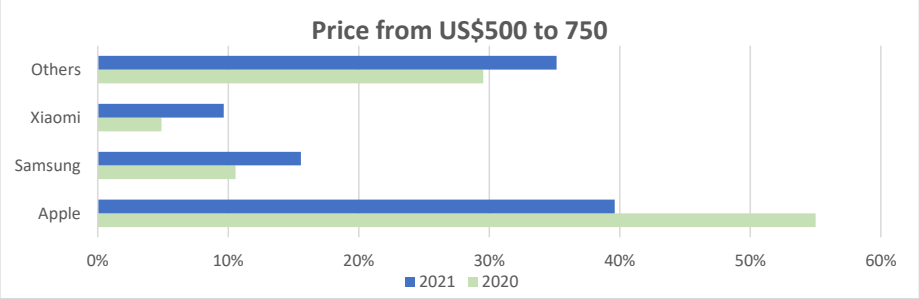
Exhibit 48: In the US$750-1,000 price band, Apple also achieved market share gain in the 2021 cycle



Source: IDC

- For the US$500-750 price band, iPhone's market share declined from 55% in 2020 to 40% in 2021, mainly because the company raised its ASP to pass through higher 5G costs. Meanwhile, Samsung's market share increased from 11% to 16% while Xiaomi's market share also grew from 5% to 10%.

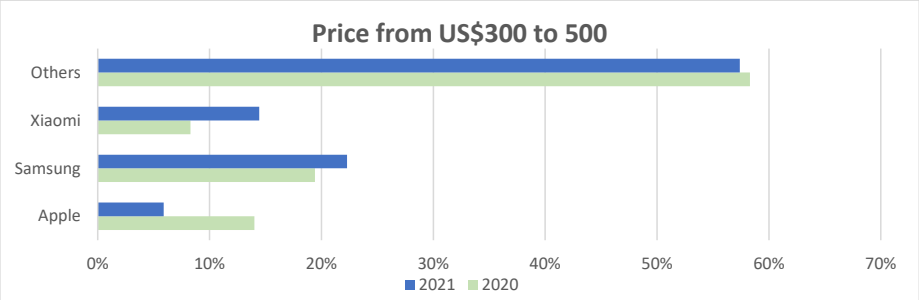
Exhibit 49: In the US$500-750 price band, Samsung and Xiaomi gained market share in the 2021 cycle



Source: IDC

- In the the US$300-500 band, iPhone's market share declined from 14% in 2020 to 6% in 2021 because the products at this price were older models without 5G features. Samsung's market share increased from 19% to 22%, while Xiaomi's market share also increased from 8% to 14%.

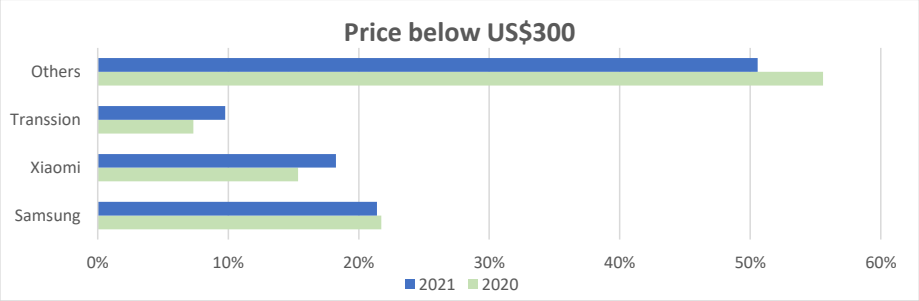
Exhibit 50: In the US$300-500 price band, Samsung and Xiaomi also gained market share in the 2021 cycle



Source: IDC

- In the band below US$300, iPhone had no exposure while Samsung's market share remained stable at 22% in 2020 and 21% in 2021. Meanwhile, Xiaomi's market share increased from 15% to 18% while Transsion's market share also improved from 7% to 10%.

Exhibit 51: Below US$300, Xiaomi and Transsion gained market share in the 2021 cycle



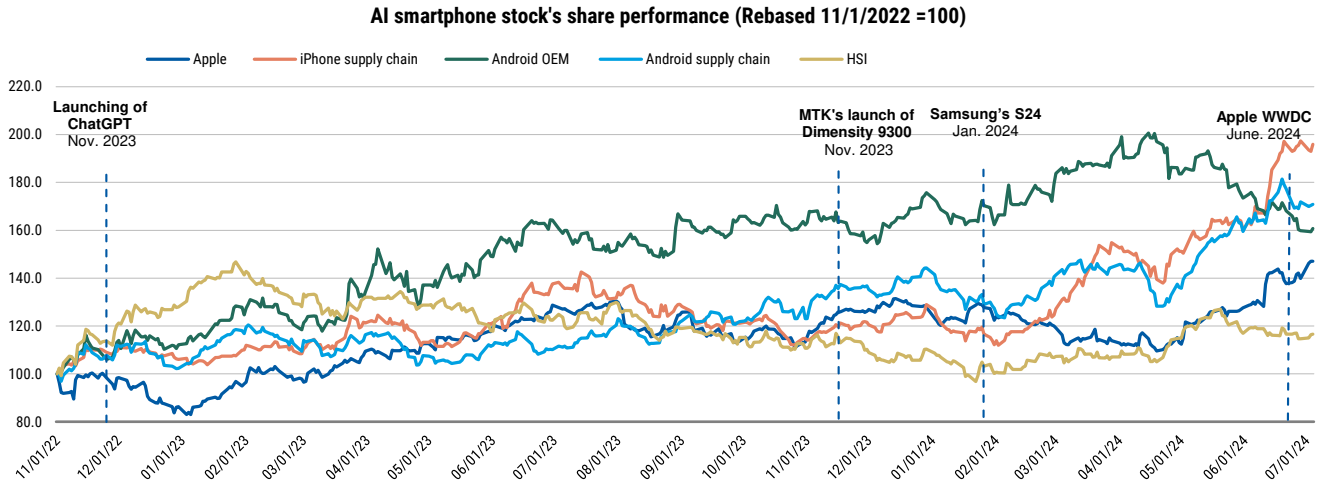
Source: IDC

Stock implications: Apple to lead outperformance, while Android performance diverges

We believe Apple will continue to lead the outperformance thanks to a strong replacement cycle in the following 12-18 months. In the Android camp, we expect performance to diverge:

- Samsung might lose some market share in the high-end segment, but gain some share in the mid-range segment.
- We believe Xiaomi is well positioned for market share gains in the mid-range/low end segment.
- Transsion could sustain its leading market share in the low-end segment.

Exhibit 52: AI smartphone stocks' performance (rebased November 1, 2022=100)



Source: Factset, Morgan Stanley Research

Note: Share price of the AI smartphone stocks are indexed based on the share price of respective stocks on November 1, 2022 (Rebased November 1, 2022=100). Therefore, the absolute value in the vertical axis refers to the share price outperformance or underperformance measured against the share price on November 1, 2022.

Exhibit 53: AI smartphone stocks' performance

Event	Apple	iPhone supply chain	Android OEM	Android supply chain	HSI	Average
Launching of ChatGPT	21%	7%	48%	19%	-3%	24%
MTK's launching of first AI smartphone SoC	5%	-1%	-3%	-3%	-14%	-1%
Samsung's S24	2%	44%	3%	27%	19%	18%
Apple WWDC	15%	17%	-4%	4%	-2%	7%

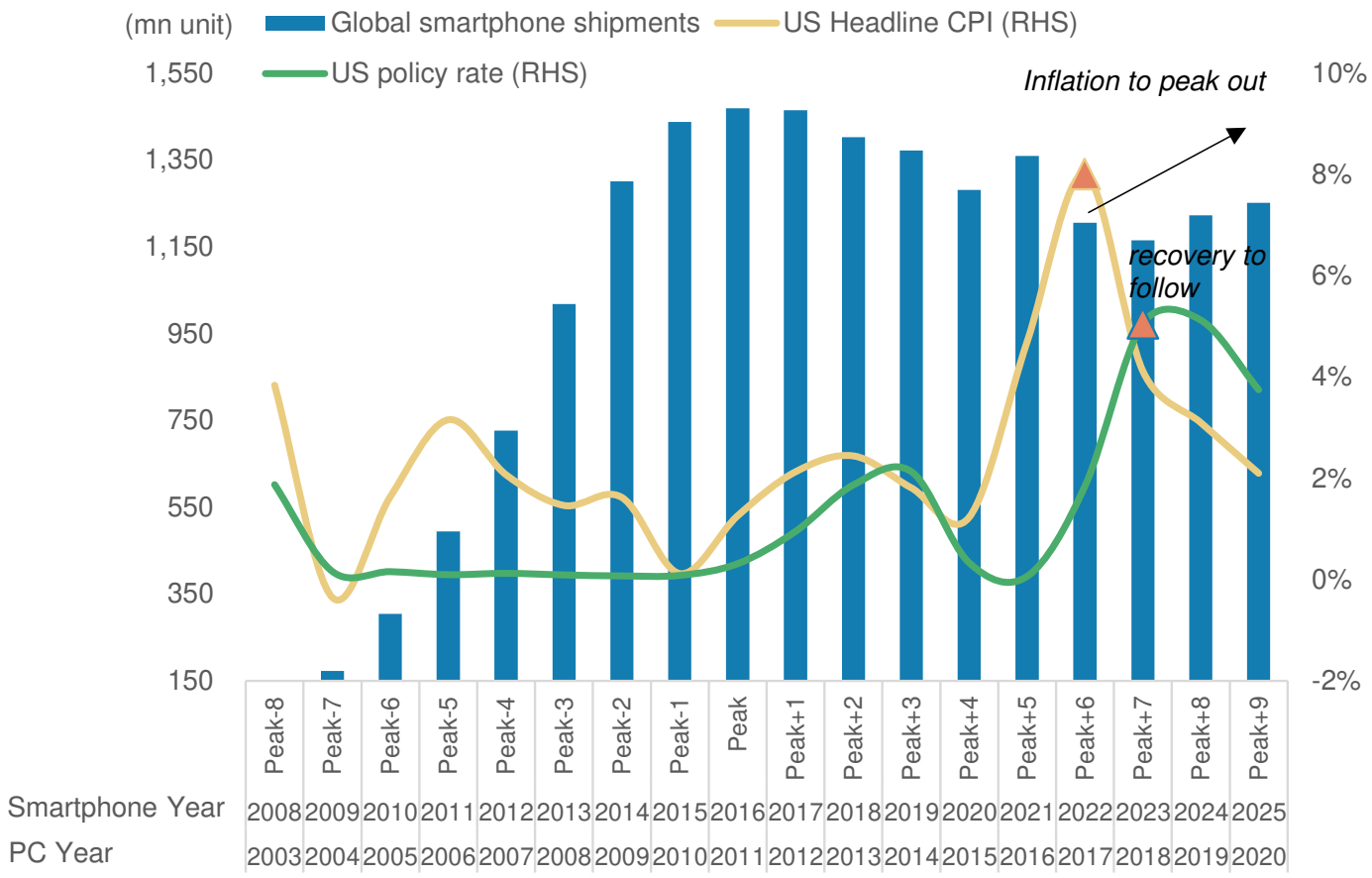
Source: Factset, Morgan Stanley Research

Note: This table measures the share price performance post the event. For example, launch of ChatGPT has triggered share price rally of 21% for Apple, 7% for iPhone supply chain, 48% for Android OEM, etc.

Where We Are in the Smartphone Cycle

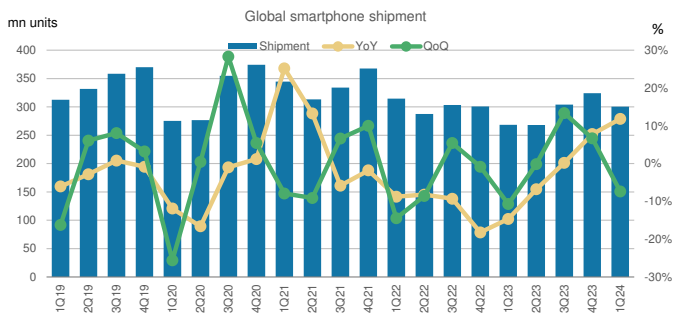
The charts below help understand where we are in the smartphone industry cycle.

Exhibit 54: Smartphone recovery in 2024-25 given potentially lower inflation and interest rates



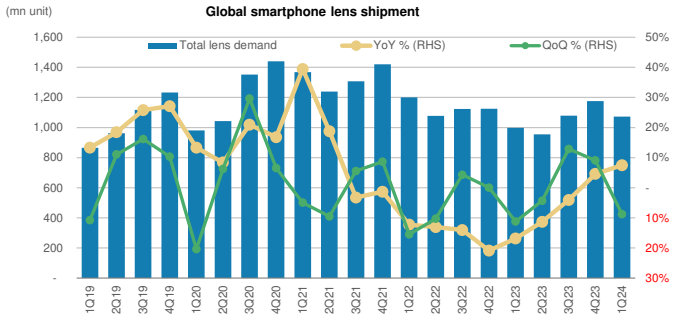
Source: IDC, CEIC, Morgan Stanley Research estimates. Note: CPI and policy rate assumptions are from our Global Economics team.

Exhibit 55: Global smartphone shipments



Source: IDC, Morgan Stanley Research

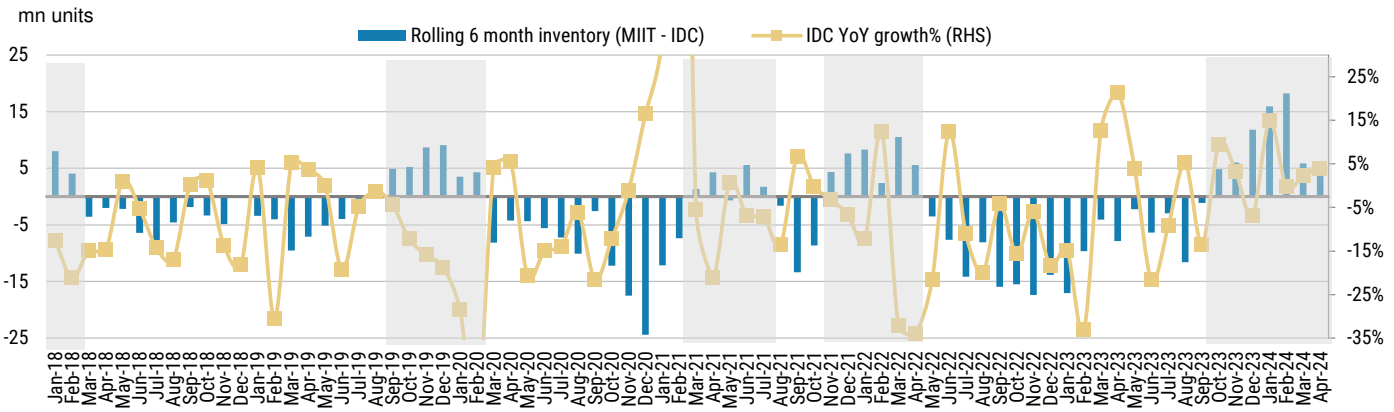
Exhibit 56: Smartphone lens shipments



Source: IDC, Morgan Stanley Research

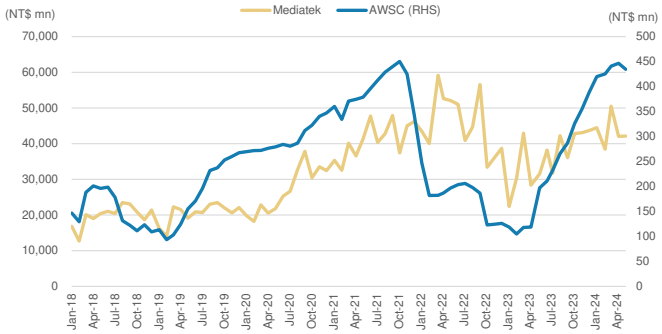
Exhibit 63

Rolling six-month smartphone inventory



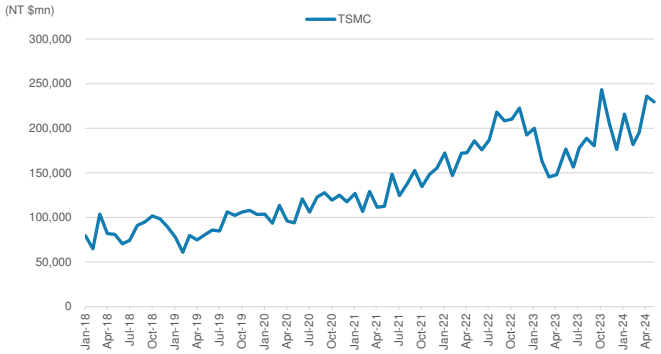
Source: MIIT, IDC, Morgan Stanley Research. Note: MIIT is the source for smartphone production data; IDC is the source for smartphone sell-in shipments; we use MIIT minus IDC shipments to calculate OEM inventory levels.

Exhibit 57: MediaTek and AWSC's monthly sales



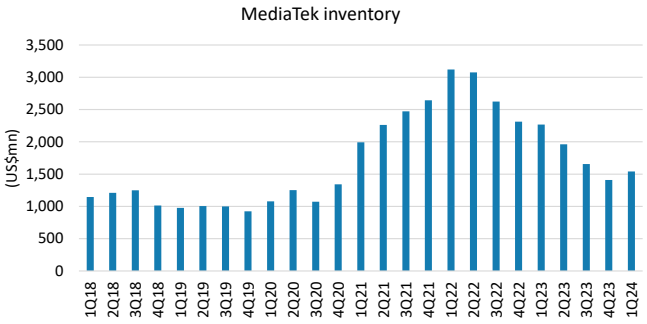
Source: TEJ, Morgan Stanley Research 更多资料关注公众号/知识星球-讯息社

Exhibit 58: TSMC's monthly sales



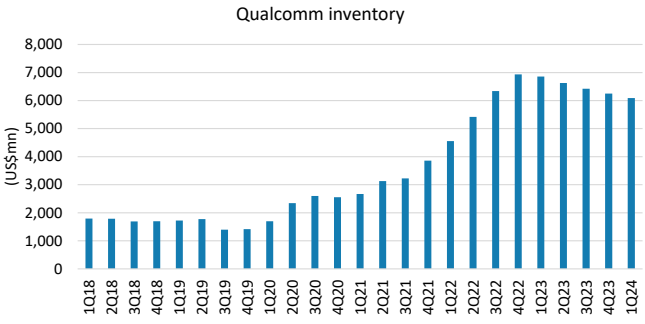
Source: TEJ, Morgan Stanley Research

Exhibit 59: MediaTek's inventory is back to a healthier level...



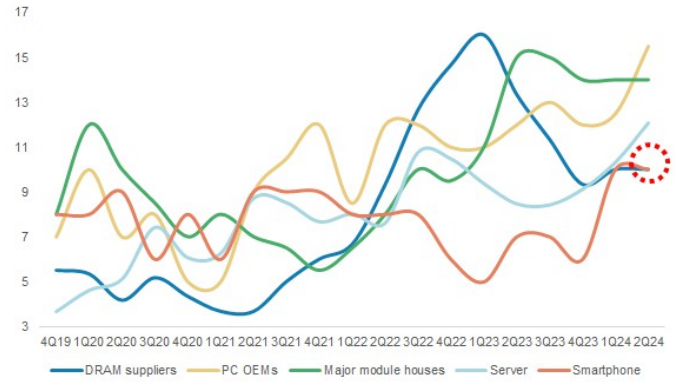
Source: Company data, Morgan Stanley Research

Exhibit 60: ...while Qualcomm's inventory remains elevated



Source: Company data, Morgan Stanley Research

Exhibit 61: DRAM – Client inventories have been piling up

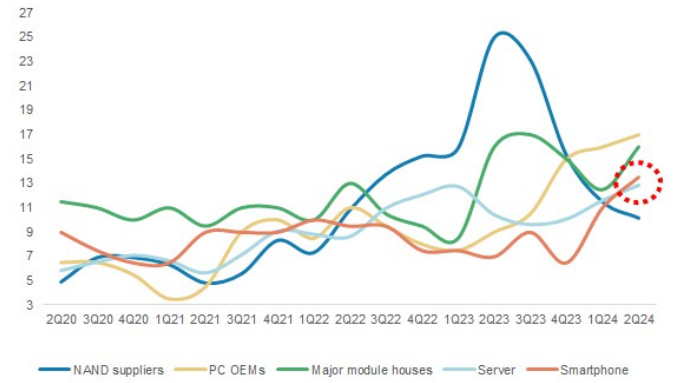


Source: TrendForce, Morgan Stanley Research

Exhibit 62: Memory price

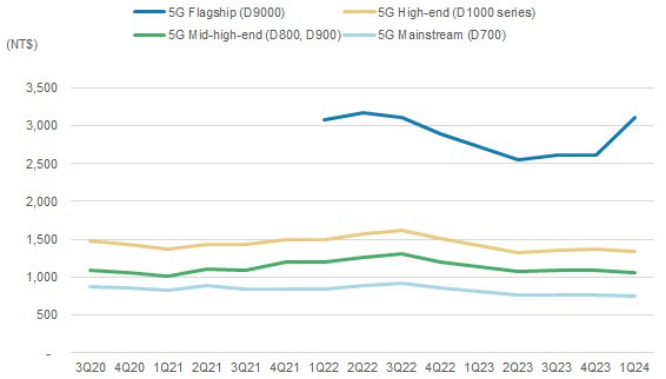
Source: TrendForce, Morgan Stanley Research

Exhibit 69 NAND – Inventories have shown recovery



Source: TrendForce, Morgan Stanley Research

Exhibit 71 Prices of MediaTek's 5G SoC



Source: Company data, Morgan Stanley Research

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(as of June 30, 2024)

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	Coverage Universe		Investment Banking Clients (IBC)			Other Material Investment Services Clients (MISC)	
Stock Rating Category	Count	% of Total	Count	% of Total IBC	% of Rating Category	Count	% of Total Other MISC
Overweight/Buy	1440	38%	342	45%	24%	677	40%
Equal-weight/Hold	1741	46%	340	45%	20%	774	46%
Not-Rated/Hold	3	0%	0	0%	0%	1	0%
Underweight/Sell	570	15%	71	9%	12%	224	13%
Total	3,754		753			1676	

Data include common stock and ADRs currently assigned ratings. Investment Banking Clients are companies from whom Morgan Stanley received investment banking compensation in the last 12 months. Due to rounding off of decimals, the percentages provided in the "% of total" column may not add up to exactly 100 percent.

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Overweight (O or Over) - The stock's total return is expected to exceed the total return of the relevant country MSCI Index or the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis over the next 12-18 months.

Equal-weight (E or Equal) - The stock's total return is expected to be in line with the total return of the relevant country MSCI Index or the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis over the next 12-18 months.

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Unless otherwise specified, the time frame for price targets included in Morgan Stanley Research is 12 to 18 months.

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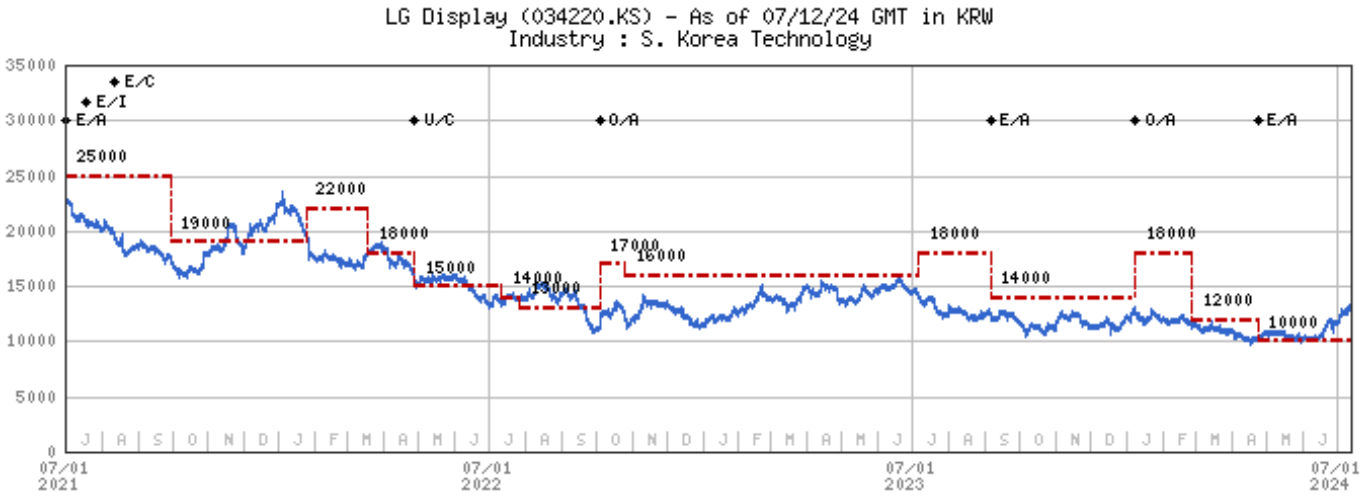
Stock Price, Price Target and Rating History (See Rating Definitions)



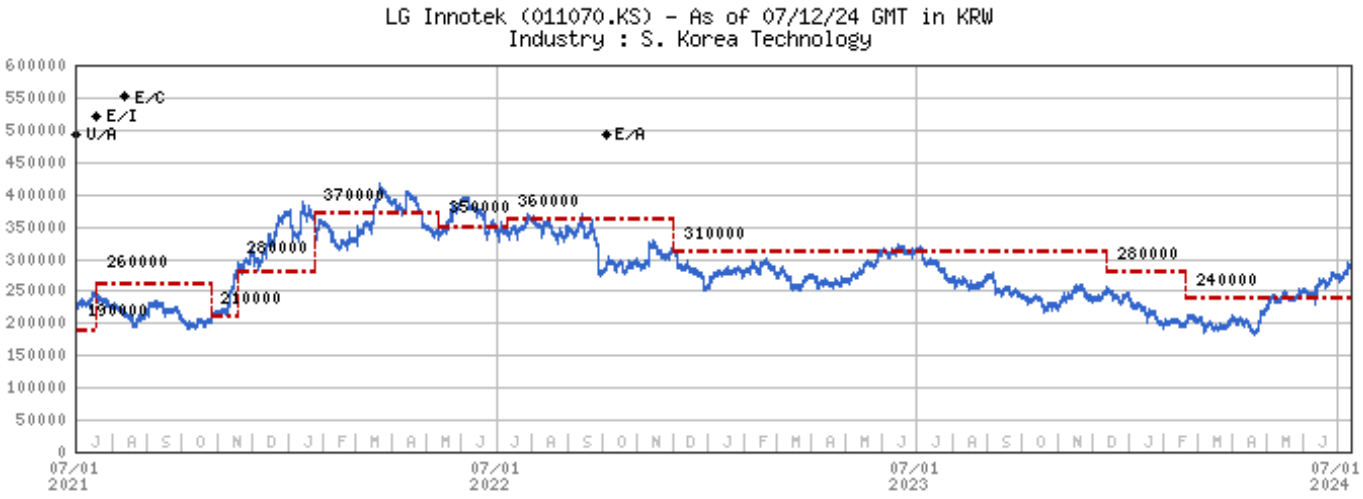
Stock Rating History: 7/1/19 : E/C; 7/30/19 : E/I; 11/18/19 : E/A; 12/9/19 : O/A; 3/19/20 : E/A; 7/19/21 : E/I; 8/12/21 : E/C; 4/27/22 : U/C; 10/4/22 : O/A; 9/6/23 : E/A; 1/8/24 : O/A; 4/23/24 : E/A

Price Target History: 1/22/19 : 19000; 7/4/19 : 18000; 7/23/19 : 17000; 8/16/19 : 14000; 12/9/19 : 19000; 3/4/20 : 17000; 3/19/20 : 11000; 7/23/20 : 12000; 8/27/20 : 13000; 10/16/20 : 16000; 10/22/20 : 17000; 12/21/20 : 18000; 1/22/21 : 26000; 3/29/21 : 24000; 4/28/21 : 25000; 9/29/21 : 19000; 1/24/22 : 22000; 3/18/22 : 18000; 4/27/22 : 15000; 7/11/22 : 14000; 7/27/22 : 13000; 10/4/22 : 17000; 10/26/22 : 16000; 7/6/23 : 18000; 9/6/23 : 14000; 1/8/24 : 18000; 2/27/24 : 12000; 4/23/24 : 10000

Source: Morgan Stanley Research Date Format : MM/DD/YY Price Target -·- No Price Target Assigned (NA)
Stock Price (Not Covered by Current Analyst) — Stock Price (Covered by Current Analyst) ▬
Stock and Industry Ratings (abbreviations below) appear as ◆ Stock Rating/Industry View
Stock Ratings: Overweight (O) Equal-weight (E) Underweight (U) Not-Rated (NR) No Rating Available (NA)
Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

Effective January 13, 2014, the stocks covered by Morgan Stanley Asia Pacific will be rated relative to the analyst's industry (or industry team's) coverage.

Effective January 13, 2014, the industry view benchmarks for Morgan Stanley Asia Pacific are as follows: relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.



Stock Rating History: 7/1/19 : U/C; 7/4/19 : O/C; 7/30/19 : O/I; 11/18/19 : O/A; 3/19/20 : E/A; 1/22/21 : U/A; 7/19/21 : E/I; 8/12/21 : E/C; 10/4/22 : E/A

Price Target History: 4/1/19 : 90000; 7/4/19 : 150000; 8/16/19 : 135000; 1/29/20 : 165000; 3/4/20 : 160000; 3/19/20 : 100000; 5/26/20 : 130000; 7/17/20 : 148000; 10/16/20 : 165000; 1/22/21 : 185000; 4/29/21 : 190000; 7/19/21 : 260000; 10/26/21 : 210000; 11/18/21 : 280000; 1/24/22 : 370000; 5/12/22 : 350000; 7/11/22 : 360000; 12/2/22 : 310000; 12/13/23 : 280000; 2/20/24 : 240000

Source: Morgan Stanley Research Date Format : MM/DD/YY Price Target No Price Target Assigned (NA)
Stock Price (Not Covered by Current Analyst) Stock Price (Covered by Current Analyst)
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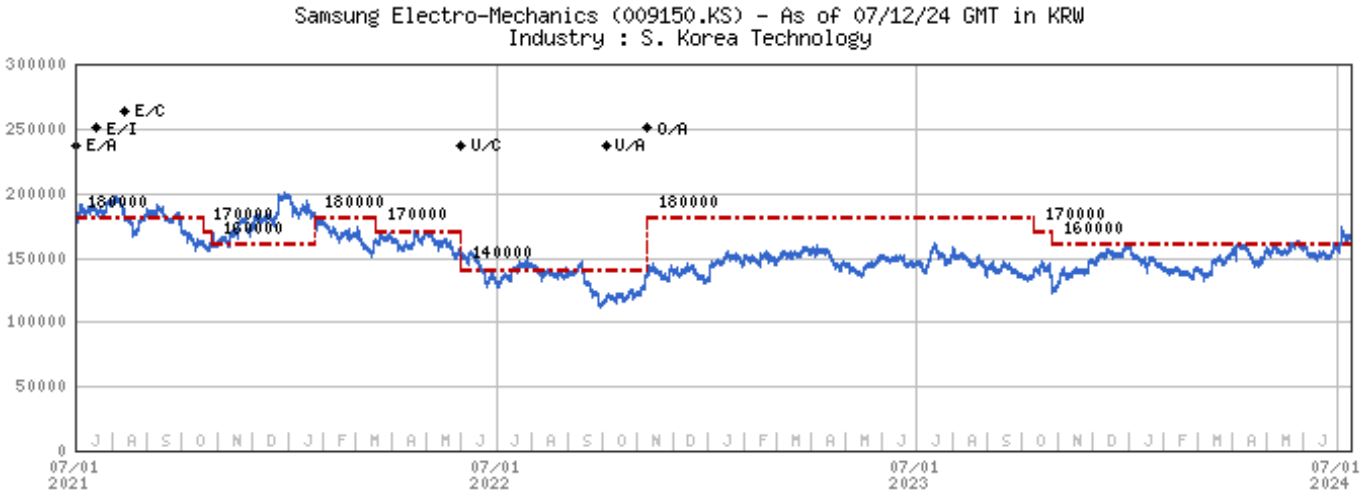


Stock Rating History: 7/1/19 : E/C; 7/30/19 : E/I; 10/6/19 : O/I; 11/18/19 : O/A; 5/12/21 : E/A; 7/19/21 : E/I; 8/12/21 : E/C; 6/1/22 : U/C; 10/4/22 : U/A; 11/9/22 : O/A

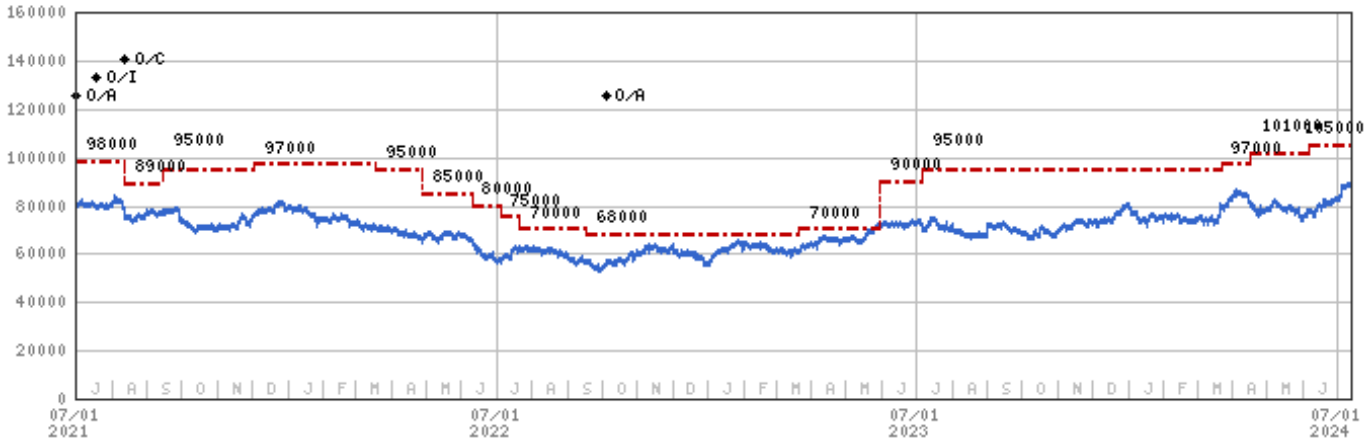
Price Target History: 4/16/19 : 115000; 7/4/19 : 100000; 7/24/19 : 92000; 10/6/19 : 140000; 1/29/20 : 150000; 2/20/20 : 165000; 3/19/20 : 130000; 4/1/20 : 120000; 5/28/20 : 150000; 9/3/20 : 170000; 12/1/20 : 180000; 1/19/21 : 240000; 3/1/21 : 250000; 5/12/21 : 180000; 10/19/21 : 170000; 10/27/21 : 160000; 1/24/22 : 180000; 3/18/22 : 170000; 6/1/22 : 140000; 11/9/22 : 180000; 10/11/23 : 170000; 10/27/23 : 160000

Source: Morgan Stanley Research Date Format : MM/DD/YY Price Target No Price Target Assigned (NA)
Stock Price (Not Covered by Current Analyst) Stock Price (Covered by Current Analyst)
Stock and Industry Ratings (abbreviations below) appear as ◆ Stock Rating/Industry View
Stock Ratings: Overweight (O) Equal-weight (E) Underweight (U) Not-Rated (NR) No Rating Available (NA)
Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

Effective January 13, 2014, the stocks covered by Morgan Stanley Asia Pacific will be rated relative to the analyst's industry (or industry team's) coverage.

Effective January 13, 2014, the industry view benchmarks for Morgan Stanley Asia Pacific are as follows: relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.

Samsung Electronics (005930.KS) - As of 07/12/24 GMT in KRW
Industry : S. Korea Technology



Stock Rating History: 7/1/19 : E/C; 7/30/19 : E/I; 11/18/19 : O/A; 7/19/21 : O/I; 8/12/21 : O/C; 10/4/22 : O/A

Price Target History: 1/15/19 : 40000; 7/30/19 : 53000; 8/16/19 : 48000; 9/10/19 : 50000; 11/18/19 : 60000; 1/14/20 : 72000; 2/26/20 : 75000; 3/19/20 : 68000; 4/29/20 : 65000; 7/12/20 : 70000; 9/11/20 : 73000; 11/27/20 : 88000; 1/12/21 : 110000; 2/25/21 : 115000; 5/18/21 : 93000; 6/8/21 : 98000; 8/12/21 : 89000; 9/15/21 : 95000; 12/3/21 : 97000; 3/18/22 : 95000; 4/28/22 : 85000; 6/10/22 : 80000; 7/5/22 : 75000; 7/22/22 : 70000; 9/17/22 : 68000; 3/21/23 : 70000; 5/30/23 : 90000; 7/7/23 : 95000; 3/22/24 : 97000; 4/16/24 : 101000; 6/6/24 : 105000

Source: Morgan Stanley Research Date Format : MM/DD/YY Price Target -- No Price Target Assigned (NA)
Stock Price (Not Covered by Current Analyst) Stock Price (Covered by Current Analyst)
Stock and Industry Ratings (abbreviations below) appear as ◆ Stock Rating/Industry View
Stock Ratings: Overweight (O) Equal-weight (E) Underweight (U) Not-Rated (NR) No Rating Available (NA)
Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

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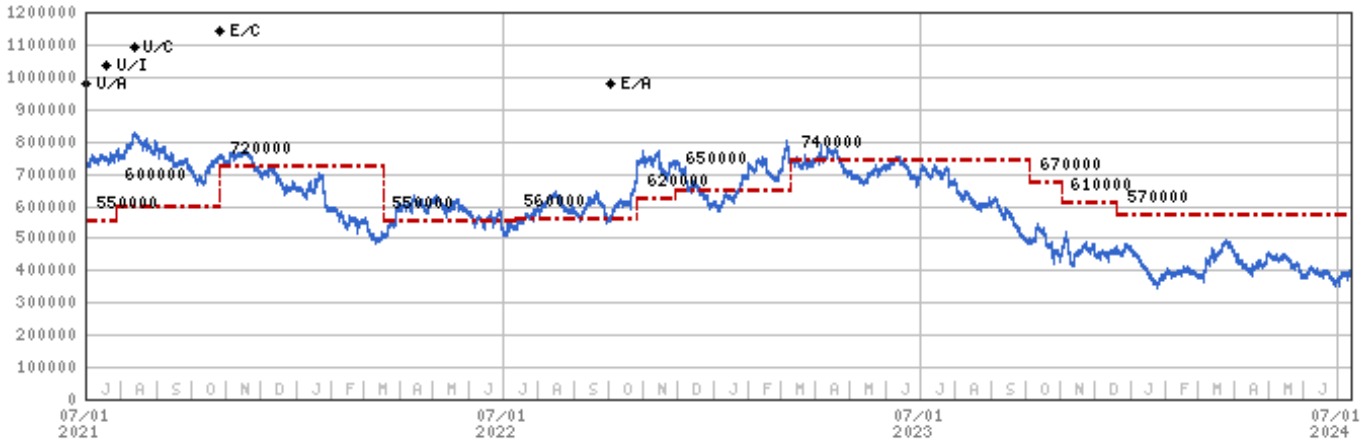
Effective January 13, 2014, the industry view benchmarks for Morgan Stanley Asia Pacific are as follows: relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.

Samsung SDI (006400.KS) - As of 07/12/24 GMT in KRW
Industry : S. Korea Technology



Stock Rating History: 7/1/19 : O/C; 7/30/19 : O/I; 11/18/19 : O/A; 8/14/20 : U/A; 1/22/21 : E/A; 5/30/21 : U/A; 7/19/21 : U/I; 8/12/21 : U/C; 10/26/21 : E/C; 10/4/22 : E/A

Price Target History: 11/21/18 : 260000; 8/16/19 : 300000; 10/18/19 : 250000; 1/17/20 : 300000; 3/19/20 : 280000; 5/4/20 : 300000; 6/10/20 : 420000; 8/14/20 : 400000; 12/30/20 : 500000; 1/22/21 : 710000; 1/28/21 : 690000; 4/14/21 : 570000; 5/30/21 : 550000; 7/27/21 : 600000; 10/26/21 : 720000; 3/18/22 : 550000; 7/11/22 : 560000; 10/26/22 : 620000; 11/29/22 : 650000; 3/10/23 : 740000; 10/6/23 : 670000; 11/2/23 : 610000; 12/21/23 : 570000

Source: Morgan Stanley Research Date Format : MM/DD/YY Price Target -- No Price Target Assigned (NA)
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Stock and Industry Ratings (abbreviations below) appear as ◆ Stock Rating/Industry View
Stock Ratings: Overweight (O) Equal-weight (E) Underweight (U) Not-Rated (NR) No Rating Available (NA)
Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

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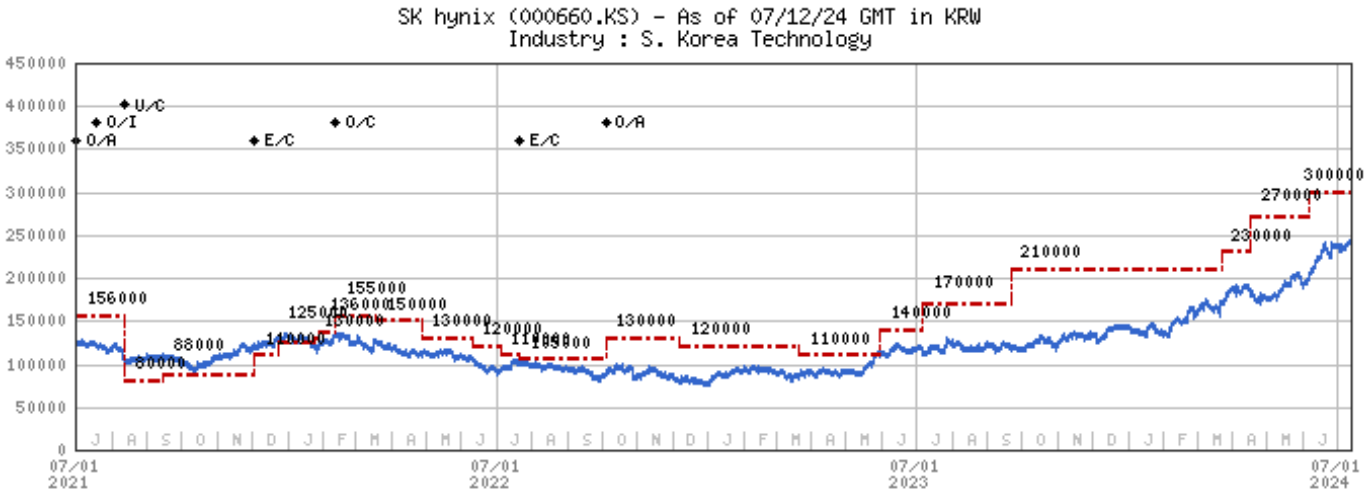

Stock Rating History: 7/1/19 : U/C; 7/30/19 : E/I; 11/18/19 : O/A; 7/19/21 : O/I; 8/12/21 : U/C; 12/3/21 : E/C; 2/11/22 : O/C; 7/22/22 : E/C; 10/4/22 : O/A

Price Target History: 6/4/19 : 61000; 7/25/19 : 70000; 7/30/19 : 85000; 8/16/19 : 80000; 9/10/19 : 81000; 11/18/19 : 95000; 1/14/20 : 115000; 2/26/20 : 120000; 3/19/20 : 110000; 8/21/20 : 93000; 10/23/20 : 100000; 12/2/20 : 160000; 1/12/21 : 170000; 2/25/21 : 174000; 5/18/21 : 146000; 6/8/21 : 156000; 8/12/21 : 80000; 9/15/21 : 88000; 12/3/21 : 110000; 12/23/21 : 125000; 1/24/22 : 130000; 1/28/22 : 136000; 2/11/22 : 155000; 3/18/22 : 150000; 4/27/22 : 130000; 6/10/22 : 120000; 7/5/22 : 110000; 7/22/22 : 105000; 10/4/22 : 130000; 12/7/22 : 120000; 3/21/23 : 110000; 5/30/23 : 140000; 7/7/23 : 170000; 9/21/23 : 210000; 3/22/24 : 230000; 4/16/24 : 270000; 6/6/24 : 300000

Source: Morgan Stanley Research Date Format : MM/DD/YY Price Target No Price Target Assigned (NA)
Stock Price (Not Covered by Current Analyst) Stock Price (Covered by Current Analyst)
Stock and Industry Ratings (abbreviations below) appear as ◆ Stock Rating/Industry View
Stock Ratings: Overweight (O) Equal-weight (E) Underweight (U) Not-Rated (NR) No Rating Available (NA)
Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

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INDUSTRY COVERAGE: Greater China Technology Hardware

COMPANY (TICKER)	RATING (AS OF)	PRICE* (07/12/2024)
Andy Meng, CFA		
AAC Technologies Holdings (2018.HK)	O (01/29/2024)	HK$32.20
Accelink Technologies Co. Ltd. (002281.SZ)	U (05/12/2022)	Rmb36.66
BYD Electronics (0285.HK)	O (04/28/2023)	HK$36.90
China TransInfo Technology Co Ltd (002373.SZ)	E (07/18/2023)	Rmb9.23
Dahua Technology Co. Ltd. (002236.SZ)	U (07/18/2023)	Rmb15.04
Eoptolink Technology Inc Ltd (300502.SZ)	E (05/16/2024)	Rmb113.35
Genius Electronic Optical Co. Ltd. (3406.TW)	O (05/16/2023)	NT$613.00
Gosuncn Technology Group Co Ltd (300098.SZ)	U (11/07/2022)	Rmb4.79
HIKVision Digital Technology (002415.SZ)	O (11/02/2015)	Rmb30.03
Largan Precision (3008.TW)	O (01/31/2024)	NT$3,065.00
LianChuang Electronic Technology Co Ltd (002036.SZ)	U (06/12/2024)	Rmb7.27
OFILM Group Co Ltd (002456.SZ)	U (06/12/2024)	Rmb8.44
Q Technology (Group) Company Ltd (1478.HK)	E (11/10/2023)	HK$5.02
Quectel Wireless Solutions Co Ltd (603236.SS)	O (11/07/2022)	Rmb51.12
Shenzhen Transsion Holdings Co Ltd (688036.SS)	O (10/24/2023)	Rmb79.33
Sunny Optical (2382.HK)	O (05/16/2023)	HK$50.05
Suzhou TFC Optical Communication Co Ltd. (300394.SZ)	U (05/16/2024)	Rmb94.99
Wingtech Technology Co Ltd (600745.SS)	E (11/10/2023)	Rmb29.50
Xiaomi Corp (1810.HK)	O (04/14/2021)	HK$16.84
Yangtze Optical Fibre and Cable JSC Ltd (601869.SS)	U (10/13/2021)	Rmb23.73
Yangtze Optical Fibre and Cable JSC Ltd (6869.HK)	E (04/20/2023)	HK$8.18
Yongxin Optics Co Ltd (603297.SS)	E (11/15/2022)	Rmb62.57
YuTong Optical Technology Co Ltd (300790.SZ)	E (04/05/2022)	Rmb14.40
Zhejiang Crystal-Optech Co Ltd (002273.SZ)	O (11/15/2022)	Rmb19.53

Zhongji Innolight Co Ltd (300308.SZ)	O (11/06/2023)	Rmb150.12
ZTE Corporation (0763.HK)	E (03/11/2024)	HK$18.64
ZTE Corporation (000063.SZ)	U (07/02/2021)	Rmb28.62
Derrick Yang		
Accton Technology Corporation (2345.TW)	O (06/06/2024)	NT$571.00
Advantech (2395.TW)	O (01/20/2021)	NT$376.00
AirTAC International (1590.TW)	E (08/04/2022)	NT$980.00
AU Optronics (2409.TW)	U (04/23/2024)	NT$19.75
BOE Technology (000725.SZ)	O (09/06/2019)	Rmb4.30
BOE Varitronix Ltd (0710.HK)	O (06/20/2023)	HK$4.70
Chroma Ate Inc. (2360.TW)	O (10/05/2021)	NT$318.00
E Ink Holdings Inc. (8069.TWO)	O (06/10/2024)	NT$270.50
Ennostar Inc (3714.TW)	U (09/23/2022)	NT$46.05
GIS Holding Limited (6456.TW)	E (05/06/2023)	NT$73.30
Hiwin Technologies Corp. (2049.TW)	E (08/11/2023)	NT$225.00
Innolux (3481.TW)	E (04/23/2024)	NT$15.60
King Slide Works Co. Ltd. (2059.TW)	O (11/08/2023)	NT$1,280.00
Lens Technology (300433.SZ)	E (07/22/2020)	Rmb19.69
Leyard Optoelectronic Co Ltd (300296.SZ)	E (11/03/2020)	Rmb4.42
Radiant Opto-Electronics Corporation (6176.TW)	E (03/01/2024)	NT$187.00
Sanan Optoelectronics (600703.SS)	U (08/21/2023)	Rmb12.07
TCL Corp. (000100.SZ)	E (06/11/2019)	Rmb4.28
Tianma Microelectronics (000050.SZ)	U (01/24/2018)	Rmb7.59
Wuhan Jingce Electronic Group Co Ltd (300567.SZ)	E (11/26/2021)	Rmb61.50
Howard Kao		
Acer Inc. (2353.TW)	E (05/01/2023)	NT$47.70
Asustek Computer Inc. (2357.TW)	O (05/22/2024)	NT$509.00
Compal Electronics (2324.TW)	E (05/01/2023)	NT$35.50
Giga-Byte Technology Co. Ltd. (2376.TW)	O (12/15/2022)	NT$309.00
Gold Circuit Electronics Ltd. (2368.TW)	O (10/06/2022)	NT$215.00
Guangdong Fenghua Adv. Tech. (Hldg) Co (000636.SZ)	E (05/12/2021)	Rmb14.45
Inspur Electronic Information (000977.SZ)	E (08/28/2023)	Rmb37.68
Kinsus Interconnect Tech. (3189.TW)	U (12/21/2022)	NT$119.50
Lenovo (0992.HK)	++	HK$11.22
Lotes Co. Ltd. (3533.TW)	O (10/06/2022)	NT$1,660.00
Nan Ya PCB (8046.TW)	U (12/21/2022)	NT$189.00
Pegatron Corporation (4938.TW)	E (03/07/2022)	NT$107.00
Quanta Computer Inc. (2382.TW)	O (05/01/2023)	NT$326.00
Shengyi Technology Co Ltd. (600183.SS)	E (05/26/2022)	Rmb22.81
Shennan Circuits Co Ltd (002916.SZ)	E (08/24/2023)	Rmb126.14
Unimicron (3037.TW)	U (02/22/2023)	NT$190.00
Wistron Corporation (3231.TW)	O (07/12/2023)	NT$106.00
Wiwynn Corp (6669.TW)	E (10/17/2023)	NT$2,440.00
Yageo Corp. (2327.TW)	O (01/04/2022)	NT$770.00
Zhen Ding (4958.TW)	E (08/02/2022)	NT$150.50
Sharon Shih		
Asia Vital Components Co. Ltd. (3017.TW)	E (02/23/2024)	NT$709.00
Auras Technology Co Ltd (3324.TWO)	E (05/04/2023)	NT$763.00
Catcher Technology (2474.TW)	E (05/22/2024)	NT$224.50
Delta Electronics Inc. (2308.TW)	O (07/13/2017)	NT$422.00
Foxconn Industrial Internet Co. Ltd. (601138.SS)	O (07/10/2019)	Rmb27.26
Foxconn Technology (2354.TW)	U (05/22/2024)	NT$71.50
GoerTek Inc (002241.SZ)	E (12/05/2022)	Rmb21.69
Guangzhou Shiyuan Electronic Tech Co Ltd (002841.SZ)	E (10/28/2021)	Rmb28.69
Hon Hai Precision (2317.TW)	O (03/15/2024)	NT$216.00

HTC Corporation (2498.TW)	E (12/06/2023)	NT$46.90
LandMark Optoelectronics Corporation (3081.TWO)	U (04/27/2023)	NT$161.00
Lingyi Itech Guangdong Co (002600.SZ)	E (08/28/2023)	Rmb7.23
Lite-On Technology (2301.TW)	U (03/28/2024)	NT$109.00
Luxshare Precision Industry Co., Ltd. (002475.SZ)	O (10/24/2016)	Rmb40.92
Sunonwealth Electric Machine Industry Co (2421.TW)	E (02/23/2024)	NT$104.50
Tong Hsing (6271.TW)	E (03/18/2019)	NT$156.50
Visual Photonics Epitaxy Co Ltd (2455.TW)	E (09/11/2023)	NT$179.50

Stock Ratings are subject to change. Please see latest research for each company.
* Historical prices are not split adjusted.