



Introducing the **122TB Solidigm™ D5-P5336**

November 2024

*Actual product label may differ.



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Agenda

Introducing the 122TB Solidigm™ D5-P5336

- A Massive Leap Forward in Storage Efficiency
- Product Positioning & Capabilities
- Storage Efficiency Matters
- Q&A



A Massive Leap Forward in Storage Efficiency

Business Momentum



- Solidigm features an industry-leading storage portfolio for AI and traditional data centers
 - The top 5 companies in the Fortune 500 use Solidigm for data storage needs
 - Approx. 70% of top OEM AI storage solution providers use Solidigm QLC SSDs
- Solidigm QLC leadership continues with 100 Exabytes shipped since 2018

Store the same amount of data in ~**15x less space**

122.88TB QLC SSD

Solidigm™ D5-P5336

*Actual product label may differ.



30TB 3.5" HDD

1,504 cm³
(376cm³ * 4)¹



How much data can a **122TB SSD** store?



4K versions of every movie
theatrically released in the 90s

2.6 times



The entire contents of The
Beatles' song catalog

144,000 times



The collected works of William
Shakespeare

17M times

...all in about
the size of a
deck of cards.

¹ Standard drive dimensions shown: Seagate Exos Mozaic 3+ 30TB 3.5" HDD - W 101.6mm, H 146mm, D 25.4mm, generic image shown; Solidigm D5-P5336 122.88TB U.2 15mm SSD - W 69.9mm, H 100.2mm, D 14.8mm

122TB Solidigm™ D5-P5336 Storage Efficiency



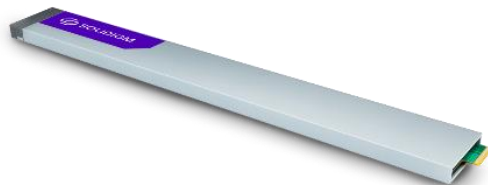
U.2 15mm
7.68TB - 122.88TB

*Actual product label may differ.



E1.L 9.5mm
15.36TB - 122.88TB

*Actual product label may differ.



- Massive capacity SSDs **use far less energy and space** per terabyte, freeing up valuable resources for compute usage
- **Reduce storage footprint** by up to 8x compared to HDD JBOD and up to 4x compared to TLC SSD JBOF configurations
- Designed by the pioneers of QLC eSSDs, with **>100EB** shipped across a broad array of customers

See referenced claims in appendix 'Storage Efficiency' for details.



Positioning and Capabilities

Sustained Track Record of **eSSD Leadership**



Solidigm™
D7-P5810

The Industry's Fastest SLC SSD¹

Solidigm™
D7-PS1030
D7-PS1010

The World's Fastest PCIe 5.0 SSDs²

Solidigm™
D7-P5620
D7-P5520

The Industry's Most Advanced PCIe 4.0 Family³

Solidigm™
D5-P5430

Drop-in QLC Efficiency for Mainstream Workloads

Solidigm™
D5-P5336
7.68-122.88TB

**The World's Highest
Capacity PCIe SSDs**

At launch...

Expanding
**industry's
strongest
DC storage
portfolio**

See referenced claims in appendix 'Sustained Track Record of eSSD Leadership' for details.

Expanding our **High-Capacity Leadership Portfolio**

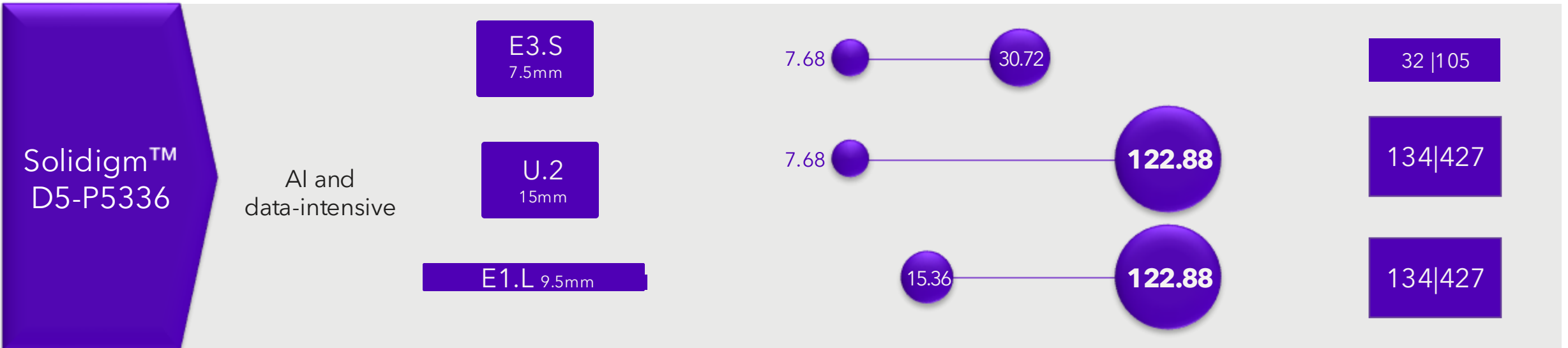
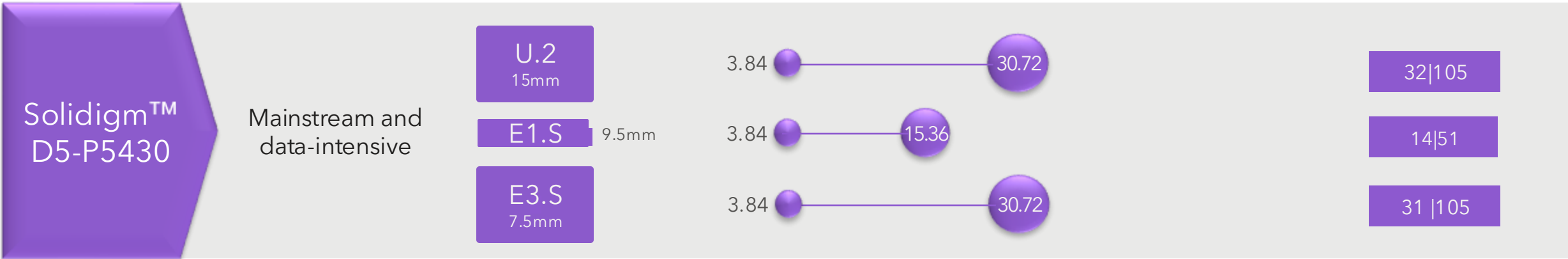


Target Workloads

Form Factors

Capacities (TB)

Endurance (up to)
(Random | Seq.) Max PBW

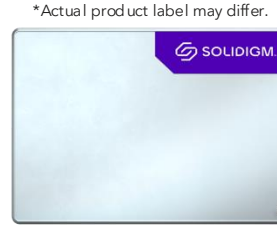


Expanding the Solidigm™ D5-P5336 family

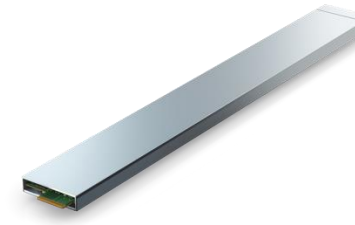


| | | | | | |
|--|---|---------|---------|---------|----------|
| Product Name | Solidigm™ D5-P5336 | | | | |
| Form Factor | U.2, E1.L, E3.S | | | | |
| Media | 192L QLC NAND | | | | |
| Power off Retention | 3 months @ 40°C | | | | |
| User Capacity | 7.68TB | 15.36TB | 30.72TB | 61.44TB | 122.88TB |
| Endurance (DWPD 5yrs)¹ | 0.42 | 0.51 | 0.56 | 0.58 | 0.60 |
| Endurance (PBW)¹ | 5.9 | 14.1 | 31.5 | 65.2 | 134.3 |
| Max Power | 25 W | | | | |
| Idle Power | <5 W | | | | |
| UBER | < 1 Sector per 10 ¹⁷ Bits Read | | | | |
| MTBF | 2 Million Hours | | | | |
| Features | OCP 2.0 support ² , NVMe 2.0 Compliance ³ , FIPS 140-3 Level 2 ⁴ | | | | |

NEW!



U.2 (15mm)
7.68TB - 122.88TB



E1.L (9.5mm)
15.36TB - 122.88TB

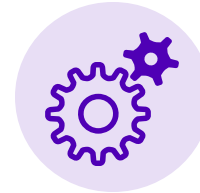


E3.S (7.5mm)
7.68TB - 30.72TB

122TB Preliminary Performance Estimation (Subject to Change)

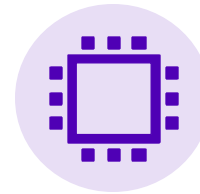
| | |
|--------------------------------------|---------------|
| 4K Random Read, IOPS, QD256 | Up to 930,000 |
| 32K Random Write, IOPS, QD256 | Up to 25,000 |
| 128K Seq. Read, MB/s, QD128 | Up to 7,400 |
| 128K Seq. Write, MB/s, QD128 | Up to 3,200 |

See referenced claims in appendix 'Solidigm D5-P5336 Overview' for details.



Spec Alignment

NVMe 2.0³, NVMe-MI 1.2³, and OCP 2.0 Support² (Latency monitor, FW History Log, NSSR, Format Progress Indicator, NUSE specific etc.)



PCIe 4.0 Controller

Delivers better latency, expanded management capabilities, and critical new NVMe features compared to previous gen QLC SSD.



Data Center SSD features

Trim Arch & Improvements, OCP 2.0 Features Support, SGL, VSS, HDR with Opal, SGL with DSM, Opal Locking Range with MNS, Extended DST, FIPS 140-3 Level 2 (Future Certification on Generic SKUs), Telemetry, etc.

Optimized Performance for data-intensive workloads



Benchmark Comparison (preliminary)¹

| Product | Capacity | Content Delivery Network Total BW | General Purpose Server Total BW | Object Storage Total BW | Write Pressure Test Lower is better |
|---|-----------------|--------------------------------------|------------------------------------|----------------------------|--|
| Micron 7450 Pro | 15.36TB | 0.84x | 0.81x | 0.92x | 1.51x |
| Kioxia CD8-R | 15.36TB | 0.85x | 0.79x | 0.92x | 2.00x |
| Micron 6500 ION | 30.72TB | 0.76x | 0.69x | 0.89x | 1.51x |
| Solidigm™ D5-P5336 (baseline) | 61.44TB | 1.0x | 1.0x | 1.0x | 1.0x |
| Solidigm™ D5-P5336 | 122.88TB | 1.0x | 0.91x | 1.04x | 0.84x |

Better real-world performance vs. competing TLC

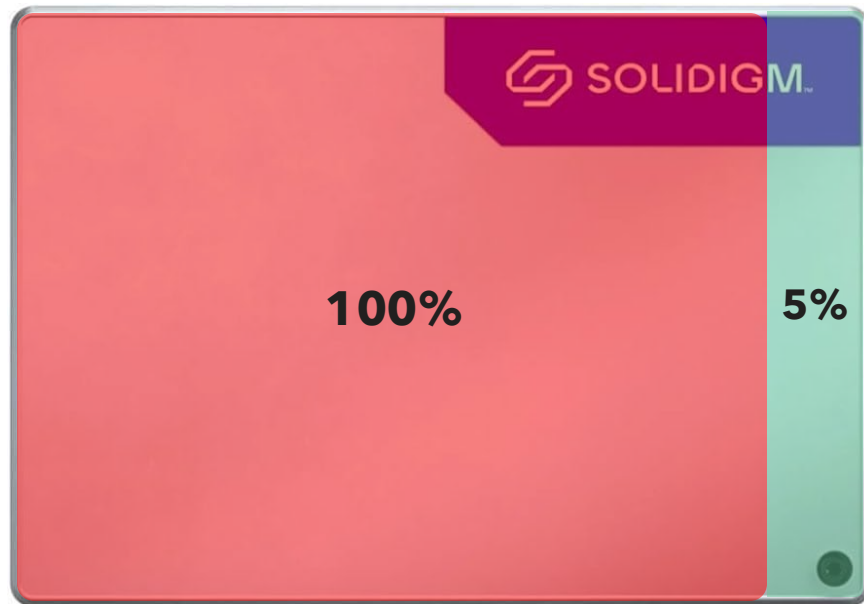
¹ Source – Solidigm. See Appendix – D5-P5336 Performance Tests for details, and Product Segmentation by Workload appendix for workload definitions

It's **not easy to wear out** 122TB of Solidigm Storage



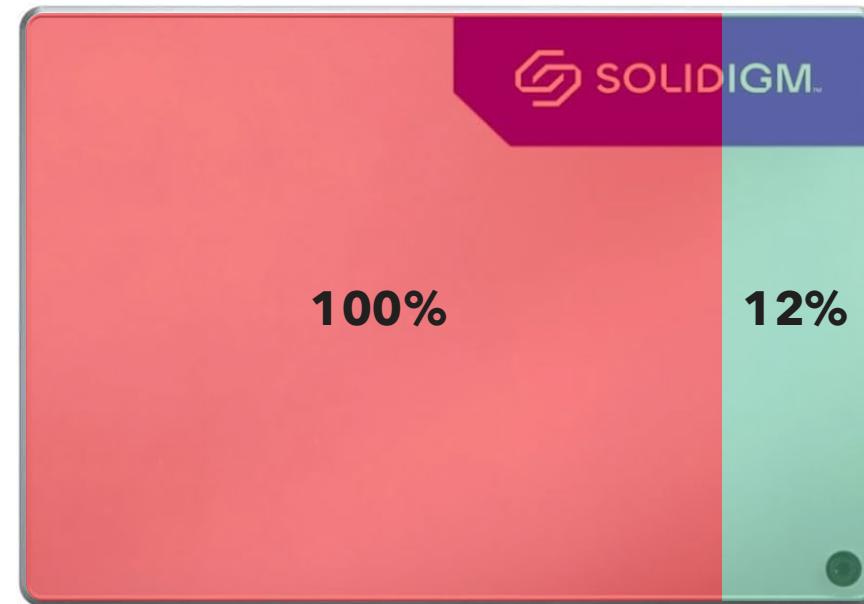
Solidigm™ D5-P5336 122.88TB Estimated Endurance (PBW)

32KB 100% Random Writes
100% Duty Cycle 24/7



5 years **continuous** writes | 2mos remain


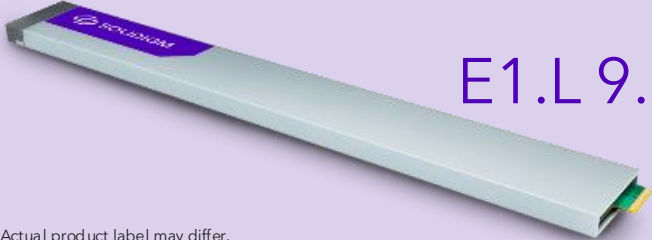
4KB 100% Random Writes
100% Duty Cycle 24/7



5 years **continuous** writes | 7mos remain

122TB Solidigm™ D5-P5336 Availability



| Form Factor | Customer Sampling | Product Availability |
|--|-------------------|----------------------|
|  <p>U.2 15mm</p> <p><small>*Actual product label may differ.</small></p> | In Progress | Q1'2025 |
|  <p>E1.L 9.5mm</p> <p><small>*Actual product label may differ.</small></p> | January 2025 | Q2'2025 |

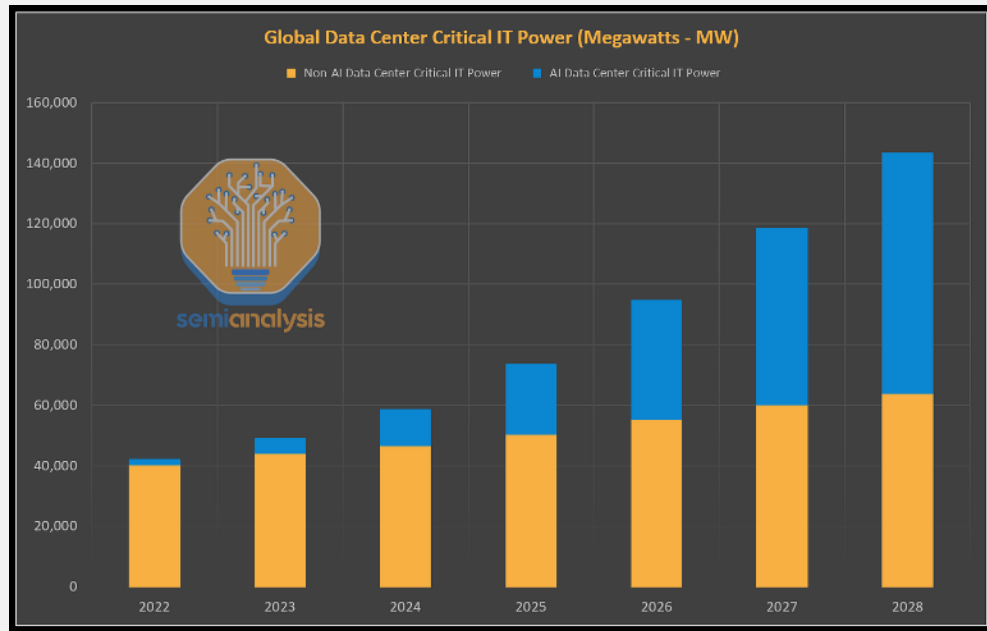


Storage Efficiency Matters

Finding AI energy in an already challenged grid



Projected **Non-AI** vs **AI** Data Center Energy Use (MW)¹



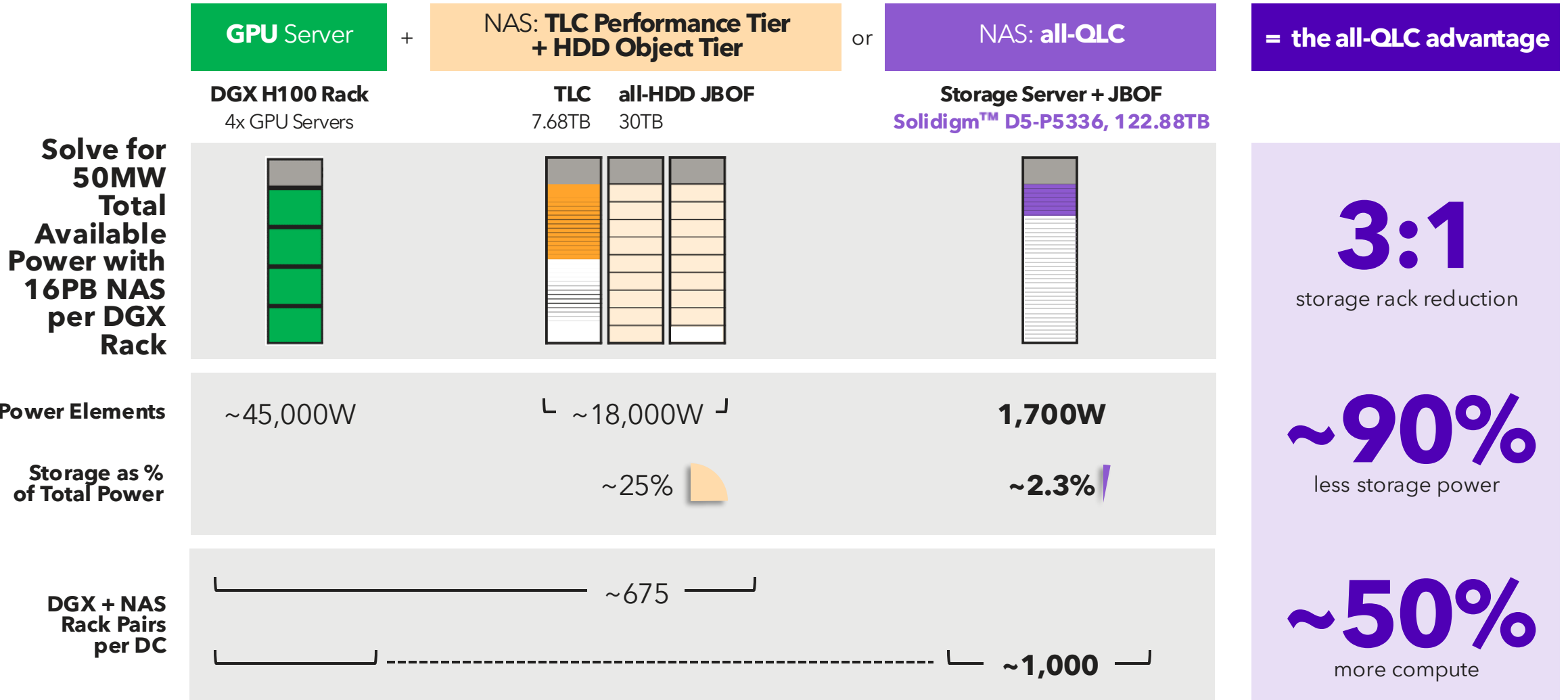
>50% of data center critical IT power² will be AI-driven by 2028

- "In 2020, we unveiled what we called our carbon moonshot. That was **before the explosion in artificial intelligence**"
Brad Smith, Microsoft, as quoted in [Bloomberg](#)
- "AI could drive **a natural gas boom** as power companies face surging electricity demand" [CNBC](#), May 2024
- "Dublin council **rejects** Equinix's **gas-powered** data center" [Data Center Dynamics](#), Aug 2023
-  "Microsoft announces plan to reopen Three Mile Island **nuclear power plant to support AI**" [USA Today](#), Sep 2024

¹ Source - [SemiAnalysis](#), Mar 2024

² Source - SemiAnalysis defines critical IT power as the power capacity required to support the essential IT infrastructure within datacenters, particularly focusing on the demand driven by AI accelerators

QLC improves power efficiency for new AI DC builds



3:1
storage rack reduction

~90%
less storage power

~50%
more compute

Source - Solidigm, Oct 2024. Power consumption analysis assumes a green field (new) bottom-range Hyper-scaler / Tier 2 AI DC implementation utilizing leading-edge power and space optimizations. See Appendix 'QLC Power Efficiency vs HDD' for modeling details.

Free up energy for GPUs with high-capacity flash



Accounting for all Power Coming into the AI Data Center

Critical IT options

Non-IT
Infrastructure

25%



① ...with
Hybrid TLC+HDD

45%



20%



10%



② ...with
30TB TLC

58%



8%



9%



③ ...with
122TB QLC

67%



3%

5%

+22% Energy for GPU vs Hybrid



+9% Energy for GPU vs TLC



Better QLC power efficiency **frees energy for compute**



AI
requires data

Data
requires infrastructure

Infrastructure
requires efficiency

Efficiency
requires Solidigm



Appendix

Appendix: Storage Efficiency



Comparing total capacity in 2U JBOF and JBOD servers. 12 x 3.5" JBOD uses 30TB Seagate Exos Mozaic HDDs. 24 x U.2 TLC SSD JBOF uses 30TB Micron 6500 ION SSDs. 24 x U.2 QLC SSD uses 122.88TB Solidigm D5-P5336 SSDs.

Appendix: Sustained Track Record of eSSD Leadership

¹ **Industry's Fastest SLC SSD:** Source - Solidigm. See product performance and specifications at <https://www.solidigm.com/products/data-center/d7/p5810.html>

² **World's Fastest PCIe Gen 5 SSD:** Source - Solidigm. Comparing product specifications and measured real-life workload performance across widely shipping PCIe 5.0 data center SSDs at the industry's highest volume shipped capacity point of 3.84TB (using Solidigm 2023 and 2024 shipments as industry representative data). See product performance and specifications at <https://www.solidigm.com/products/data-center/d7/ps1010.html>

³ **Industry's Most Advanced PCIe 4.0 Portfolio:** Comparing Solidigm™ D7-P5520/P5620 to Samsung PM9A3, Kioxia CD6, Micron 7400 Pro/Max and 7450 Pro/Max where Solidigm is the only supplier offering E1.L, co-leads U.2 capacity range with Kioxia and co-leads E1.S capacity range with Samsung and the Micron 7450. Other factors considered are leading the chief competitor, Samsung, in 'Performance with Impact' attributes such as read latency under write pressure (Source - StorageReview.com: <https://www.storagereview.com/review/solidigm-p5520-maintains-lead-in-enterprise-workloads>), and the additional measures implemented by Solidigm in designing in for quality and the product testing (see Quality and Reliability footnote).

Appendix: 122TB D5-P5336 Overview



¹ IU-Aligned Endurance. Based on 100% Random Write 16KB for 16KB IU SKUs, and 100% Random Write 32KB for 32KB IU 122.88TB SKU.

² See D5-P5336 Product Specification for Exceptions and Modifications for Compliance/Support Details

³ PRQ1 SKUs compliant with NVMe version 1.4 and NVMe MI 1.1. NVMe 2.0 and NVMe-MI 1.2 support in PRQ2 and subsequent releases.

⁴ Requires FIPS enabled SKU. Certification may not be available at release. FIPS 140-3 Level 1 capability for 15.36TB & 30.72TB E1.L 9.5mm. PRQ2 and PRQ3 release SKUs of U.2 15mm, E3.S 7.5mm and 61.44TB E1.L 9.5mm will include Level 2 capability.

Appendix: D5-P5336 Performance Tests for real world Performance with Impact



Common test configuration:

Test Configuration: Intel® Server Board M50CYP2SB2U, Intel® ICE LAKE - P5 4GXRAV D, Number of CPUs: 2, Cores per CPU 18 (total 36), DRAM: DDR4 - 64GB, OS: CentOS Linux release 7.5.1804, Kernel Version: 3.10.0-862.el7.x86_64. For IO workload measurement, FIO tool was used.

Drives under test:

- Solidigm™ D5-P5336, QLC, 122.88TB: Product brief in process.
- Kioxia CD8-R, TLC, 15.36TB: <https://americas.kioxia.com/content/dam/kioxia/shared/business/ssd/data-center-ssd/asset/productbrief/dSSD-CD8-R-U2-product-brief.pdf>
- Micron 7450, TLC, 15.36TB: <https://www.micron.com/products/storage/ssd/data-center-ssd/7450-ssd>
- Micron 6500 ION, TLC, 30.72TB: <https://www.micron.com/products/storage/ssd/data-center-ssd/6500-ion>

Write Pressure Test: Comparing 61.44/122.88TB Solidigm™ D5-P5336 with read QoS of 806/676µsec to Kioxia CD8-R read QoS of 1221 µsec as entry TLC SSD, Micron 7450 read QoS of 1221 µsec as mainstream TLC SSD, and Micron 6500 ION 30.72TB read QoS of 1614 µsec as mainstream TLC SSD. Write pressure tests measure 16KB Random read QoS under 16KB random writes. Read response at a 99.99% availability is measured where 250MB/sec of random write pressure is applied.

General Purpose Server Workload: Comparing 61.44/122.88TB Solidigm™ D5-P5336 with total BW of 6.7/6.1GB/sec to Kioxia CD8-R 15.36TB with 4.6 GB/sec as entry TLC SSD, Micron 7450 15.36TB with 5.4GB/sec as mainstream TLC SSD and Micron 6500 ION 30.72TB with 5.3GB/s as mainstream TLC SSD. GPS workloads typically consists of concurrent large block (≥32KB) reads and writes with random access pattern. Test Configuration: Intel® Server Board M50CYP2SB2U, Intel® ICE LAKE - P5 4GXRAV D, Number of CPUs: 2, Cores per CPU 18 (total 36), DRAM: DDR4 - 64GB, OS: CentOS Linux release 7.5.1804, Kernel Version: 3.10.0-862.el7.x86_64. For IO workload measurement, FIO tool was used.

CDN Workload: Comparing 61.44/122.88TB Solidigm™ D5-P5336 with read BW of 7.4/7.4GB/sec to Kioxia CD8-R 15.36TB with 5.6 GB/sec as entry TLC SSD, Micron 7450 15.36TB with 6.2GB/sec as mainstream TLC SSD and Micron 6500 ION 30.72TB with 6.3GB/s as mainstream TLC SSD. Workload based on representative customer profile. Test Configuration: Supermicro SYS-120U-TNR, Intel(R) Xeon(R) Gold 6354. Number of CPUs: 2, Cores per CPU: 18 (total 36), DRAM: DDR4 - 64GB, OS: Ubuntu 20.04.5 LTS Linux 5.15.0-67-generic. FIO 3.16.

Object Storage Workload: Comparing 61.44/122.88TB Solidigm™ D5-P5336 with read/write bandwidth of 7.1/7.4GB/sec to Kioxia CD8-R 15.36TB with 6.3 GB/sec as entry TLC SSD and Micron 7450 15.36TB with 6.5GB/sec as mainstream TLC SSD and Micron 6500 ION 30.72TB with 6.5GB/s as mainstream TLC SSD. Workload based on SNIA definition from https://www.snia.org/sites/default/files/SDC/2019/presentations/Storage_Performance/Harrigan_John_Object_Storage_Workload_Testing_Tools.pdf (slide 8). Test Configuration: Intel® Server Board M50CYP2SBSTD, Intel® Xeon® Platinum 8360Y, Number of CPUs: 2, Number of Cores per CPU: 24 (total 48), DRAM: DDR4 - 768GB, OS: CentOS Linux release 7.9.2009. FIO v3.7.