

DRAM & NAND: at the forefront of the semiconductor industry

DRAM and NAND Quarterly Market Monitor – Q1, 2021

MARKET DYNAMICS :

- The memory market grew 15% to reach US\$122 billion in 2020.
- NAND Q4 2020:
NAND market revenue grew 28% in 2020.
NAND's competitive landscape remains incredibly dynamic.
As the NAND market evolves, the industry faces many important questions...
- DRAM Q4 2020:
DRAM market revenue grew 6% in 2020.
The DRAM market is constantly evolving and changing.
The DRAM market's future promises to be as dynamic as its past...

When the memory markets surpassed US\$160 billion in revenue in 2018 it would have been easy to believe that a new era had dawned on the notoriously volatile semiconductor segment. The last two years, however, have proven that the only certainty in the memory markets is uncertainty. Revenues collapsed in 2019 by more than 30% as prices fell by nearly 50% for both DRAM and NAND.

As the COVID-19 pandemic gripped the world in 2020 it seemed certain that the memory markets would continue their disastrous declines...yet they did not.

Proving once again that they are volatile and fickle markets, both NAND and DRAM markets grew revenue in 2020, 28% and 6% respectively. Exiting 2020 both the DRAM and NAND markets showed signs that 2021 could be an even stronger year.

Are we entering another memory super cycle similar to 2017? There are still a lot of moving pieces and a lingering pandemic that could change the market's prospects, but the current outlook is bright.

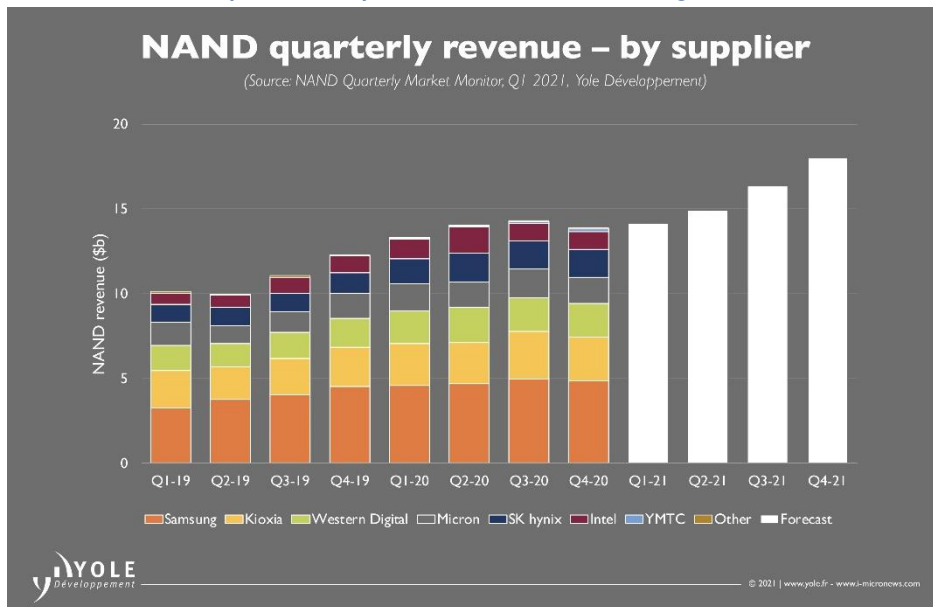
NAND CONTROLLER SHORTAGES PULL IN 2021 RECOVERY

Megatrends and HDD¹ replacement will push NAND to new heights

As said in the [NAND Quarterly Market Monitor, Q1 2021](#), the long-term outlook for the NAND market is positive, despite the continued presence of seasonality and cyclicity. Imbalances in supply and demand can cause market volatility in the short term, but emerging

¹ HDD: Hard-Disk Drives

megatrends driving massive data generation and the ongoing replacement of HDDs with NAND-based SSDs² are expected to push NAND to new heights.



According to **Walt Coon, VP of NAND and Memory Research at Yole Développement (Yole)**: “Shortages of controllers and other NAND sub-components are causing supply chain uncertainty, putting upwards pressure on ASP³s. The recent shutdown of Samsung’s manufacturing facility in Austin, Texas, USA, 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 the controller shortages are most pronounced”.

NAND’s competitive landscape remains incredibly dynamic. Samsung is utilizing its massive Pyeongtaek site and expanding its facilities in Xi’an, China; KIOXIA Corporation and its partner Western Digital continue to expand their footprint in Japan; SK Hynix is in the process of acquiring Intel’s NAND/SSD business; and Micron continues to be a 3D technology leader even as it transitions from floating - to replacement-gate technology. Meanwhile, a new entrant looms on the horizon: China’s Yangtze Memory Technologies Co. (YMTC), which threatens to disrupt the status-quo.

THE DRAM ROCKET SHIP IS FUELED UP AND READY FOR BLAST OFF

Megatrends are pushing more dram into products

The DRAM rocket ship is fueled up and ready for blast off to reach US\$120 billion by 2022 due to limited supply coupled with resurgent demand.

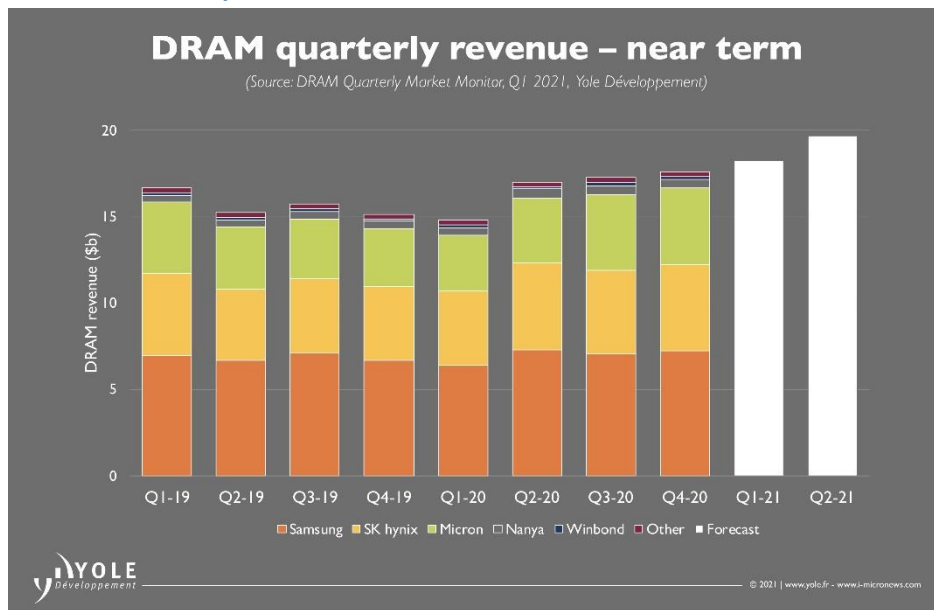
The long-term megatrends boosting the entire semiconductor industry have a very positive impact on the memory market, especially DRAM. Mobile phone in general and the 5G revolution in particular, along with hyperscale data center, AI⁴ and machine learning, and

² SSD: Solid-State Drives

³ ASP: Average Selling Price

⁴ AI: Artificial Intelligence

autonomous driving are all pushing DRAM adoption, with a CAGR⁵ of more than 20% for bit demand over the next five years.



According to **Mike Howard, VP of DRAM and Memory Research from Yole** in the **DRAM Quarterly Market Monitor**: *“The DRAM market is constantly evolving and changing. The recent market volatility is clear evidence of this. New Chinese suppliers threaten to eventually disrupt the market and emerging memory technologies are poised to cannibalize huge chunks of DRAM demand while the demand drivers of the past (PCs and smartphones) lose steam and no longer push industry demand”*.

The DRAM market’s future promises to be as dynamic as its past.

DRAM & NAND INDUSTRIES: OUTLOOK LOOKS PROMISING. BUT... | QUARTERLY MARKET MONITOR

Without a doubt, memory is one of the primary market segments for semiconductor products. However, uncertainties in the NAND and DRAM markets remain, as highlighted by Yole Développement (Yole) in its latest memory monitors, NAND Quarterly Market Monitor and DRAM Quarterly Market Monitor, Q1 2021. The market research and strategy consulting company invites you to discover today the status of these markets, one year removed from the start of the COVID-19 pandemic... Discover the full article on i-Micronews.

WHAT’S NEXT?

Although the anticipated 2020 NAND recovery failed to materialize as impacts from COVID-19 and worsening trade tensions between the US and China proved too much to overcome, the market appears poised for a rebound in 2021. Post pandemic demand recovery and limited

⁵ CAGR: Compound Annual Growth Rate

supply growth should lead to market and profit expansion this year. Longer-term, NAND revenue is expected to grow as cost reductions enable further penetration of NAND-based storage solutions into traditional HDD markets. On the technology front, despite layer count growth and the emergence of QLC, technology-driven bit growth will slow as process and manufacturing complexities continue to rise.

With the world slowly emerging from the COVID pandemic and markets returning to normal things are looking very positive for the DRAM market. Underinvestment in new production capability over the last two years will result in a tight supply of DRAM which, when coupled with recovering demand, will result in rising prices and rising prospects for the overall DRAM market. We are likely on the cusp of another huge up-cycle for the DRAM market.

Yole's NAND QUARTERLY MARKET MONITOR and DRAM QUARTERLY MARKET MONITOR will be 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..



In addition, the market research and strategy consulting company Yole released the annual Memory technology & market report: Status of the Memory Industry 2020 – Focus on Kioxia.

Stay tuned to i-Micronews to get further information about our Advanced Packaging, Semiconductor Manufacturing & Memory activities!

In this regard, take part to the dedicated DRAM & NAND Memory markets show building strength – Could we be entering the next supercycle? LIVE MARKET BRIEFING, presented by **Walt Coon** and **Mike Howard**, on Wednesday 07, April 2021. Register on i-Micronews.

Finally, do not miss the Intermag 2021: 12th MRAM Global Innovation Forum on Tuesday 27, April 2021 2:00am - 4:00am, especially the live panel discussion titled “What do we need to bring MRAM to next level?”. Register on i-Micronews.

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About the memory team at Yole Développement

Walt Coon joins Yole Développement's memory team as VP of NAND and Memory Research, part of the Semiconductor & Software division. 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).

Mike Howard is a member of the memory team at Yole Développement (Yole) as VP of DRAM and Memory Research. 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).

Simone Bertolazzi, PhD is a Technology & Market analyst at Yole Développement (Yole) working with the Semiconductor, Memory & Computing Division. He is member of the Yole's memory team and he contributes on a day-to-day basis to the analysis of nonvolatile memory 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- κ dielectrics. Simone earned a double M. A. Sc. degree from Polytechnique de Montréal (Canada) and Politecnico di Milano (Italy), graduating cum laude.

Emilie Jolivet is Director of the Semiconductor, Memory & Computing Division at Yole Développement, part of Yole Group of Companies, where her specific interests cover package & assembly, semiconductor manufacturing, memory and software & computing fields. Based on her valuable experience in the semiconductor industry, Emilie manages the expansion of the technical and market expertise of the Semiconductor and Software Team. The team interacts daily with leading companies allowing semiconductor & software analysts to collect a large amount of data and integrate their understanding of the evolution of the market with technology breakthroughs. In addition, Emilie's mission focusses on the management of business relationships with semiconductor leaders and the development of market research and strategy consulting activities inside the Yole group. Emilie Jolivet holds a Master's degree in Applied Physics specializing in Microelectronics from INSA (Toulouse, France). After an internship in failure analysis at Freescale (France), she was an R&D engineer for seven years in the photovoltaic business where she co-authored several scientific articles. Enriched by this experience, she graduated with an MBA from IAE Lyon and then joined EV Group (Austria) as a business development manager in 3D & Advanced Packaging before joining Yole Développement in 2016

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



Press Release

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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