



SCARY MEMORY

NO.9 OCT23 MEMPHIS MEMORY ESSENTIALS

Everything you need to know about the semiconductor memory industry, from legacy technologies to latest innovations.
 Brought to you by MEMPHIS Electronic, your specialist memory distributor and DRAM module configurator. We are posting similar stories regularly on [LinkedIn](#), so follow us there to stay on top of the news.

Who's Afraid of Memory Prices?

October is a scary time of the year with Halloween around the corner challenging us to face our fears. And if you have been following our updates, you might be scared of the looming price increases in DRAM and NAND memory. But fear not, we help you conquer those fears.

The recent spot price increase for NAND flash and DRAM appears to indicate that the toughest part of the downturn is over, and that the semiconductor market is returning to health as a whole.

For the last six months, this market has experienced an upturn, indicating that demand is coming back to healthy levels. So yes, prices are increasing. But from a very low level. And while there are also indications that we are headed into the next "boom and bust cycle", there's no need to panic.

But the time is just right to plan ahead, assess your demand for the next months and speak with us to secure your supply at the current price.

What else is new? ReRAM might be an alternative for NOR, and hybrid bonding could be a way to increase DRAM capacity. Samsung has introduced a roadmap for its automotive eMRAM products, and Intelligent Memory explains why writing and reading NAND flash at different temperatures can cause bit errors.

We also held a session on the DRAM tester from Neumonda Technology beginning of the month that you shouldn't miss. After all, the Rhinoe Tester is shortlisted for an Elektra Award as Innovative Test Product of the Year!

Enjoy the read!

Price Projections for Different Categories of DRAM Products, 2023-2025				Price Projections of Different Categories of NAND Flash Products, 2023-2025			
PC DRAM	DDR4 down 1-2% DDR5 up 1-2% DDR5 up 1-2% DDR5 up 1-2%	DDR4 up 1-2% DDR5 up 1-2% DDR5 up 1-2% DDR5 up 1-2%	DDR4 up 1-2% DDR5 up 1-2% DDR5 up 1-2% DDR5 up 1-2%	Client SSD	down 3-13%	up 8-13%	up 10-13%
Server DRAM	DDR4 down 1-2% DDR5 up 1-2% DDR5 up 1-2% DDR5 up 1-2%	DDR4 up 1-2% DDR5 up 1-2% DDR5 up 1-2% DDR5 up 1-2%	DDR4 up 1-2% DDR5 up 1-2% DDR5 up 1-2% DDR5 up 1-2%	Enterprise SSD	down 3-13%	up 5-10%	up 10-13%
Mobile DRAM	LPDDR4 down 1-2% LPDDR5 up 1-2% LPDDR5 up 1-2% LPDDR5 up 1-2%	LPDDR4 up 1-2% LPDDR5 up 1-2% LPDDR5 up 1-2% LPDDR5 up 1-2%	LPDDR4 up 1-2% LPDDR5 up 1-2% LPDDR5 up 1-2% LPDDR5 up 1-2%	eUFS	down 3-13%	up 10-13%	up 10-13%
Automotive DRAM	down 1-2%	up 1-2%	up 1-2%	3D NAND Wafers (TLC & QLC)	up 3-8%	up 13-18%	up 13-18%
Total DRAM	down 1-2%	up 1-2%	up 1-2%	Total NAND Flash	down 1-10%	up 8-13%	up 8-13%



Q4 DRAM and NAND Prices Set to Rise

We're in the last quarter of 2023 and as anticipated Trendforce reports indicate a price increase for both DRAM and NAND Flash. DRAM prices are projected to see a quarterly surge of about 3-8% and NAND a hike of 8-13%. Whether this upward momentum can be sustained will hinge on the suppliers' steadfastness in maintaining production cuts and the actual demand, with the general-purpose server market being a critical determinant for both, DRAM and NAND memory.

DDR5 prices had already surged in the third quarter and are expected to maintain their upward trajectory. As DDR5 adoption accelerates, an approximate 3-8% quarterly increase is projected for PC DRAM contract prices. Trendforce also sees that most manufacturers are resistant to further price reductions, instead pushing for aggressive increases. This stance sets the stage for an anticipated rise in DDR4 prices by 0-5%.

Find out more [here](#).

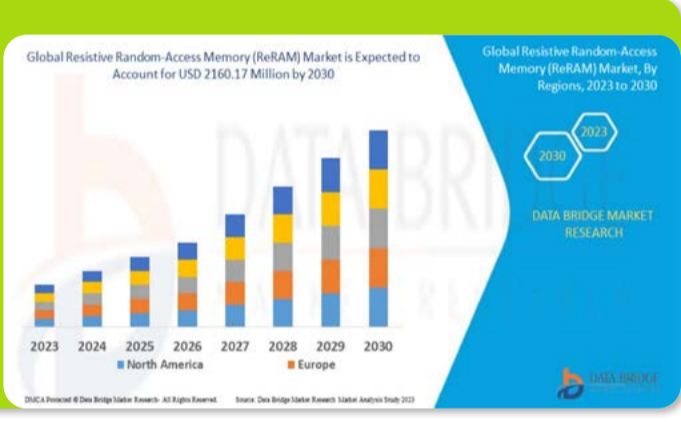
Samsung Plans 5nm Automotive eMRAM

In order to meet the needs of the latest advancements in the automotive market, Samsung is setting out to develop the industry's first 5-nanometer eMRAM for next-generation automotive technology. eMRAM is a next-generation memory semiconductor used for automotive applications that enables high read and write speeds as well as superior heat resistance.

Since developing and mass-producing the industry's first 28nm eMRAM based on its Fully Depleted Silicon On Insulator process technology in 2019, Samsung has been developing 14nm for the FinFET process based on AEC-Q100 Grade 1. Samsung Foundry plans to expand its eMRAM portfolio by adding 14nm by 2024, 8nm by 2026, and 5nm by 2027.

Samsung's 8nm eMRAM shows the potential to deliver a 30% increase in density and a 33% increase in speed, compared to the 14nm process.

Read more [here](#).



ReRAM Seeks to Replace NOR

Resistive RAM is gaining renewed attention as demand for faster and cheaper non-volatile memory alternatives continues to grow, particularly in applications such as automotive. A key argument is that some new applications are demanding higher performance and that improved speed is no longer achievable just through scaling that flash.

The NOR market is growing at a 14% CAGR and is forecast to reach \$1.64 billion by 2028, according to Business Market Insights. ReRAM, meanwhile, will surpass NOR in value over the next few years, growing at a 17.2% CAGR and forecast to reach \$2.16 billion by 2030, according to Data Bridge Market Research. Companies remain bullish for all of these memories, particularly in light of heterogeneous integration and the rapidly increasing volume of data.

ReRAM is now one of the leading contenders to replace the high end of the embedded flash (eFlash) lineup, although not likely NAND flash.

Read more [here](#) on semiconductor engineering.



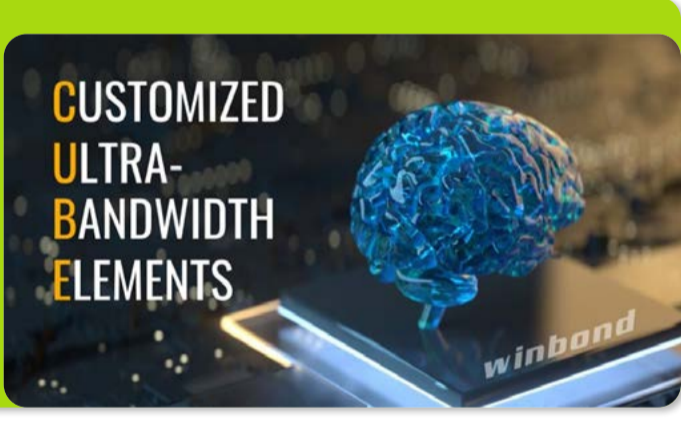
Why Trust is Good, but DRAM Testing is Better

Have you ever experienced random boots or single-cell fails in your DRAMs? How fast did you find the root cause? And more importantly, what was the impact?

As vital as DRAMs are for virtually all designs, they are not immune to errors and some of those only occur after hours of use once a product is widely shipped and deployed. During the Industry Tech Days from All About Circuits Peter Pöchmüller, CEO of MEMPHIS and Neumonda explained the revolutionary new approach to application-specific DRAM testing with the new Rhinoe Tester.

Peter explained the complex steps in DRAM testing today and pointed out the weaknesses in the current process. A way out is looking at testing from an application point of view and simulating the actual industrial application a DRAM will be used in. Are you curious how this can be done and even at a fraction of the costs of traditional tests?

Then make sure you watch the recording [here](#).

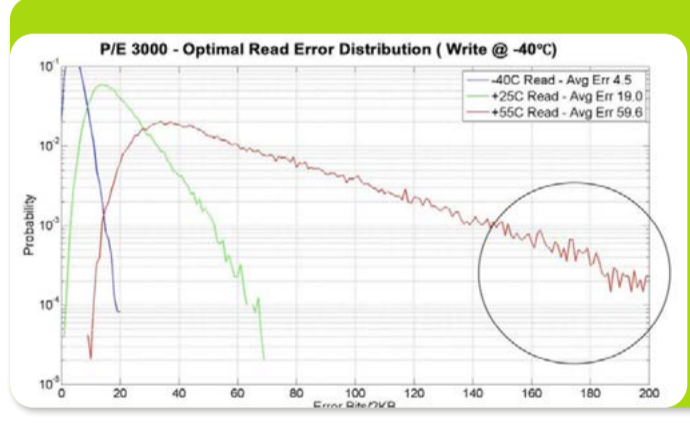


Winbond CUBE for AI devices

Winbond has unveiled a powerful memory enabling technology for affordable Edge AI computing in mainstream use cases, called CUBE (customizable ultra-bandwidth elements). It is optimized for seamless performance running generative AI on hybrid edge/cloud applications.

CUBE enhances the performance of front-end 3D structures such as chip on wafer (CoW) and wafer on wafer (WoW), as well as back-end 2.5D/3D chip on Si-interposer on substrate and fan-out solutions. It is compatible with memory density from 256Mb to 8Gb in a single die, and it can also be 3D stacked to enhance bandwidth while reducing data transfer power consumption. The technology will be used in advanced applications such as wearable and edge server devices, surveillance equipment, ADAS, and co-robots as well as advanced AI devices.

Read the full press release [here](#).

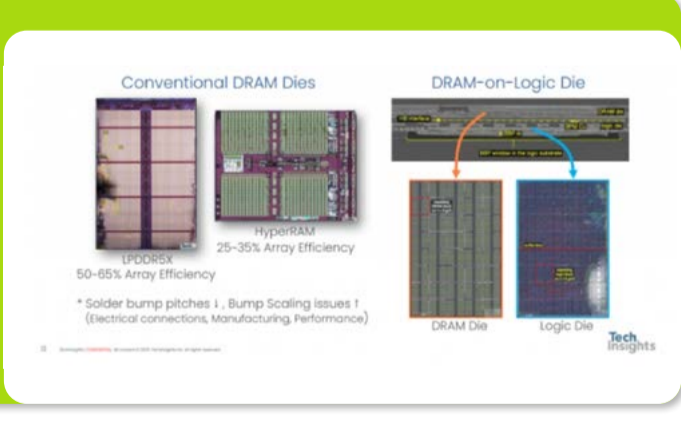


Cross Temperature Challenges in NAND Flash

The cross-temperature effect, caused by reading and writing at different temperatures, has always presented a challenge for NAND Flash technology. Sensing data at a temperature different from that used during programming can introduce error bits, leading to unrecoverable data corruption, even when integrated error correction codes are employed. The key issue that induces these error bits is the shift in Vth during data sensing, and Program/Erase cycles exacerbate the problem.

For this reason, same temperature performance cannot be guaranteed solely through production testing when NAND flash is in a fresh state. High-endurance conditions pose a greater challenge for cross-temperature applications. That's why Intelligent Memory's NAND memory products not only rely on production tests but also on NAND Flash-level research and evaluation results, validated through extensive lab testing for high-endurance conditions.

Read the short white paper [here](#).



Hybrid Bonding to Increase DRAM Capacity?

Current DRAMs include the logic circuits inside the DRAM array die. If this could be separated to move the logic to the peripheral, the space can be used to pack in more memory circuits. This idea is not new, NAND memory already has the peripheral underneath the memory cell to increase density.

According to TechInsights, Samsung, SK Hynix, and Intel are preparing to apply the process in their chip-making. However, they also acknowledge that

3D DRAM is difficult to develop as unlike gate-all-around NAND, DRAM faces homogeneity issues when moving to a 3D architecture.

That is why memory chip makers will likely develop 4F square instead, a cell array structure that is an upgrade from 6F square and can reduce the surface area of the die by 30%.

Read the full story [here](#).



Fingers Crossed for our Elektra Awards Nomination

Have you heard the news? The DRAM test board developed by Neumonda Technology, a division of Neumonda Group, has been shortlisted for an Elektra Award in the category "Test Product of the Year". The prestigious award will be presented during an award ceremony on November 29, 2023 in London.

With its new Rhinoe DRAM tester, Neumonda revolutionizes memory testing. The tester is light-weight, low-cost and energy-efficient and enables longer testing of DRAM components. The new tester enables Neumonda to conduct vendor-independent tests that also simulate the actual environment in which the DRAM memory is going to be used in to predict potential failures much more accurately. All this at a fraction of the costs of traditional testers.

Read the press release [here](#) and keep your fingers crossed for us next month!

How do you like our monthly newsletter?
 Let us know how we are doing and what topics you would like to read more about.
 Stay in the know. Subscribe to our newsletter [here](#).

If you no longer wish to receive this mail you can unsubscribe [here](#) for free.