

BiCS FLASH 3D Flash Memory – The Powerful Combination of Vertical and Lateral Scaling

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In a recent [interview with EETimes](#), I was asked about advancements and innovations surrounding 3D flash memory. In this conversation I touched on one of the industry's hottest topics – layers.

During this discussion, I dispelled the assumption that the supplier with the highest number of layers must be leading the race, and that the others must be lagging behind technology-wise. In reality, there are a number of factors that determine the NAND offering that is best suited to each application – and getting to the most layers the fastest is far less important than producing a competitive, cost-efficient part.

The conversation surrounding 3D flash memory is ongoing, and one I have often with customers, analysts and others. Here is a sampling of some of the questions I typically get asked – as well as my responses:



Q: How has the discussion surrounding the very hot topic of layers evolved?

A: Last time, we talked about bringing to market memory solutions that are cost competitive and high performing. This is the gold standard by which we operate. Addressing application needs in a cost sensitive environment brings new challenges that are difficult or impossible to achieve when you're focused on achieving x amount of layers. At KIOXIA, we believe that technology leadership is determined not by how high you go but by bringing the most cost-effective solution that meets the performance and density requirements, regardless of number of layers.

Q: What is the latest technology from KIOXIA that addresses the industry demand for greater density at lower cost?

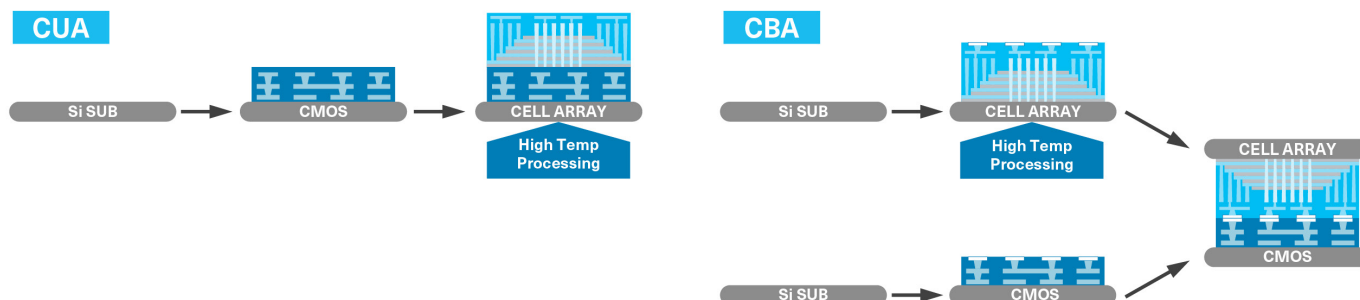
A: This year we announced our 8th generation of BiCS FLASH™ 3D flash memory which introduced an entirely new architecture. Keep in mind, our goal is not to go higher, which adds more costs. But rather we are addressing the application challenges we face by innovating in our design. This latest BiCS FLASH generation offers 218 layers with a CMOS directly bonded to array (CBA) architecture and lateral shrink technology in a 4-plane device.

The performance improvements are many¹ – including 60% interface speed increase to 3.2 Gbps, 20% write performance improvement, more than 10% read latency improvement, 50% higher bit density, and greater than 30% improvement in power efficiency, as compared to our previous generation.

Q: Explain a bit more about CBA technology

A: KIOXIA has implemented CBA (CMOS directly bonded to array) technology wherein each CMOS wafer and cell array wafer are manufactured separately in its optimized condition and then bonded together to deliver enhanced bit density and fast NAND I/O speed. Fabrication of the cell and peripheral separately enables optimization of each, eliminating the trade-off between cell reliability and I/O speed.

Previous generations of our BiCS FLASH 3D flash memory utilized a CUA architecture. Here's a look at the two side by side:



Q: Recap for us how KIOXIA is tackling performance and density demands differently than competitors.

A: It's no surprise that economic times are challenging us to be creative in order to thrive. The demand for high performance is stronger than ever with data-centric applications like advanced smart phones, PCs, SSDs and data centers being pushed to the limit with more and more data every day. KIOXIA is committed to bringing high density, high performance and cost-effective solutions to market. While competitive solutions seem to be in a constant scramble to go higher, we view it differently. Our combination of vertical and lateral scaling produces greater capacity with fewer layers. We believe that offering a major leap in performance, density and cost through vertical and lateral scaling and wafer bonding is the best solution for our customers. This powerful combination results in higher density, smaller die size and optimized costs.

¹ Features and typical use performance improvements as compared to the previous generation of BiCS FLASH™ 3D flash memory.

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In every mention of a KIOXIA product: Product density is identified based on the density of memory chip(s) within the Product, not the amount of memory capacity available for data storage by the end user. Consumer-usable capacity will be less due to overhead data areas, formatting, bad blocks, and other constraints, and may also vary based on the host device and application. For details, please refer to applicable product specifications. The definition of 1KB = 2¹⁰ bytes = 1,024 bytes. The definition of 1Gb = 2³⁰ bits = 1,073,741,824 bytes. The definition of 1GB = 2³⁰ bytes = 1,073,741,824 bytes. 1Tb = 2⁴⁰ bits = 1,099,511,627,776 bits.

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