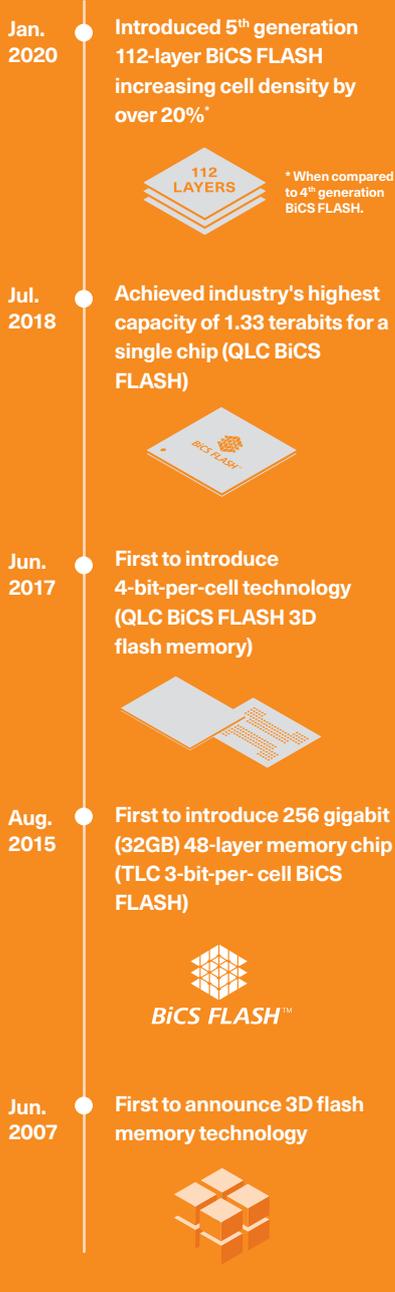


# 3D BiCS FLASH™: The Future of High-Density Flash Memory

KIOXIA delivers flash-based products for next-generation storage applications. Having invented NAND flash over 30 years ago, KIOXIA is now one of the world's largest flash memory suppliers – and continues to move the technology forward.

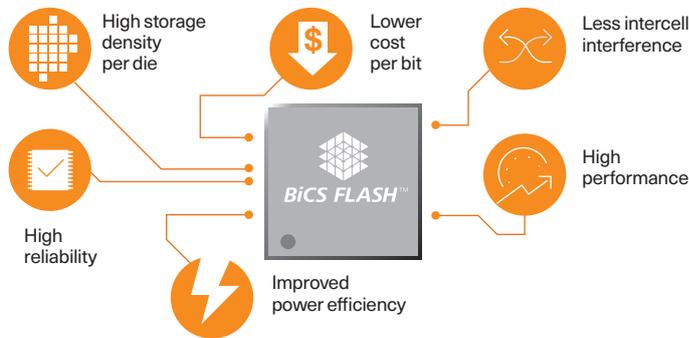
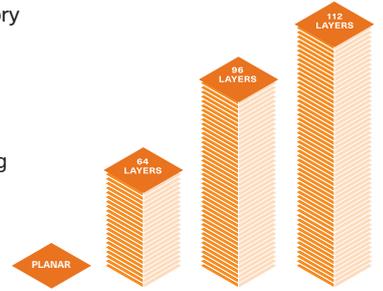
## BiCS FLASH: Accelerating Beyond 2D



## What is BiCS FLASH™?

KIOXIA's BiCS FLASH is a three-dimensional (3D) vertical flash memory cell structure. This structure enables it to surpass the capacity of mainstream 2D (planar) flash memory.

KIOXIA's TLC 3-bit-per-cell 512Gb (64GB<sup>1</sup>) BiCS FLASH, an industry first<sup>2</sup>, enhances the reliability of write/erase endurance while boosting write speeds. The company also offers a 1.33Tb BiCS FLASH device that features 4-bit-per-cell, quadruple-level-cell (QLC), technology. It's the first 3D flash memory device to do so<sup>3</sup>.



## DENSITIES OFFERED

Based on 16-die stacked architecture in a single package

TLC Triple-Level Cell	QLC Quad-Level Cell
<b>1TB</b> Single-package device with 512Gb die	<b>2.66TB</b> Single-package device with 1.33Tb die
<b>512GB</b> Single-package device with 256Gb die	<b>BENEFITS OF QLC</b> <ul style="list-style-type: none"> <li>Highest density flash (2.66TB single package)</li> <li>Lowest cost per bit</li> </ul>

## Why 3D Memory?

Moving to a 3D structure was a necessary evolution from 2D floating gate flash, because the memory cell size for 2D flash had shrunk to its limit. Floating gate's last generation was 15nm, which enabled a density of 128Gb per die. Compared to floating gate, BiCS FLASH 3D flash memory offers higher density, higher endurance, higher performance and better power efficiency. Single die densities of 256Gb and higher are now possible with BiCS FLASH.

## APPLICATIONS



The future of high-density flash memory lies in 3D. Already enabling the enterprise, data center, PC and mobile applications of today, our BiCS FLASH has paved the way for the applications that will turn possibilities into realities. Storage density needs are continually climbing higher and higher – and we designed BiCS FLASH with this in mind.”

– **Scott Nelson**, Senior Vice President and General Manager, Memory Business Unit, KIOXIA

**\$** The global 3D flash memory market garnered \$9.06 billion in 2017 and is expected to reach \$99.77 billion by 2025.  
Source: Allied Market Research<sup>4</sup>

[1] 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 1Gb = 2<sup>30</sup> bits = 1,073,741,824 bits. The definition of 1GB = 2<sup>30</sup> bytes = 1,073,741,824 bytes.  
 [2] As of August, 2015. KIOXIA survey.  
 [3] As of June, 2017. KIOXIA survey.  
 [4] Source: Allied Market Research report: "3D NAND Flash Memory Market by Type (Single-Level Cell, Multi-Level Cell, and Triple-Level Cell), Application (Cameras, Laptop & PCs, Smartphone & Tablets, and Others), and End Users (Automotive, Consumer Electronics, Enterprise, Healthcare, and Others): Global Opportunity Analysis and Industry Forecast, 2017 – 2025."  
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