

# QLC Accelerates into the Mainstream

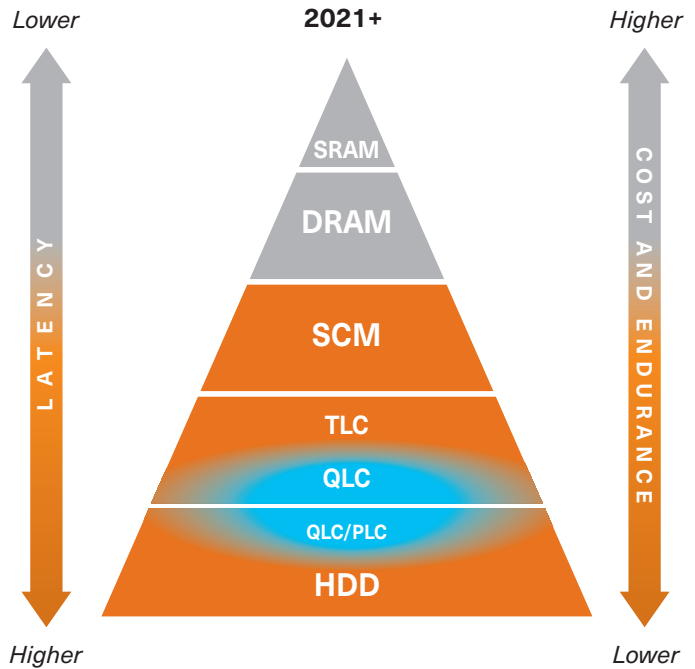
With accelerating data creation comes an increased need for high density storage solutions, and KIOXIA has applied its flash engineering expertise to push boundaries. The inventor of flash memory, KIOXIA successfully created the world's first 3D QLC flash memory back in 2017<sup>1</sup>.

## What is QLC?

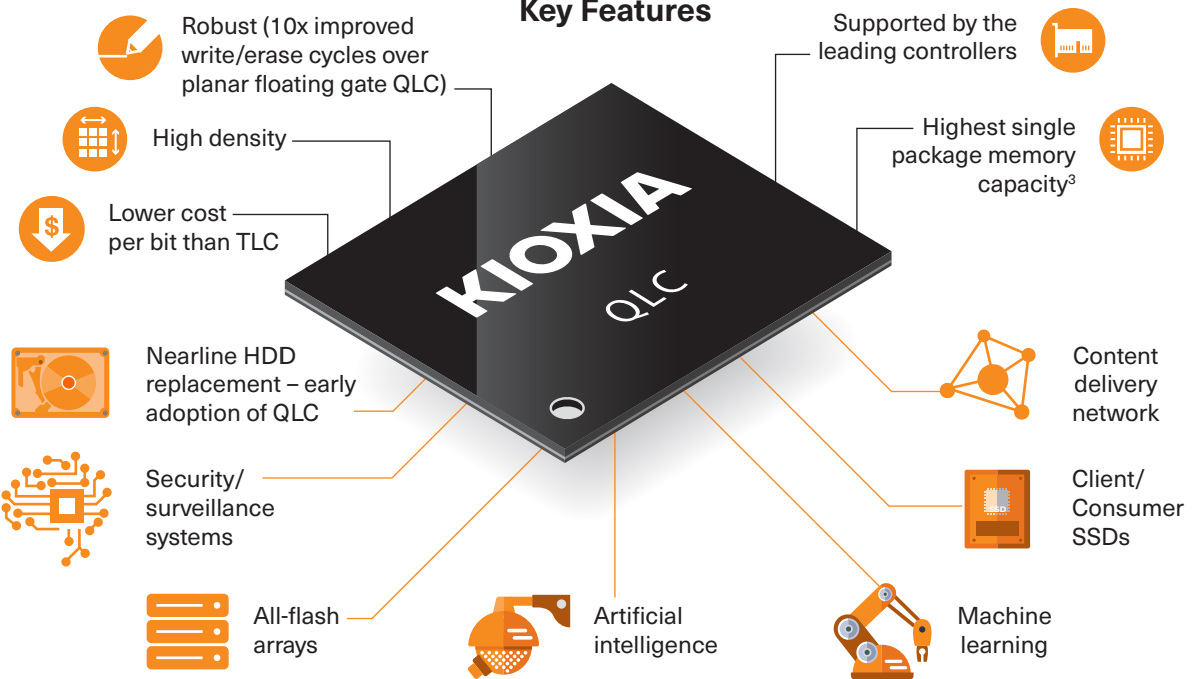
KIOXIA's BiCS FLASH™ 3D flash memory product lineup includes 4-bit-per-cell, quadruple-level-cell (QLC) technology, which significantly expands capacity by pushing the bit count for data per memory cell from three to four.

KIOXIA's QLC technology is an ideal solution for read-intensive environments, enabling data center and enterprise customers to balance performance, endurance, density, and cost.

## The Memory Hierarchy



## Key Features



## Eyes on the Future – QLC Applications

### Densities Currently Offered

1. 33Tb die

2. 66TB Single package (16-stacked die)

## Make Way for QLC SSDs

The cost/performance of QLC SSDs is better than HDDs – making them an ideal alternative to the lower performance spinning disks commonly deployed in data centers. Nearline HDD replacement is one area in which QLC SSDs are increasingly impacting the data center.

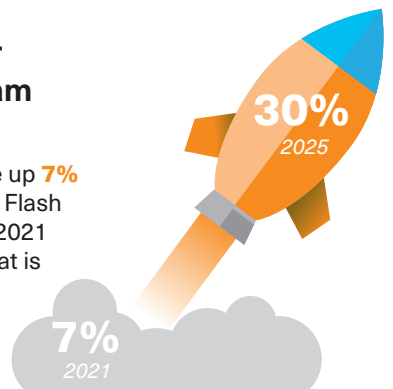
## Data Centers get Greener<sup>4</sup> with QLC

When compared to nearline HDDs, QLC-based SSDs:

- Improve power consumption
- Increase scaling density per watt
- Bring new levels of scalability to the data center

## Poised for Mainstream Adoption

QLC will make up **7%** of total NAND Flash shipments in 2021 – a number that is projected to grow to **30%** by 2025<sup>2</sup>.



# KIOXIA

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.

1: As of June 28, 2017, KIOXIA survey.  
 2: Statistic used with permission from Forward Insights.  
 3: Source: KIOXIA Corporation, as of July 19, 2018.  
 4: Defined as needing less power to operate, consuming less power and enabling data centers to increase capacity within existing footprints.  
 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 = 2<sup>10</sup> bytes = 1,024 bytes. 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. 1Tb = 2<sup>40</sup> bits = 1,099,511,627,776 bits.  
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