

# **NAND consolidation, China's bet on two key players, the rise of the CXL interface... Memory business keeps growing<sup>1</sup>**

***Amid the pandemic, trade-war tensions, and chip shortages, the memory market outlook remains bright, to reach more than US\$180 billion in 2022***

## **OUTLINE:**

- **Market forecasts & trends:**  
Combined DRAM and NAND revenue in 2020 was US\$122 billion, up 15% from 2019. NAND and DRAM are commodity products and are used, respectively, as storage and working memory for smartphones, SSDs, PCs, servers and vehicles...  
DRAM and NAND represent 96% of the stand-alone memory markets.  
DRAM and NAND revenues are expected to grow with 15% and 8% CAGR<sub>2020-2026</sub> respectively.  
The pandemic had a mixed impact on the memory industry datacenter and laptop demand grew, automotive and smartphones faced a slowdown.  
Thanks to a combination of CAPEX cuts from suppliers in recent years and flourishing demand, the future is looking bright, particularly for DRAM.
- **Products' evolution:**  
In 2020 the leading 3D NAND manufacturers have been ramping up the new 1xxL generation... In parallel, following Micron, Samsung and SK hynix have been ramping up 1z DRAM technology.  
The processor memory interface is rapidly evolving to meet the demands of emerging data intensive applications: memory sizes must increase, while the bandwidth between memory and the CPU must grow.
- **Supply chain:**

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<sup>1</sup> Extracted from:

- [Status of the Memory Industry report](#), Yole Développement, 2021
- [DRAM Quarterly Market Monitor, Q2 2021](#), Yole Développement
- [NAND Quarterly Market Monitor, Q2 2021](#), Yole Développement

The consolidation of the NAND market has started with the acquisition of Intel's 3D NAND business by SK hynix.

The DRAM oligopoly of Samsung, SK hynix, and Micron remained largely unchanged in 2020, with Samsung being the undisputed leader with up to 42% market share.

The Chinese efforts to develop a local semiconductor memory industry narrowed down to 2 key players: YMTC and CXMT.

*"NAND and DRAM are the workhorse memory technologies," says **Simone Bertolazzi, PhD. Senior Technology & Market analyst at Yole Développement (Yole).** "They are used, respectively, as storage and working memory for a broad spectrum of applications and systems, including smartphones, tablets, SSDs, PCs, servers, and vehicles." The market research and strategy consulting company, Yole announced a combined DRAM and NAND revenue rose 15% from 2019, reaching about US\$122 billion in 2020.*

**Mike Howard, VP of DRAM and Memory Research at Yole** explains: *"Thanks to a combination of CAPEX cuts from suppliers in recent years and flourishing demand, the future is looking bright, particularly for DRAM. Revenues will peak again in 2022, reaching record-high values of US\$122 billion (DRAM) and US\$77 billion (NAND)."*

In the long term, DRAM and NAND revenues are expected to grow to US\$86 billion (NAND) and US\$151 billion (DRAM) with CAGR<sub>20-26</sub> of about 15% and 8%, respectively. In the same period, the ASP<sup>2</sup> is expected to decrease by ~5% (DRAM) and ~16% (NAND), driven by cost-per-bit reductions enabled by technology scaling.<sup>3</sup>

**Walt Coon, VP of NAND and Memory Research at Yole** adds: *"Both the DRAM and NAND markets are cyclical in nature, as they are characterized by periods of shortages and oversupply that give rise to strong price variations and revenue volatility." After substantial oversupply in 2019 – with ASPs down 49% year-over-year for both NAND and DRAM – overall market conditions improved in 2020 despite trade-war tensions and the outbreak of Covid-19. The pandemic had a mixed impact on the memory industry: data center and laptop demand grew, automotive and smartphones faced a slowdown. The net outcome has been a relatively balanced memory demand, while NAND/DRAM production started slowing down as memory suppliers significantly underinvested in new wafer capacity*

*"In the present semiconductor shortage era, the storage-drive industry is facing a scarcity of SSD controllers and other NAND sub-components, which causes supply chain uncertainty and puts pressure on ASPs," comments Simone Bertolazzi from Yole. And he adds: "The recent shutdown of Samsung's manufacturing facility in Austin, which manufactures NAND controllers for its SSDs, further amplifies this situation and will likely accelerate the NAND pricing recovery, particularly in the PC SSD and mobile markets where impacts from controller shortages are most pronounced."*

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<sup>2</sup> ASP: Average Selling Price

<sup>3</sup> These market figures are well detailed and analyzed in [DRAM & NAND Quarterly Market Monitor, Q2 2021](#).

Yole investigates disruptive memory technologies and related markets in depth, to point out the latest innovations and underline the business opportunities.

Its memory team has been following the memory industry for a while. Yole proposes two types of analyses, reports and quarterly market monitors to deliver a deep understanding of the market evolution, technology trends and the market positioning and strategy of the leading memory companies.

Today, Yole is pleased to announce its Status of the Memory Industry report, 2021 edition. It delivers an in-depth understanding of the memory ecosystem and key technical insights. This new report analyses future technology trends and challenges. Including market trends and forecasts, supply chain, technology trends, technical insights and analysis, take away and outlook, this study also delivers an in-depth analysis of the ecosystem and main players' strategies.

In addition, all year long, memory analysts follow the market evolution, quarter after quarter, and propose the Yole's NAND Quarterly Market Monitor and DRAM Quarterly Market Monitor. Both monitors are updated and published every beginning of March (Q1), June (Q2), September (Q3) and December (Q4). Aim of these services is to provide an in-depth coverage of rapidly changing market dynamics and main players' status and strategy.

What is the status of the memory industry, today? What are the economic and technological challenges? What are the key drivers for each market segment, NAND and DRAM? Who are the players to watch, and what innovative technologies are they working on?

Yole presents today its vision of the memory industry.

The memory-processor interface is key for overcoming the “memory wall”, announce Yole's Memory analysts. CXL and DDR5 will enable the new wave of data-intensive applications...

The processor-memory interface is rapidly evolving to meet growing performance needs from data intensive applications, which are being hampered by the so-called “memory wall”, a bandwidth limitation associated with data transfer between the memory and the processing unit.

DDR5 DRAM is the latest updated to the DDR<sup>4</sup> standard and will significantly boost performance compared to DDR4. The new specification brings lower voltage and moves PMICs<sup>5</sup> onto the memory module. It doubles the maximum data rate and increases the die density by a factor of 4 (up to 64Gb).

The production of DDR5 memory is now gaining momentum, with all leading DRAM manufacturers having already finalized their mainstream DDR5 designs:

- SK hynix announced that they are ready to start shipping DDR5 memory to module manufacturers.

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<sup>4</sup> DDR: Double Data Rate

<sup>5</sup> PMIC : Power Management ICs

- Micron announced sampling of DDR5 memory based on the Iznm technology, targeting RDIMMs for servers.
- The DDR5 memory standard will be utilized by upcoming Intel’s server CPUs
- Regarding AMD, its platforms are expected to be launched later this year.

“At Yole we expect a veritable takeoff of DDR5 will occur from 2022”, points out Simone Bertolazzi from Yole.

Besides DDR, a variety of new open interfaces and protocols are currently in the works: CXL, Gen-Z, OpenCAPI, CCIX. Among these, CXL is picking up momentum in data center applications, providing a sweet spot – in terms of capacity and density – for connecting high-capacity DRAM and SCM technologies such as 3D XPoint.

The Status of the Memory Industry 2021 report provides an overview of DIMMs, SSDs, and interfaces. This report marks the beginning of Yole’s systematic investigations in the field of memory modules and storage drives.



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All year long, *Yole Développement* publishes numerous reports and monitors. In addition, memory experts realize various key presentations and organize key conferences.

For example, do not miss to watch the Live Market Briefing: [DRAM & NAND Memory markets show building strength – Could we be entering the next supercycle?](#)

During this digital event, Yole explored what the next few quarters and years hold for both the NAND and DRAM markets, including demand, pricing, and profitability. Watch the replay now!

Make sure to be aware of the latest news coming from the industry and get an overview of our activities, including interviews with leading companies and more on [i-Micronews](#). Stay tuned!

### Press contacts

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### About our analysts

**Simone Bertolazzi, PhD** is a Senior Technology & Market analyst, Memory, at Yole Développement (Yole), working with the Semiconductor, Memory & Computing division. As member of the Yole's memory team, he contributes on a day-to-day basis to the analysis of nonvolatile memory markets and technologies, their related materials and fabrication processes. Previously, Simone carried out experimental research in the field of nanoscience and nanotechnology, focusing on emerging semiconducting materials and their opto-electronic device applications. He (co-) authored several papers in high-impact scientific journals and was awarded the prestigious Marie Curie Intra-European Fellowship. Simone obtained a PhD in physics in 2015 from École Polytechnique Fédérale de Lausanne (Switzerland), where he developed novel flash memory cells based on heterostructures of two-dimensional materials and high- $\kappa$  dielectrics. Simone earned a double M. A. Sc. degree from Polytechnique de Montréal (Canada) and Politecnico di Milano (Italy), graduating cum laude.

As VP of NAND and Memory Research, **Walt Coon** is a member of the Semiconductor, Memory & Computing division, at Yole Développement (Yole). Based in the US, Walt is leading the day-to-day production of both market updates and Market Monitors, with a focus on the NAND market and semiconductor industries. In addition, he is deeply involved in the business development of these activities. Walt has significant experience within the memory & semiconductor industry. He spent 16 years at Micron Technology, managing the team responsible for competitor benchmarking, and industry supply, demand, and cost modeling. His team also supported both corporate strategy and Mergers & Acquisitions analysis. Previously, he spent time in Information Systems, developing engineering applications to support memory process and yield enhancement.

Walt Coon earned a Master of Business Administration from Boise State University (Idaho, United-States) and a Bachelor of Science in Computer Science from the University of Utah (United-States).

As VP of DRAM and Memory Research, **Mike Howard** is a member of the Semiconductor, Memory & Computing division, at Yole Développement (Yole).

Mike's mission at Yole is to deliver a comprehensive understanding of the entire memory and semiconductor landscape (with special emphasis on DRAM) via market updates and Market Monitors. Mike is also deeply involved in the business development of all memory activities. Mike is based in the US.

Mike has a deep understanding of the DRAM and memory markets with a valuable combination of industry and market research experience. For the decade prior to joining Yole, Mike was the Senior Director of DRAM and Memory Research at IHS. Before IHS, Mike worked at Micron Technology where he had roles in corporate development, marketing, and engineering.

Mike earned a Master of Business Administration at The Ohio State University (United-States), a Bachelor of Science in Chemical Engineering and a Bachelor of Arts in Finance at the University of Washington (Washington, United-States).

### About the memory report & monitors

#### **Status of the Memory Industry**

*NAND consolidation, China's bet on two key players, the rise of the CXL interface: as the memory business narrows, the market keeps growing and is poised to exceed \$200B in 2026* – Performed by Yole Développement

#### **Companies cited:**

Adata, Alliance Memory, AP Memory, Apacer, Applied Materials, ASML, Avalanche, Canon, Centon, CXMT, Dialog Semiconductor, Dsilicon, Etron, ESMT, Everspin, Fujitsu, GigaDevice, GlobalFoundries, H-Grace, Hitachi, HLMC, IBM, IDT, Infineon-Cypress, Intel, ISSI, JHICC, Kingston, Kioxia, KLA Tencor, Lam Research, Lapis, Longsys, Liteon, Macronix, Marvell, Maxio, and more...

#### **DRAM and NAND Quarterly Market Monitor**

*The DRAM rocket ship is fueled up and ready for blast off to reach 120B\$ by 2022 due to limited supply coupled with resurgent demand. After a difficult finish to 2020, the NAND market outlook improves in early 2021.* – Performed by Yole Développement



## Press Release

### Related reports:

- [Emerging Non-Volatile Memory 2021](#)
- [Equipment and Materials for 3D-NAND Manufacturing 2020](#)

### About Yole Développement

Founded in 1998, Yole Développement (Yole) has grown to become a group of companies providing marketing, technology and strategy consulting, media and corporate finance services, reverse engineering and reverse costing services and well as IP and patent analysis. With a strong focus on emerging applications using silicon and/or micro manufacturing, the Yole group of companies has expanded to include more than 80 collaborators worldwide... [More](#)

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