



HL NAND
www.HLNAND.com



HLNAND2 DDR800 Arrives

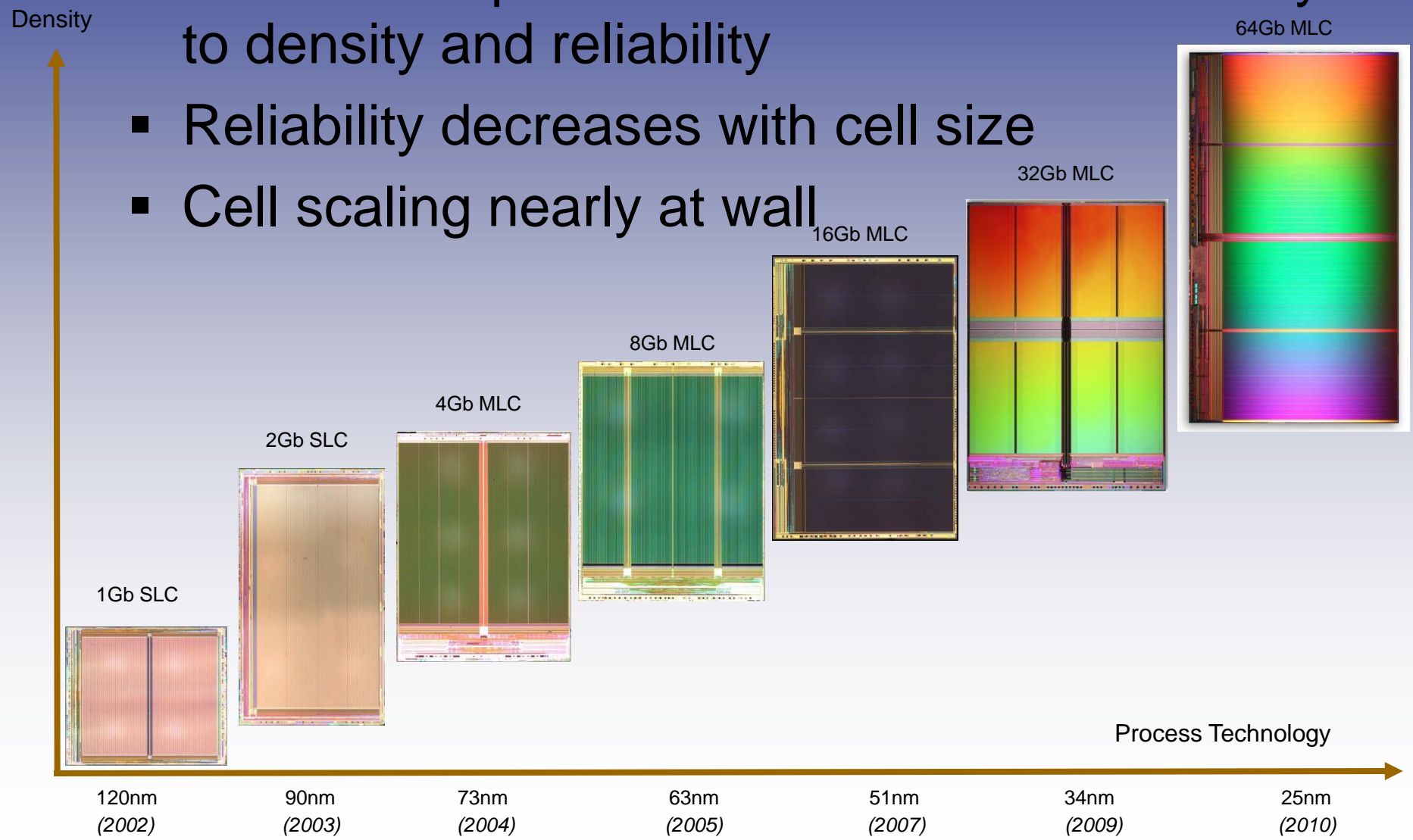
Roland Schuetz

Director, Applications & Business Initiatives
MOSAID Technologies Inc.

Scalability
Flash
Performance
Memory
Error Detection Code
DDR800
HLNAND2
High Throughput
Hyperlink Architecture
Low Power
Independent Bank
Unified Synchronous
Scalable Memory
Bank-oriented
Interface
Point-to-Point
Flexibility
Next Generation
Virtual Pages
Flash Memory
High Capacity
High Bandwidth
Daisy-chain Cascade
Architecture
Command Packet
SSD
EDC
800MB/s
Duplex RW

Scaling History

- Vendor and product differentiation tied mainly to density and reliability
- Reliability decreases with cell size
- Cell scaling nearly at wall



Nearly at Scaling Wall, What Next?

- How will Flash producers make a compelling story at the wall?
- Reliability will still play a differentiating role
- Feature enrichment and performance improvements will also help distinguish products and serve product niches

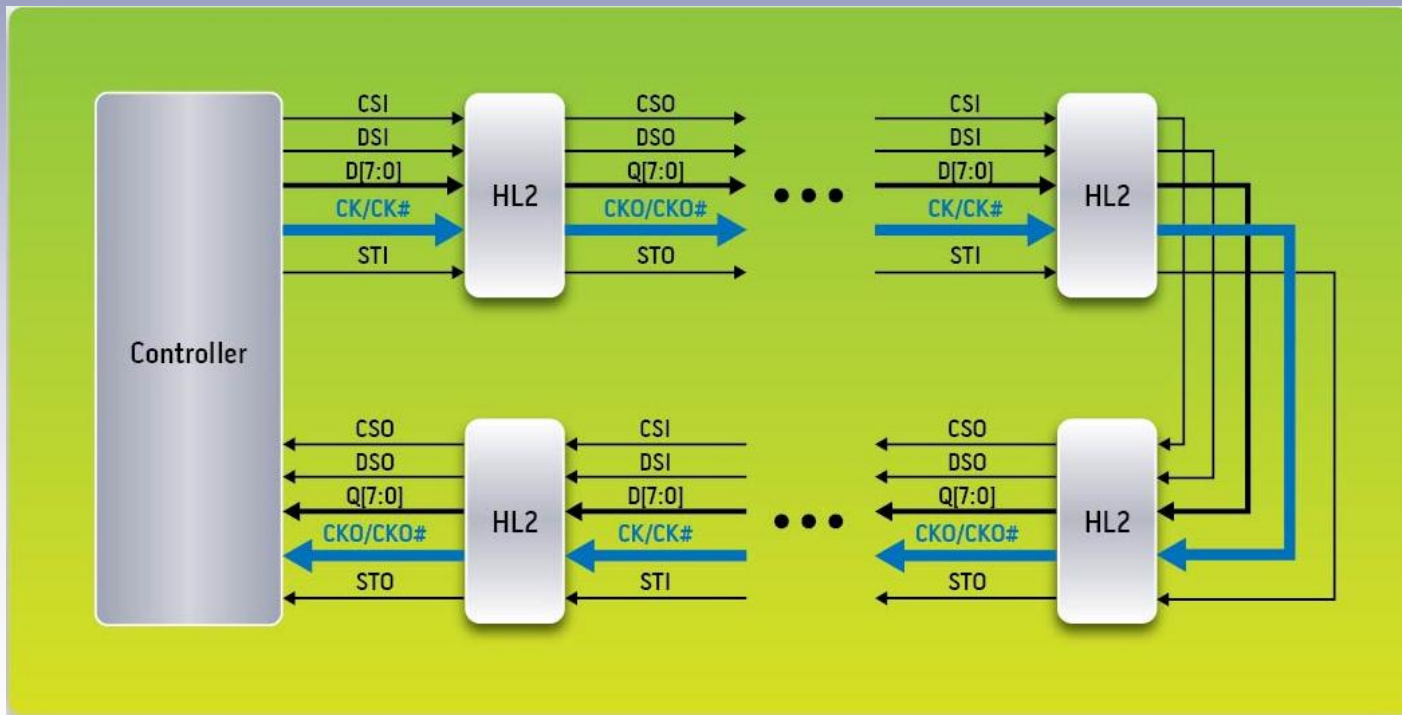


Feature Rich Interface Chip Lights the Way

- Load buffering
- Higher transfer rates
- Higher capacity per channel
- Built-in ECC
- Localized page copy
- Relieves IO congestion in mobile platforms
- Consolidated mixed memory types

HLNAND2: First DDR800 NAND Flash Device Arrives

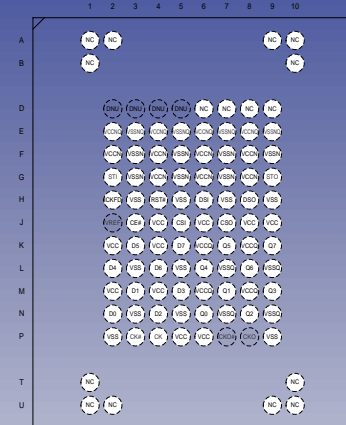
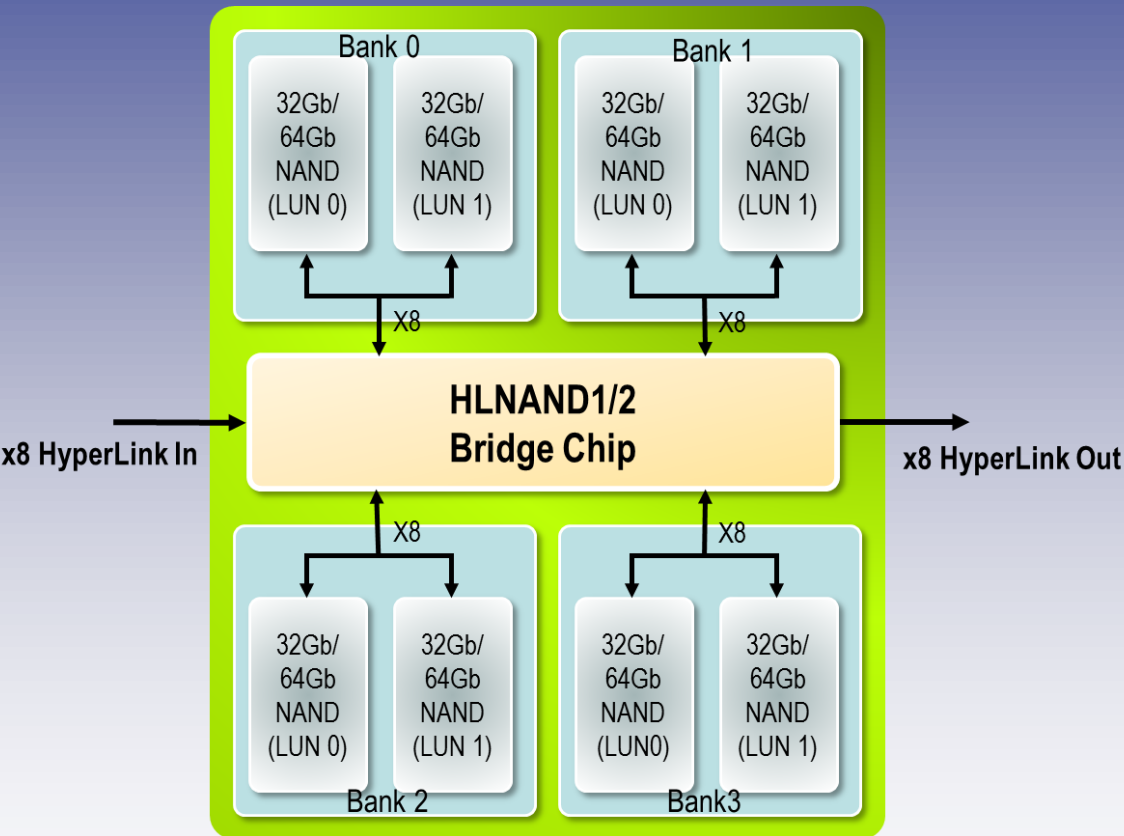
- 1.2V interface achieves up to DDR800
- Source synchronous clocking
- DuplexRW™ doubles throughput, upto 1.6 GB/s



HLNAND2 Features

- DDR533 / DDR667 / DDR800
- JEDEC 1.2V HSUL_12 Interface Signaling
- Source Synchronous differential clock
- No On-Die Termination (ODT)
- Four bank architecture
- Fully independent 8 die operation
- Built-in EDC (Error Detection Code)
- DuplexRW™: Simultaneous DDR800 read & write, effectively 1600MB/s data throughput
- Independent, automatic status bus

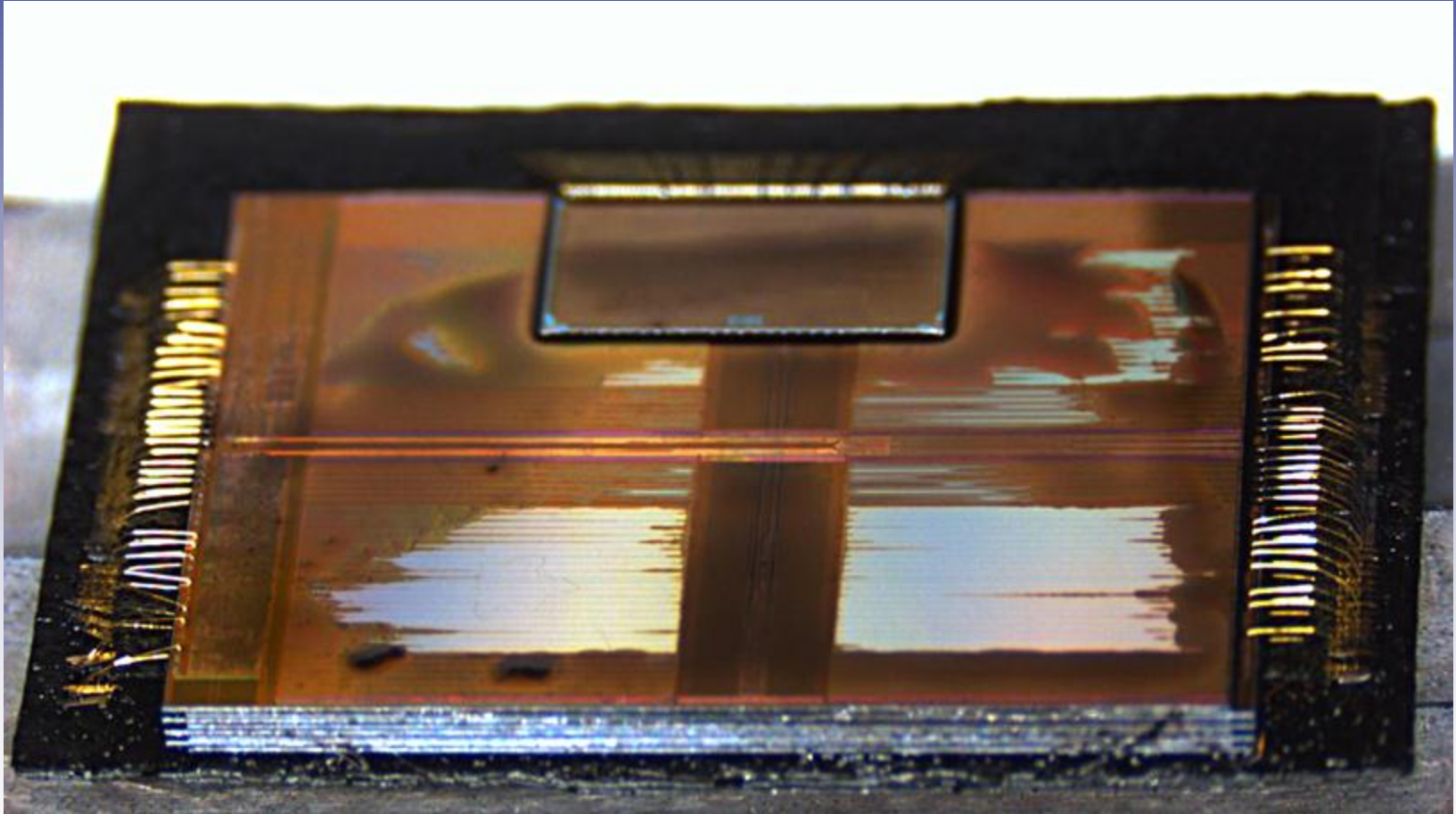
256Gb MLC HLNAND2 MCP



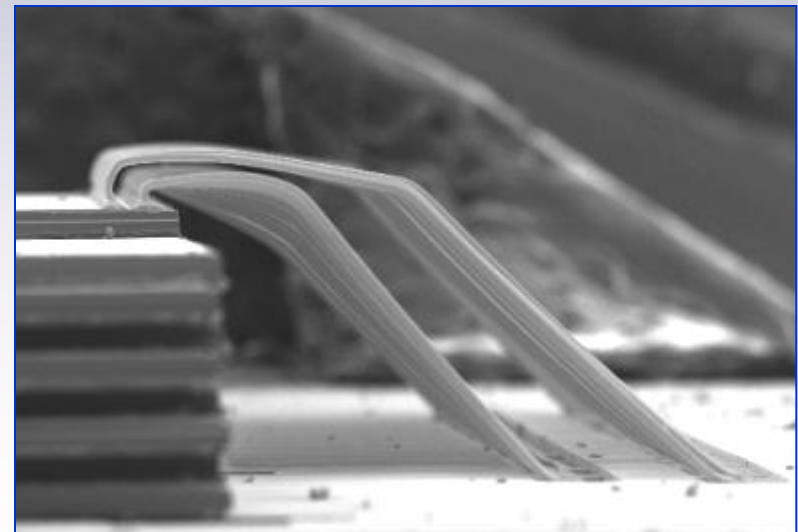
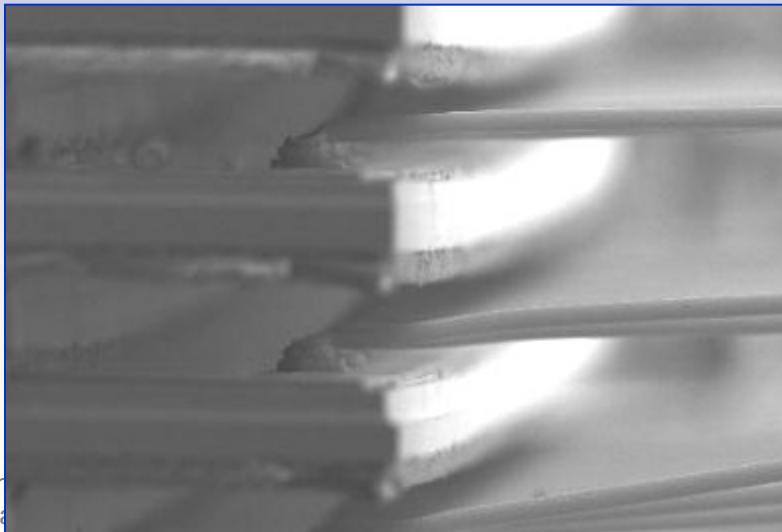
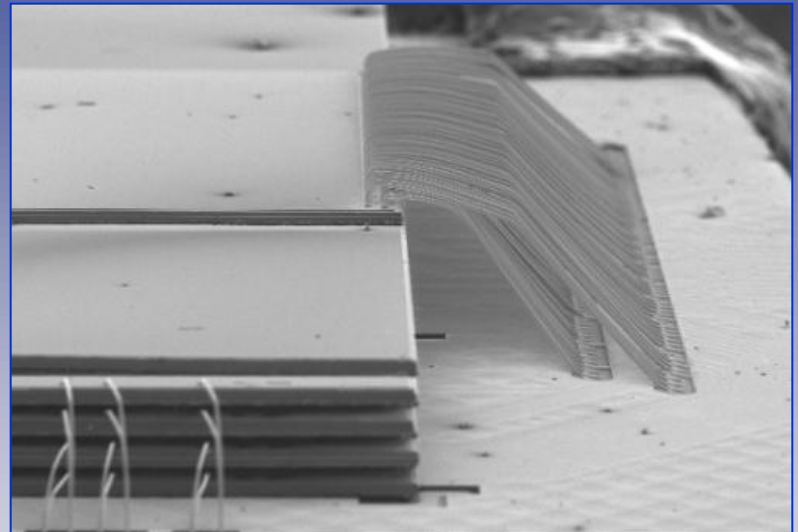
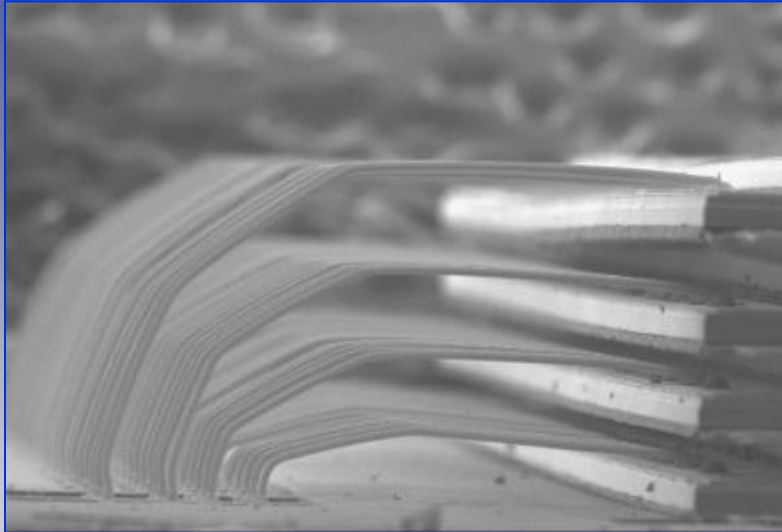
100-Ball BGA (18mm x 14mm)



Inside the MCP lies a 9-Die Stack

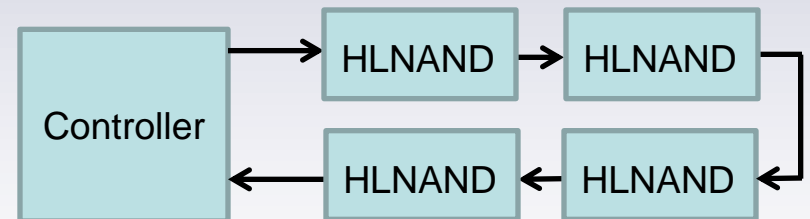
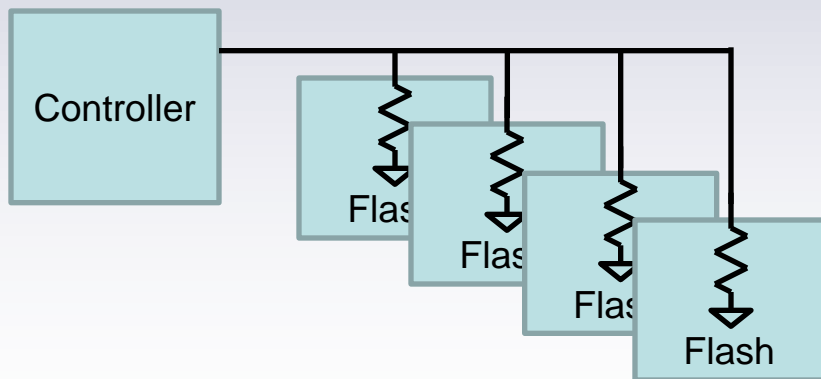


SEM of 9-Die Stack

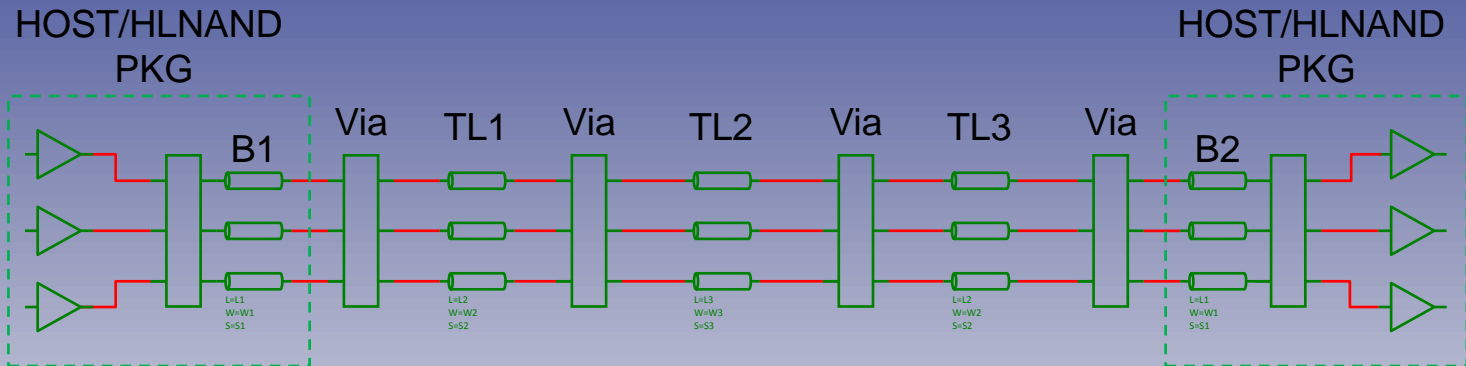


HLNAND2: High Speed, no ODT

- Parallel-bus flash requires power hungry ODT beyond 200MT/s
- HLNAND2 needs no termination, even at 800MT/s
- Point-to-point topology is logical choice at higher transfer rates

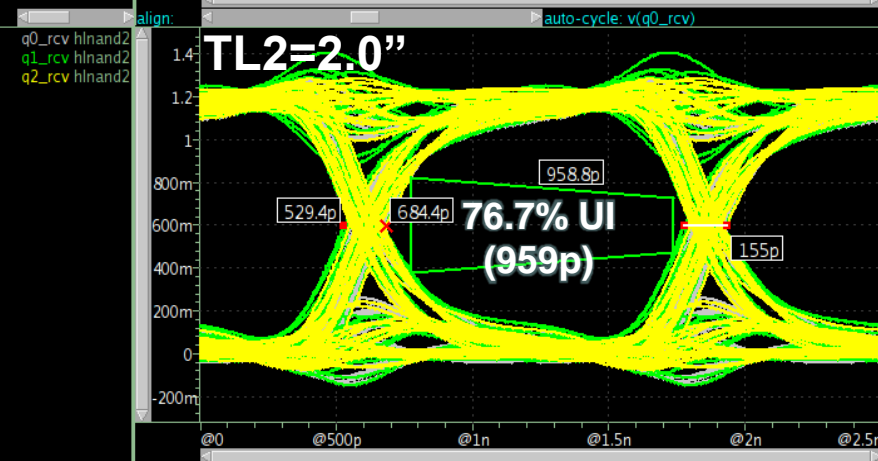
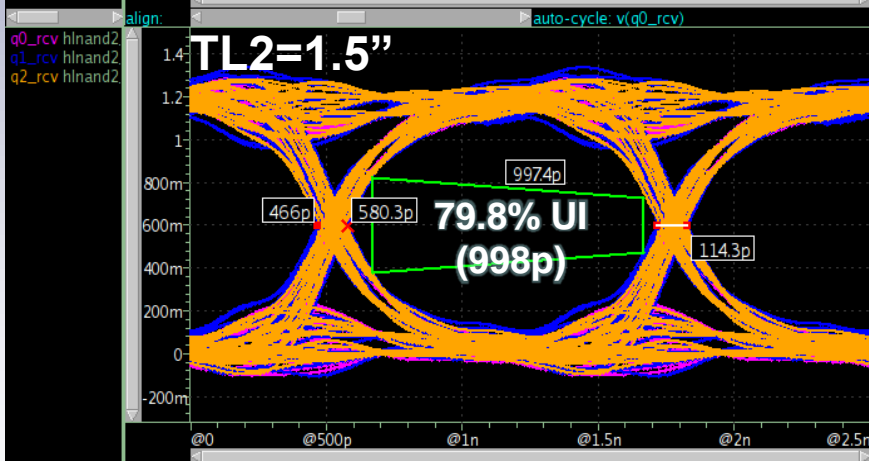
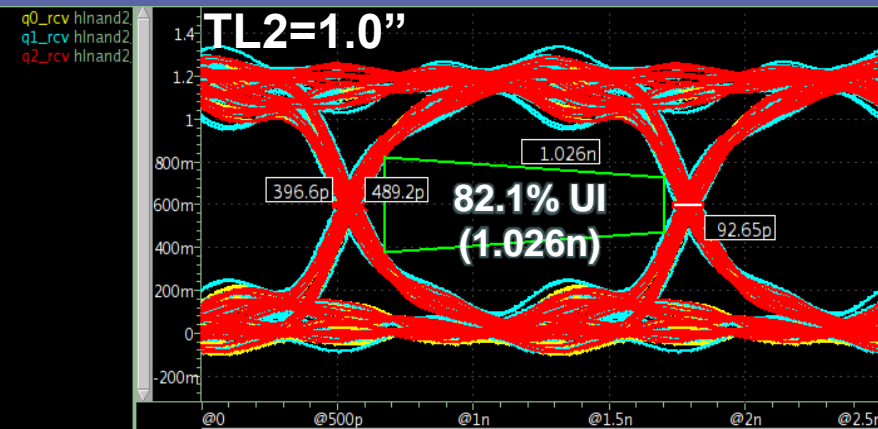
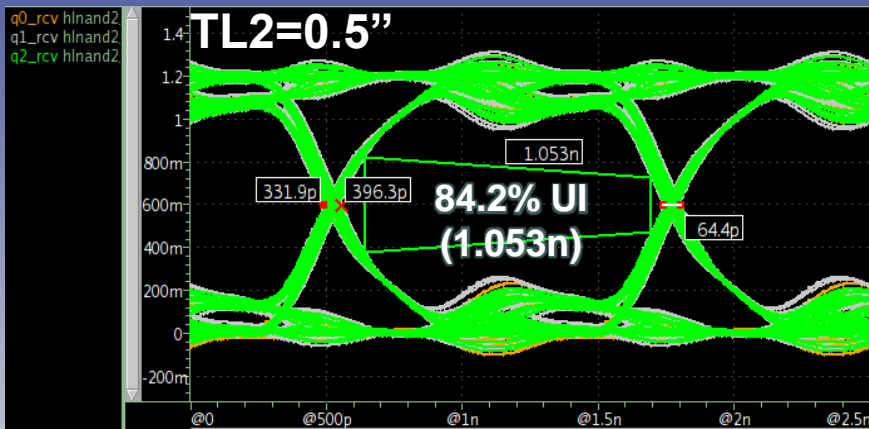


DDR800 HLNAND2 Signal Integrity (General Topology Model)



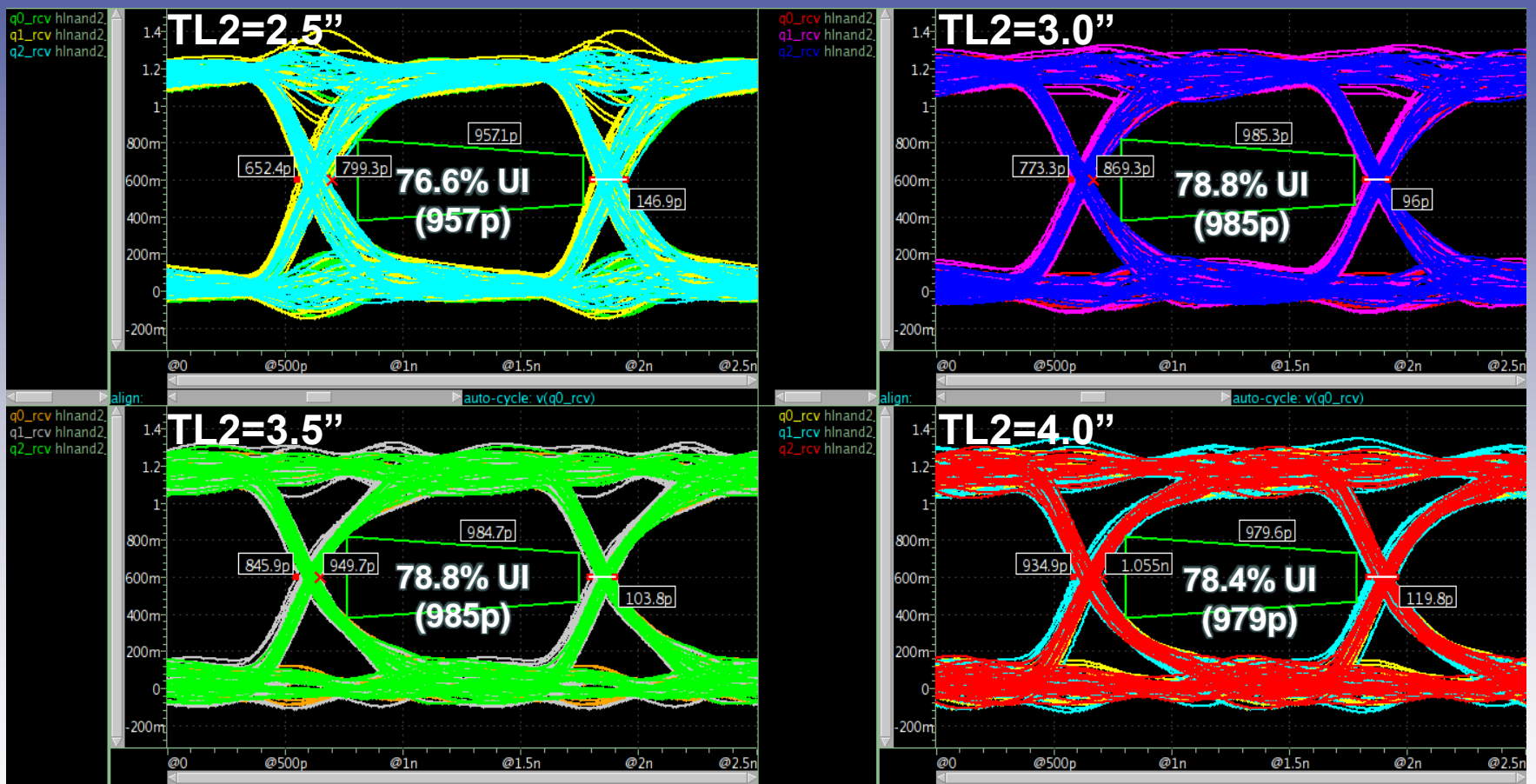
- PCB Impedance = $50 \Omega \pm 7.5 \Omega$
- Space of Lines = $4/8 \text{ mil} = 101.6/203.2 \mu\text{m}$
- X-talk = 3 Line Model
- Min. time width of RCV eye window = $0.66UI$
- Driver Strength = $50 \Omega / 33 \Omega$
- ODT = Not Required

DDR800 HLNAND2 Signal Integrity (Eye Diagram, 0.5" - 2.0" trace length)



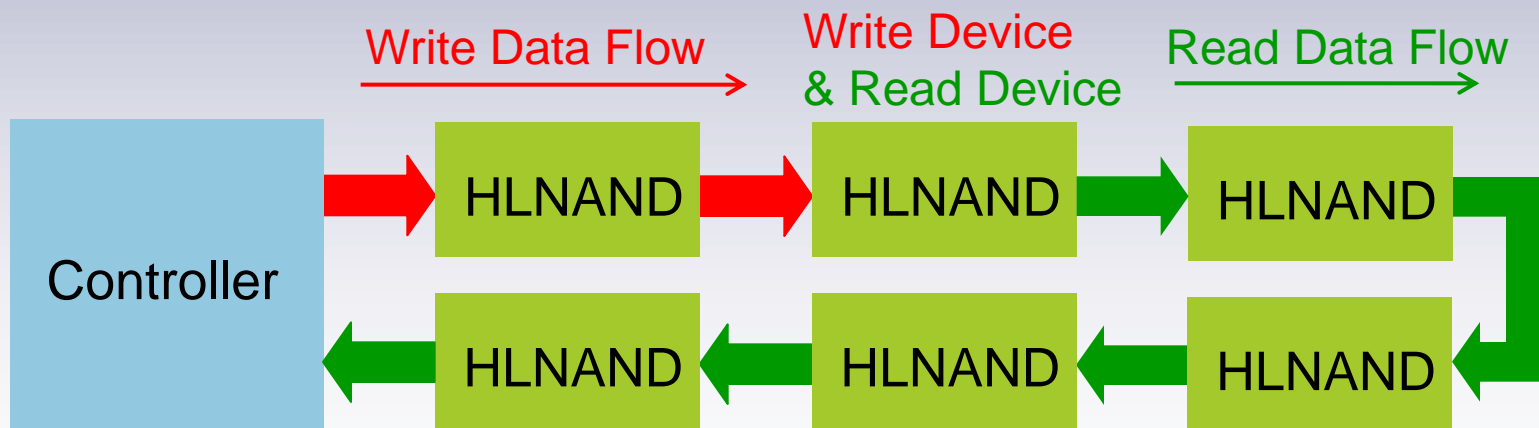


DDR800 HLNAND2 Signal Integrity (Eye Diagram, 2.5" – 4.0" trace length)



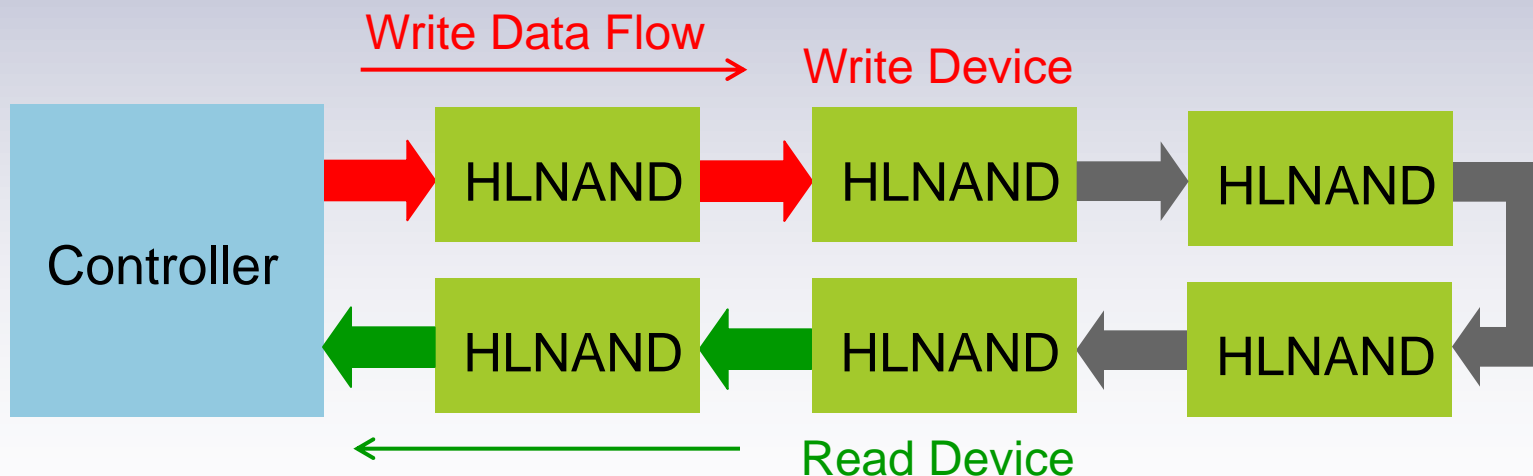
Enabling DuplexRW

- DuplexRW doubles throughput to 1600MB/s
- Write and read on ring simultaneously
- Write & Read same device on ring



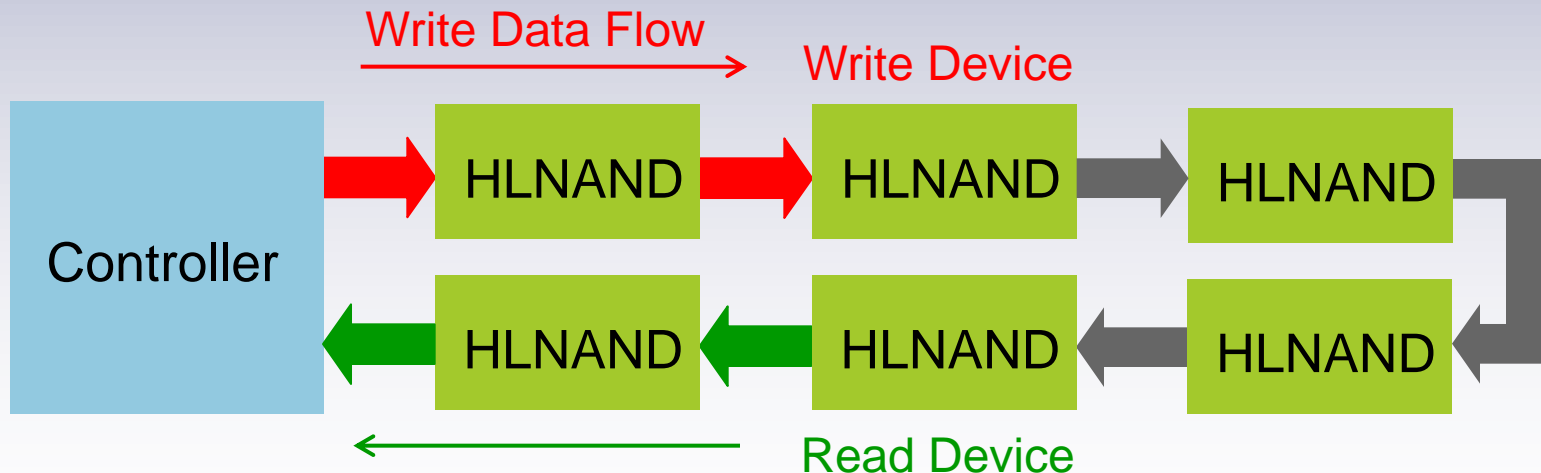
Enabling DuplexRW

- DuplexRW doubles throughput to 1600MB/s
- Write and read on ring simultaneously
- Write & Read same device on ring
- Read device downstream from write device



Enabling DuplexRW

- DuplexRW doubles throughput to 1600MB/s
- Write and read on ring simultaneously
- Write & Read same device on ring
- Read device downstream from write device
- Can use DuplexRW 50% of the time

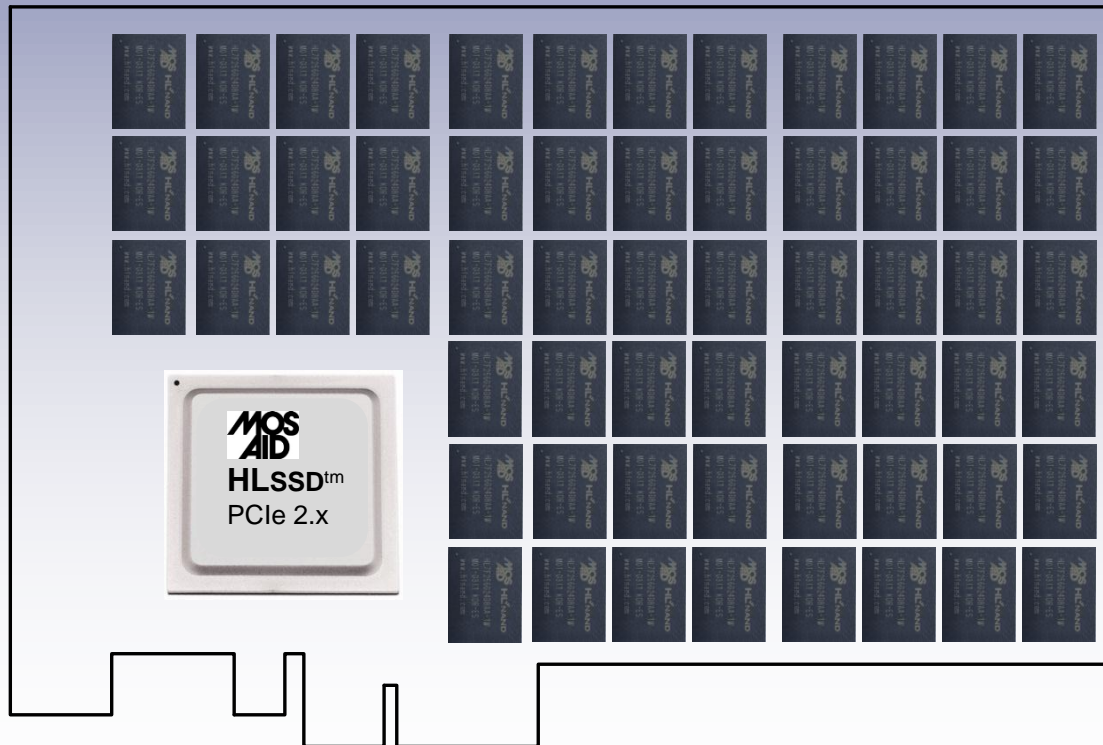


High-Speed NAND Comparisons

	HLNAND2	HLNAND	ONFI 3.0	Toggle Mode 2.0
Synchronous I/O	Yes	Yes	Yes	No (Pseudo Sync)
Clock Speed	400MHz	133MHz	200MHz	200MHz (DQS)
Transfer Rate (Duplex RW)	800MT/s 1600MT/s	266MT/s 533MT/s	400MT/s N/A	400MT/s N/A
I/O Voltage	1.2V	1.8V	1.8V	1.8V
# of Chips before Roll-off	255	255	8	8
Termination	No	No	Yes	Yes


PCIe HLSSD™ Prototype

- Native PCIe SSD Controller (ASIC/FPGA)
- X4 or x8 PCIe V2.0
- TB Capacity & GB/s-Class Performance




- Flash vendors offering faster flash IO as they approach the scaling wall
- Interface chip enables product differentiation through feature enrichment and faster interface
- HLNAND2 provides 800MB/s/ch. transfer rate with no ODT
- HLNAND provides high capacity at any performance level

HLNAND2 with Interface chip lights the way...



HLNAND

A NEW STANDARD FOR
HIGH-PERFORMANCE
FLASH MEMORY



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WHAT'S NEW


- Feb 24/11 **MOSAID Introduces HLNAND2 Flash Memory Specification**
- Jul 28/10 **MOSAID Showcases Solid State Drive Prototype**
- Jul 27/10 **Click here for HLNAND SDD Technical Overview**
- May 12/10 **Scanimetrics Now Offering MOSAID HLNAND™ Flash Memory Chip and Module**

INNOVATIONS

INTRODUCING HLNAND2

First to deliver Gigabyte-per-second performance and Terabyte-class capacity for SSDs

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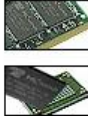
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PUBLICATIONS




White Paper
Enabling Ultra-High Bandwidth Scalable SSDs with HLNAND



64GB HLNAND Flash Module Brief



64Gb HLNAND Flash MCP Brief



256GB HLNAND2 Flash MCP Brief

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