

# 3D NAND and UFS for Mobile



High-Performance 32GB Mobile Memory

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# Micron 3D NAND Technology Summary

## High Capacity

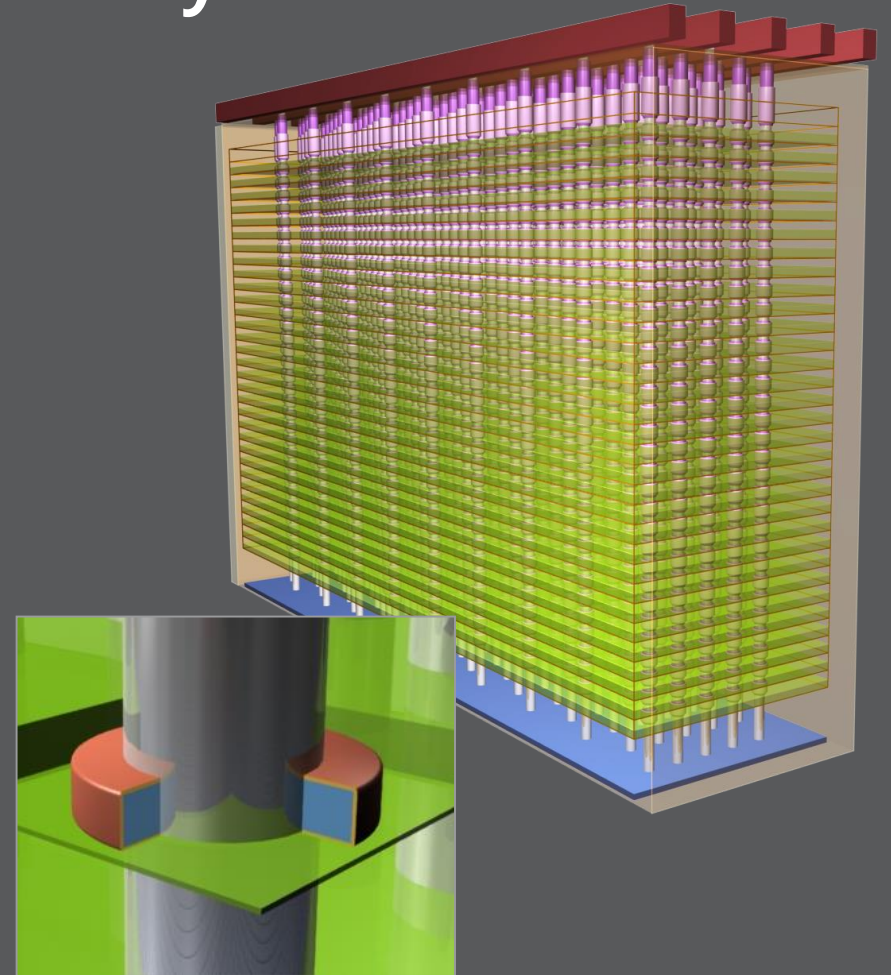
The thin 32-layer technology allows for high capacity solutions (MLC 64Gb, MLC 256Gb, TLC 384Gb) by vertically adding layers to the 3D stack without increasing the footprint

## Proven Technology: Floating Gate

Micron 3D NAND uses a floating gate cell, providing a proven cell foundation that limits the design variables and ultimately increases the quality and reliability of the design

## High Performance Architecture

Larger size cells enables higher electron counts, making it much easier to differentiate voltage levels in the cells which increases performance



# Micron Mobile 3D NAND Memory

BREAKTHROUGH STORAGE PERFORMANCE, POWER AND RELIABILITY



## High Performance

Up to 30% faster sequential writes vs. 2D NAND\*; UFS 2.1 interface delivers 33% higher bandwidth vs. eMMC 5.1\*



## Enhanced Reliability

Unique floating gate technology provides superior data retention compared to charge trap gates



## Power Efficiency

Significantly reduce power with 3D NAND's efficient sleep mode feature



## Superior Mobile Experience

Faster boot up, seamless HD streaming, high bandwidth gaming, and responsive camera performance



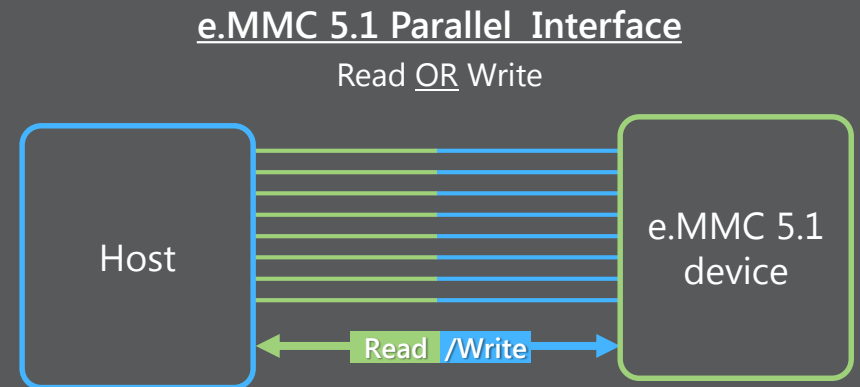
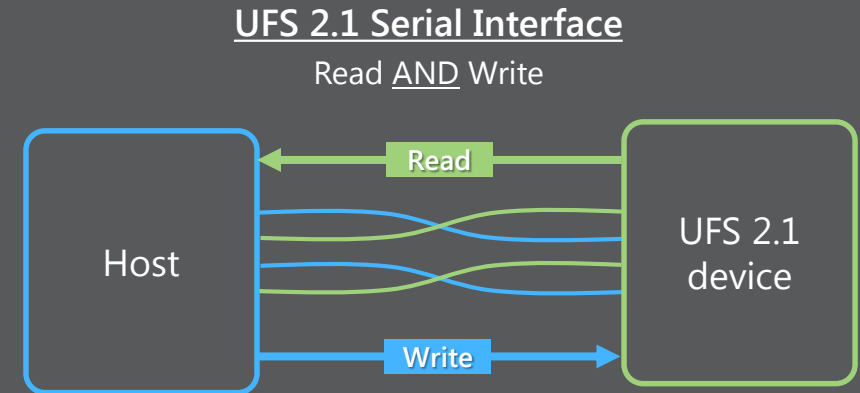
## High Capacity

Higher storage capacity in a smaller space with 3D NAND's vertically tiered die

\* Source: Micron. Theoretical performance values are based on specification capabilities using optimized controller/FW/NAND.

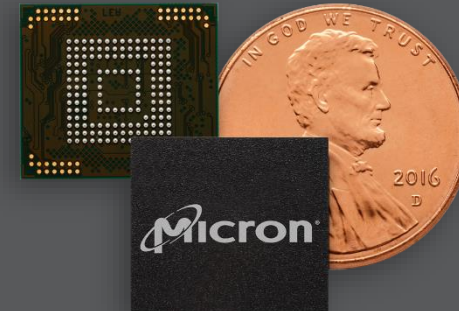
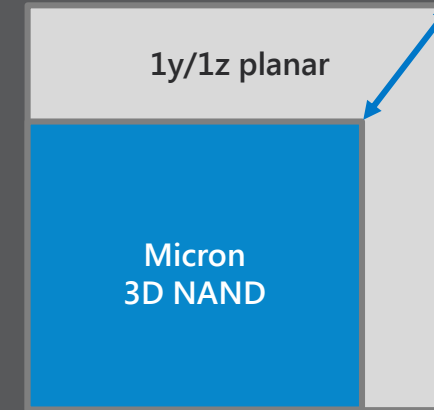
# Universal Flash Storage (UFS) 2.1 Interface

- UFS 2.1 is the next-generation interface to the e.MMC 5.1 specification, delivering significantly faster random read speed performance
  - UFS uses a full duplex serial interface, allowing reading and writing at the same time, unlike e.MMC's half duplex parallel interface
- Micron UFS 2.1 devices utilize High Speed Gear 3 specification to deliver industry-leading sequential read performance for mobile devices
- Increased IOPS and reduced read/write latencies provide additional performance improvements and security features that enhance multimedia transfer in mobile devices



# Micron: World's Smallest 3D NAND Die

- Micron 8GB 3D NAND die measures **60.217mm<sup>2</sup>**, making it the smallest 3D NAND on the market\*
  - ~30% smaller than 1y/1z planar NAND\*
  - Enables ultra small form factor packaging such as 9x9mm ePOP or 8.5x11mm discrete UFS
- Tiny memory packaging can free up space for additional battery size or enable smaller form factor devices

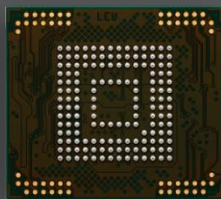


\* Based on Micron internal competitive measurements

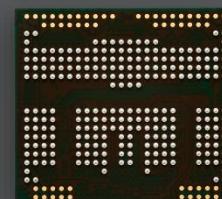
# New Micron Mobile 3D NAND and UFS Products

32GB MULTICHIP PACKAGE AND DISCRETE MEMORY DEVICES

Product	Interface	3D NAND	LPDRAM
<b>eMCP4</b>	e.MMC 5.1	32GB MLC	3GB LPDDR4
<b>eMCP4X</b>	e.MMC 5.1	32GB MLC	3GB LPDDR4X
<b>uMCP4X</b>	UFS 2.1 HS-G3 1L	32 GB MLC	3GB LPDDR4X
<b>Discrete UFS</b>	UFS 2.1 HS-G3 1L	32GB MLC	N/A

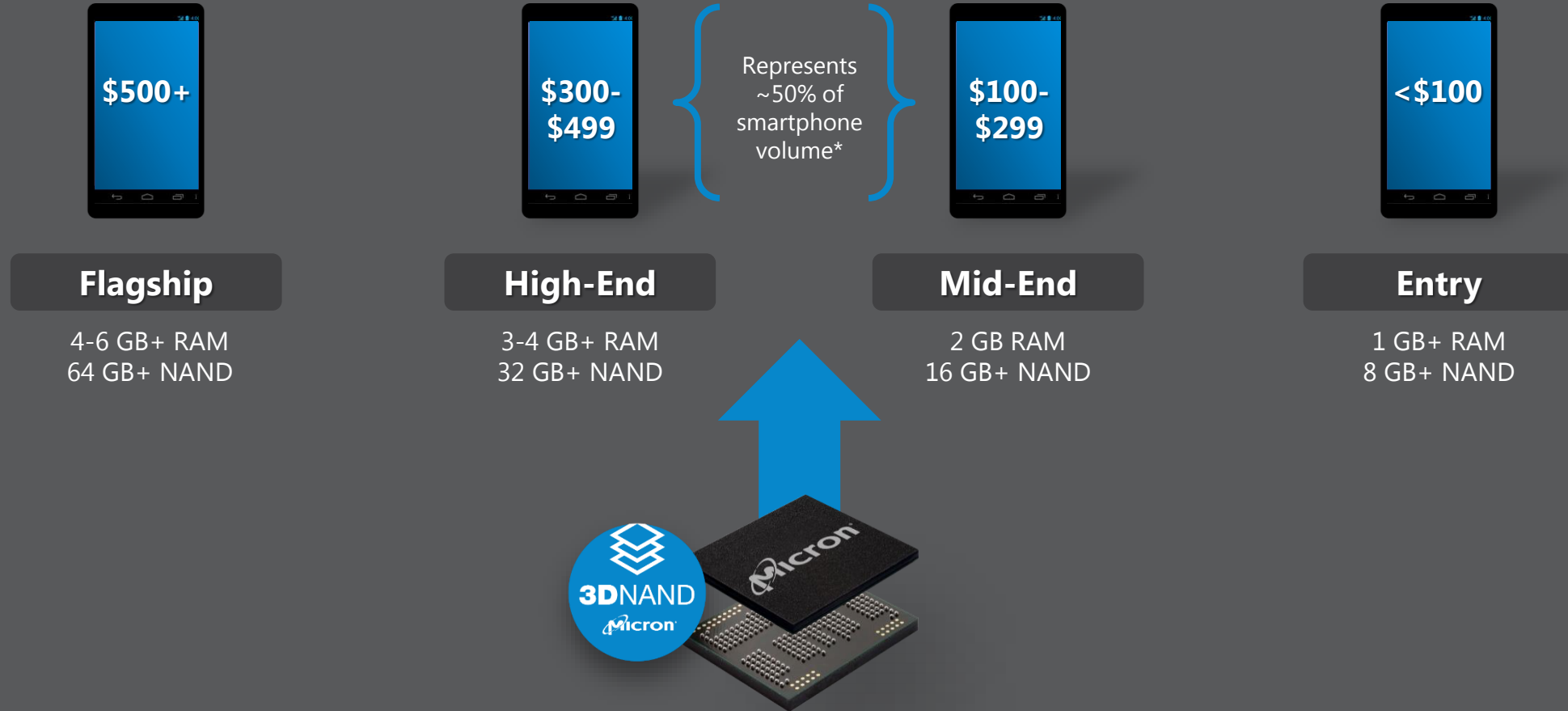


Micron 3D NAND  
Multichip Package



Micron 3D NAND  
Discrete UFS Package

# 32GB 3D NAND Targeted for Volume “Sweet Spot”



\* Source: Micron

# Summary of 3D NAND Messages

1. New Micron Mobile 3D NAND-based 32GB memory delivers leading UFS 2.1 random write memory device performance
2. Industry's first mobile product built on floating gate technology—a proven cell technology that enables better performance, quality, and reliability
3. Introducing industry's smallest 3D NAND: Micron 8GB 3D NAND die, measuring 60.217mm<sup>2</sup>
4. 3D NAND-based MCP includes Micron's first low power LPDDR4X, up to 20% more power efficient than standard LPDDR4
5. Micron 3D NAND and UFS products are now sampling with mobile customers and chipset partners for qualification; broad availability in end of 2016



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