

Memory sector

AI changes DRAM supply & demand dynamics

Overweight • Maintained

Key message

1. AI PC & AI server will commercialize, accelerating DRAM demand growth.
2. DDR5 & HBM have bigger die size, capping DRAM supply.
3. We are positive on the memory sector, expecting its upcycle to boost the earnings outlooks and share valuations of memory makers, especially DRAM wafer makers that can reduce idling cost by increasing capacity utilization.

Event

We predict the memory sector will enter a full-fledged upcycle in 2024.

Impact

AI PC & AI server accelerating DRAM demand growth. AI PC equipped with neural processing units (NPU) and inference software must use 16-32GB DDR5 DRAM, higher than general PC's 13.4GB in 2023. We forecast AI PC sales will total around 20mn units in 2024, boosting PC's weighting in DRAM bit demand from 12% in 2023 to 13% in 2024. On the expected further expansion of AI server shipments, we forecast DDR5 used in AI server will account for 8% of DRAM bit demand in 2024, up from 4% in 2023, while the weighting of high-bandwidth memory (HBM) will rise from 1.5% to 3.0%. We estimate overall DRAM bit demand will grow 15% YoY in 2024, matching DRAM bit supply growth of 15%, resulting in a sufficiency ratio of only 97%.

DDR5 & HBM capping DRAM supply. New types of products and technology platforms, such as AI PC, AI server, Eagle Stream server platform, and Meteor Lake CPU all utilize DDR5. As DDR5 die size is 15% larger than that of DDR4, DDR5 market penetration will increase DRAM capacity usage. We forecast DDR5 penetration of the DRAM market will climb to 44% in 2024, accounting for 17% of overall DRAM bit supply and 20% of wafer starts. HBM die size is two times larger than that of DDR5, and production yield is just 50-65%. We therefore forecast HBM will account for 3.0% of overall DRAM bit supply and 8.7% of wafer starts in 2024. We estimate overall DRAM bit supply will grow 15% YoY in 2024, matching wafer start growth of 15% YoY.

Output cuts to sustain prices in 2023F; both price & production volume to rise in 2024F.

The memory sector entered a downcycle, with output cuts, inventory digestion, and price declines in 3Q-4Q22. Micron (US) has completed DRAM inventory digestion in 4Q23 and eased DRAM output cuts. Samsung (KR) and SK Hynix (KR) both plan to slow the reduction of output in 1Q24. Taking into consideration that end demand will grow in 2Q24F, leading vendors all strive for sales-based disciplined production, and AI applications are changing the dynamics of DRAM supply and demand. Therefore, we predict the contract pricing of DRAM will rise throughout 2024. We expect Nanya Technology (2408 TT, NT\$74.2, OP) to start increasing capacity utilization in 2Q24, and the rise in DDR4 prices will outpace that of DDR5 prices in 1H24, as DDR3 and DDR4 completed inventory adjustments later than DDR5.

Stocks for Action

We are positive on the memory sector, expecting its upcycle to boost the earnings outlooks and share valuations of memory makers, especially DRAM wafer makers that can reduce idling cost by increasing capacity utilization. Our preference for memory subsectors is: wafer makers over module makers; DRAM makers over NAND flash makers; and DDR4 makers over DDR5 makers.

Risks

Slower-than-expected production node migration; weakening market demand.

Stock valuations

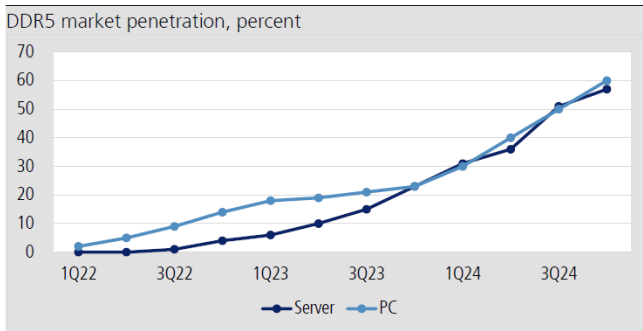
| Ticker | Company | Revenue contribution of related products(%) | Market cap (US\$m) | Price (NT\$) | Rating | Target price (NT\$) | Upside/downside(%) | EPS (NT\$) | | |
|---------|------------------|---|--------------------|--------------|--------|---------------------|--------------------|------------|--------|-------|
| | | | | | | | | 2022 | 2023F | 2024F |
| 2408 TT | Nanya Technology | DRAM(100) | 7,430 | 74.20 | OP | 85 | 15 | 4.72 | (2.10) | 2.83 |

Source: Bloomberg; KGI Research

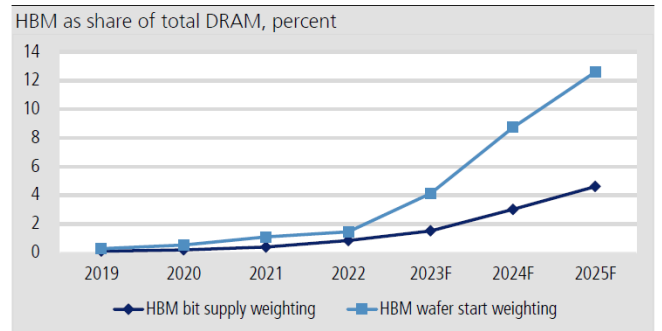
Figure 1: Overview of DRAM & NAND flash supply & demand, as well as pricing outlook

| % | 2023 | | | | 2024 | | | | 2022 | 2023 | 2024 |
|---|------|-------|-------|-------|------|-----|-----|-----|------|-------|------|
| | 1Q | 2Q | 3Q | 4Q | 1Q | 2Q | 3Q | 4Q | | | |
| DRAM | | | | | | | | | | | |
| Bit supply growth | | | | | | | | | 19 | (4) | 15 |
| Wafer output YoY growth | | | | | | | | | 7 | (15) | 15 |
| Wafer output QoQ/YoY growth (kwpm) | (84) | (201) | (25) | 50 | 66 | 101 | 124 | 73 | 98 | (237) | 197 |
| Bit demand growth | | | | | | | | | 12 | 8 | 15 |
| Sufficiency rate | 113 | 105 | 89 | 83 | 91 | 95 | 98 | 102 | 108 | 97 | 97 |
| DDR4 8Gb contract price QoQ growth | (18) | (22) | (6) | 12 | 10 | 10 | 15 | 15 | | | |
| NAND Flash | | | | | | | | | | | |
| Bit supply growth | | | | | | | | | 30 | (2) | 7 |
| Wafer output QoQ/YoY growth | | | | | | | | | 5 | (17) | (5) |
| Wafer output growth (kwpm) | (65) | (100) | (264) | (109) | 8 | 85 | 151 | 111 | 82 | (295) | (64) |
| Bit demand growth | | | | | | | | | 19 | 11 | 16 |
| Sufficiency rate | 120 | 112 | 89 | 75 | 85 | 85 | 91 | 96 | 110 | 97 | 90 |
| 512Gb TLC wafer contract price QoQ growth | (11) | (14) | 3 | 15 | 10 | 15 | 20 | 5 | | | |

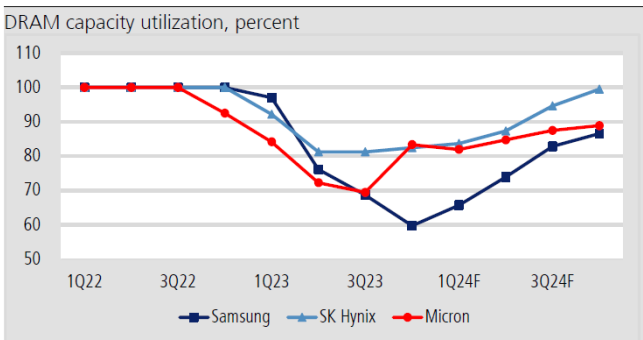
Source: TrendForce; KGI Research

Figure 2: Platform upgrades & AI PC rollout to increase DDR5 market penetration to over 50%


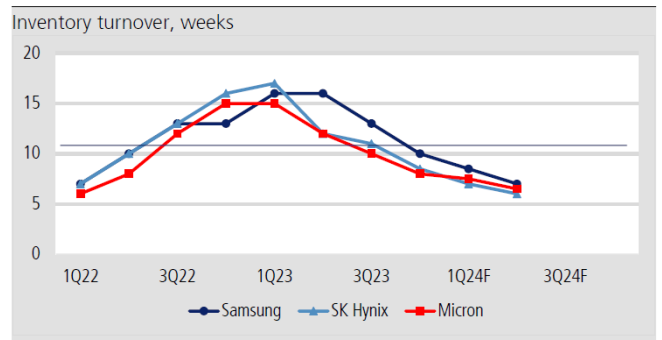
Source: TrendForce; KGI Research

Figure 3: HBM to account for 3.0% of 2024F DRAM bit supply & 8.7% of 2024F DRAM wafer starts


Source: TrendForce; KGI Research

Figure 4: Micron led in production cuts in 4Q22 & in capacity utilization increase in 4Q23


Source: TrendForce; KGI Research

Figure 5: Micron led by cutting inventory to 10 weeks in 3Q23


Source: TrendForce; KGI Research

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