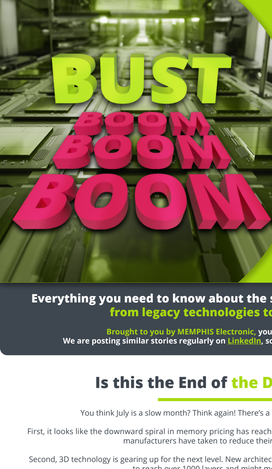


MEMPHIS
WE KNOW MEMORY

NO.6 JULY 23

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.
We are posting similar stories regularly on LinkedIn, so follow us there to stay on top of the news.

Is this the End of the Downward Spiral?

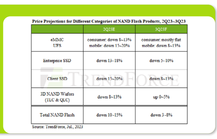
You think July is a slow month? Think again! There's a lot happening in semiconductor memory.

First, it looks like the downward spiral in memory pricing has reached its end. Industry experts all agree that the measures manufacturers have taken to reduce their stock levels are taking effect.

Second, 3D technology is gearing up for the next level. New architectures have been introduced that might help scale NAND to reach over 1000 layers and might move 3D DRAM within reach.

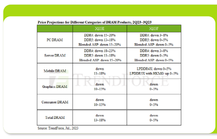
Third, do you know the DRAM security threat RowPress? And more importantly, do you know how to safeguard against it? Then read on.

Stay on the pulse of development in the market. And most importantly, plan ahead to make sure you have the memory products that you need. Industry experts agree that the market might move to an undersupply fast, as the production output cannot be scaled up that quickly. So do you have the supply you need? Speak with us. We have over 18 memory manufacturers in our line card. We can help – we always aim high (read on and you will understand).


Price Projections for Different Categories of NAND Flash Products: 2Q23-3Q23

Item	2Q23	3Q23
eMMC/UFS	consumer: down 0~5%	consumer: mostly flat
UFS	mainstream: down 5~10%	mainstream: down 0~5%
Enterprise SSD	down 10~15%	down 5~10%
Client SSD	down 5~10%	down 0~5%
3D NAND Wafer (SLC & QLC)	down 5~15%	up 0~5%
Total NAND Flash	down 10~15%	down 5~10%

Source: TrendForce, Jul., 2023


Price Projections for Different Categories of DRAM Products: 2Q23-3Q23

Item	2Q23	3Q23
PC DRAM	2Q23: down 15~20% Blended ASP: down 15~20%	3Q23: down 0~5% Blended ASP: down 0~5%
Server DRAM	2Q23: down 18~23% 3Q23: down 11~16% Blended ASP: down 15~20%	3Q23: down 2~8% 3Q23: down 0~5% Blended ASP: down 0~5%
Mobile DRAM	2Q23: down 13~18% 3Q23: down 0~5%	3Q23: down 0~5% LPDDR4X: down 0~5% LPDDR5/5X with BOM cut: up 0~5%
Graphics DRAM	2Q23: down 0~5%	3Q23: down 0~5%
Consumer DRAM	2Q23: down 10~15%	3Q23: down 0~5%
Total DRAM	2Q23: down 13~18%	3Q23: down 0~5%

Source: TrendForce, Jul., 2023

NAND Prices Will Continue to Fall Slightly

Given that the trajectory of market demand is still unclear, it's expected that the NAND Flash market will continue to be in a state of oversupply in 3Q23. TrendForce predicts that NAND Flash wafers will be the first to see a price hike in 3Q23 while the overall average selling price of NAND Flash is forecast to continue dropping by about 3~8% in 3Q23, though a possibility exists prices may recover in 4Q23.

However, for small-capacity eMMCs, suppliers have aggressively slashed prices in 2Q23 to the point where there's almost no further room for prices to continue falling. As such, suppliers have ceased price-cutting, and it's predicted that the price of small-capacity eMMCs will remain stable in 3Q23.

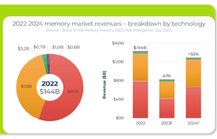
Read the full press release here.

DRAM Price Decrease to Bottom Out

It looks like the production cut of memory manufacturers is taking effect, even if only slowly. TrendForce projects that the third quarter will see the average selling price for DRAM converging towards a 0~5% decline. Despite suppliers' concerted efforts, inventory levels persistently remain high, keeping prices low. While production cutbacks may help to curtail quarterly price declines, a tangible recovery in prices may not be seen until 2024.

Trendforce takes a closer look at price development in Q3 in PC DRAM, Server DRAM, Mobile DRAM, Graphics DRAM and Consumer DRAM. Even if these might not directly cover the areas you are working in, it is a good indication of what to expect.

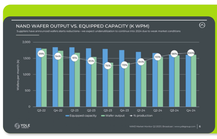
Read the full press release here.



Memory Market is Primed for Comeback

Over the past several quarters, the memory markets have faced the most dramatic downturn of the last 15 years. Production cuts have set up suppliers to reach a market balance by the end of 2023. However, the financial losses incurred so far have been massive, and a recovery time longer than usual will be needed before suppliers increase their investments again. As such, Yole Intelligence predicts that 2024 and 2025 will be marked by undersupply and climbing prices, and expects revenues to soar: after declining to $42B for DRAM (-47% YoY) and $37B for NAND (-37% YoY) in 2023, combined memory revenues are expected to grow to a new record-high of over $200B by 2025.

Read more here.



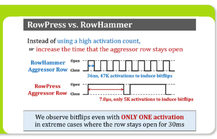
Impact of NAND Wafer Cuts

Wafer cuts are very rare in the memory industry and are indicative of how serious the long downturn has become for manufacturers. In its Q2 NAND Market Monitor, Yole Intelligence takes a look at the impact of these reductions.

Although it takes time for cuts to actually impact bit output, Yole expects that by the end of the second half of the year, wafer output will be below 80% of the max capacity for the industry! This will not only lead to record-low production growth in 2023. In fact, Yole expects bit production will be even lower than in 2022, which is unheard of.

However, inventory levels will normalize and set the market up for a rebound in 2024. As market conditions improve, wafer utilization will climb up again to 100% by the end of 2024.

Read more here.



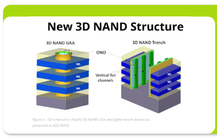
RowPress: A New DRAM Vulnerability

You probably heard of RowHammer, but do you know RowPress? This is another widespread read-disturb phenomenon that researchers at ETH Zürich analyzed in more detail. In their paper, the researchers show in real DDR4 chips that RowPress breaks memory isolation by keeping a DRAM row open for a long period of time, which disturbs physically nearby rows enough to cause bitflips.

They demonstrate that RowPress amplifies DRAM's vulnerability to read-disturb attacks by significantly reducing the number of row activations needed to induce a bitflip by one to two orders of magnitude under realistic conditions. It's also worth noting, that RowPress affects a different set of DRAM cells from RowHammer.

The research team also describes some mitigation techniques, so future DRAM modules will likely be safer from this particular attack.

Read more here.



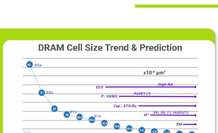
Getting to +1,000 NAND Layers

3D NAND flash has moved from 24 layers initially to almost 240 layers today. However, increasing the number of layers introduces ever higher processing complexities and costs, challenges deposition and etch processes, and causes stress to build up inside the layers. To overcome these challenges, industry is introducing a few complementary process 'tricks' to obtain the 1,000 layers eventually.

Once GAA NAND Flash scaling has saturated, imec foresees the introduction of a new architecture to connect the charge trap cells: the trench cell architecture. With this architecture, 3D NAND moves away from the circular GAA memory cell geometry. Instead, the cells are implemented at the sidewall of a trench – resembling a planar configuration being tilted on its side – with two transistors at opposite walls of the trench.

This next-generation NAND Flash cell architecture will not only offer the required leap in bit storage density it is also believed to reduce costs.

Read more here.



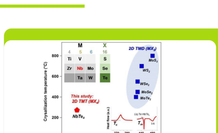
3D DRAM is Coming

Advances in DRAM have been driven by scaling, shrinking the overall footprint as each generation progresses to the next (node to node). And so DRAM is following in the steps of NAND by evolving to three dimensions in order to build more storage (more bits) per unit area.

LAM Research published suggestions for a 3D DRAM architecture that addresses the current issues in scaling, stacking and shrinking. Its proposed architecture is based on innovative connections to facilitate current moving through a central stack of bitlines and suggests introducing an array of vias that goes through the silicon stack and can stop at each level—one via per level.

The 3D DRAM architecture outlined by LAM is cutting-edge design, which demands never seen or tried processes and designs. Still, bases on current technical capabilities, it will still be at least 5-8 years before we see 3D DRAM.

Read more here.



Promising Materials for Next-Gen Memories

With traditional memory technologies reaching their physical limits, new materials show promise for next-generation memory technology. One of them is Phase Change Memory, a type of nonvolatile memory that harnesses a phase change material's (PCM) ability to shift from an amorphous state, i.e., where atoms are disorganized, to a crystalline state, i.e., where atoms are tightly packed close together. This change produces a reversible electrical property that can be engineered to store and retrieve data.

While this field is in its infancy, phase change memory could potentially revolutionize data storage because of its high storage density, and faster read and write capabilities. Now, a group of researchers from Tohoku University has identified an exceptionally promising material—niobium telluride (NbTe4)—that exhibits an ultra-low melting point of approximately 447 °C (onset temperature), setting it apart from other Transition Metal Dichalcogenides.

Read more about it here.

Aiming High

We are all focused on our work, however, beginning of July the MEMPHIS team focused on #fun during our summer event. Starting with a round of field archery, where small teams practiced their aim. Although most of us had not had a bow and arrow in hand since our childhood days, it was fun to see how quickly we got better with a bit of focus and by following the advice of our team members.

After all, that's what a great team is all about. And that's what we celebrated with a great BBQ on a beautiful summer evening.

What are you doing for your summer parties? We would love to hear your stories and ideas.

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.

MEMPHIS Electronic GmbH

www.memphis.de
info@memphis.de

MEMPHIS
WE KNOW MEMORY