2.5-inch U.2, 15mm, NVMe™ ZNS SSD

Features

- NVMe ZNS Command Set 1.0 specification compliant

- Western Digital dual-port NVMe 1.3c compliant controller

- Up to 4x performance improvement and up to 2.5x Quality of Service (QoS) improvement over conventional SSDs

- Open-source support and documentation available at zonedstorage.io

Applications and Workloads

- Data bases and key-value storage

- Persistent storage for VMs and containers

- File and Object storage applications in multi-tenant systems

- Serialized data streams, i.e. video, event stream processing

- Cloud Services, IoT

- Artificial Intelligence/Machine Learning

Zoned Storage for the Zettabyte Era

Zettabytes of data generated by IoT, 5G, sensors, edge computing, and AI/ML are the fuel that drives the global economy. Traditional data center architectures cannot match infrastructure cost and management escalations with the pace that data is being created. With vast amounts of stored data it is extremely complex to design systems and applications in a multi-tenant setting, which is a growing requirement. Zoned Storage enables cloud service providers and enterprise data center customers to architect more efficient, agile, and scalable data centers to address growing data demands.

NVMe™ Zoned Namespace (ZNS) technology enables application optimized storage in a complex multi-tenant environment. ZNS technology unlocks the potential of NAND by removing drive level inefficiencies and introducing read/write operations specifically designed for NAND media.

ZNS SSD garbage collection is managed by the host, which requires the user to make software stack modifications. A ZNS SSD groups its capacity into zones, where each zone can be read in any order but must be written sequentially. Host managed garbage collection and sequential writes improve internal data placement leading to higher performance, lower latency and significantly enhanced QoS. The new NVMe ZNS Command Set 1.0 specification follows the Zoned Storage standards-based architecture, which takes a unified approach to storage that enables both Shingled Magnetic Recording (SMR) in HDDs and ZNS for SSDs share a unified software stack.
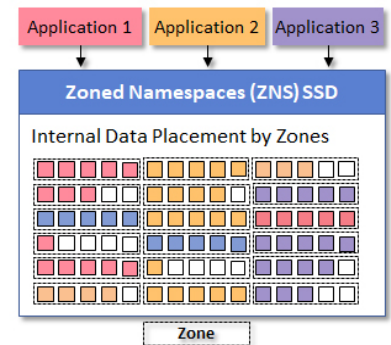
Zoned Storage for Cloud and Enterprise Data Center Customers

The Ultrastar DC ZN540 ZNS NVMe SSD is Western Digital's zoned storage SSD for cloud and enterprise data center customers. It implements the ZNS command set as defined by the NVM Express™ (NVMe) organization. It is available with a vertically integrated dual-port controller for storage systems.

Ultrastar DC ZN540 offers these benefits:

- Up to 4x throughput and 2.5x QoS Improvement over conventional data center SSDs
  - Reduces Write Amplification Factor

- Maximizes Scale and Utilization
  - Improves drive utilization with multi-tenancy via zones

- Based on Industry Standards

Open Community and Ecosystem Backs ZNS SSDs

Western Digital is committed to maintain an open community and flourishing hardware and software ecosystem for ZNS SSDs. Learn more at: https://www.westerndigital.com/solutions/business/zns

Specifications

Model Information

Endurance[2]	3.5 DW/D	3.5 DW/D	3.5 DW/D	3.5 DW/D
Capacity[1]	1024GB	2048GB	4096GB	8192GB
Security	SE, ISE, TCG, TCG FIPS 140-2			
Form Factor	U.2 2.5" 15mm			
Interface	Dual-port, PCIe 3.0 1×4 or 2×2, NVMe 1.3c			

Performance[3]

Read Throughput (max MB/s, Seq 128KiB)	3200	3200	3200	3200
Write Throughput (max MB/s, Seq 128KiB)	1200	1000	2000	2000
Read IOPS (max, Rnd 4KiB)	406K	390K	442K	486K
Mixed Throughput (max MB/s, 70/30 RR/SW 4KiB/128KiB)	2800	2600	2900	3000
Read Latency (µs, avg.)[4]	73	80	80	91
Maximum Petabytes Written	6.5	13	26	52

Reliability

MTBF[5] (M hours, projected)	2.5
Uncorrected Bit Error Rate (UBER, projected)	1 in 10^{17}
Annualized Failure Rate[5] (AFR, projected)	0.35%
Limited Warranty[6] (years)	5

Power Management

Requirement (DC +/- 5%)	12V +/- 15%, 3.3V +/- 15%
Operating (W, typical)	11, 14W
Idle (W, average)	< 5W

Physical Size

z-height (mm)	15
Dimensions (width x length, mm)	69.85 × 100.45
Weight (g, max)	140

Environmental

Operating Temperature	0° to 70°C
Non-Operating Temperature[7]	-40° to 85°C

Part Number

SE	ISE	TCG	TCG FIPS 140-2	Model Number	Capacity	Endurance
0TS2098	0TS2094	0TS2102	0TS2106	WZS4C8T1TDSP30x	1,024GB	3.5 DW/D
0TS2099	0TS2095	0TS2103	0TS2107	WZS4C8T2TDSP30x	2,048GB	3.5 DW/D
0TS2100	0TS2096	0TS2104	0TS2108	WZS4C8T4TDSP30x	4,096GB	3.5 DW/D
0TS2101	0TS2097	0TS2105	0TS2109	WZS4C8T8TDSP30x	8,192GB	3.5 DW/D

x = Encryption Setting

1 = Secure Erase

3 = Instant Secure Erase

4 = TCG

5 = TCG FIPs 140-2

[1] One megabyte (MB) is equal to one million bytes, one gigabyte (GB) is equal to 1,000MB (one billion bytes), one terabyte (TB) is equal to 1,000GB (one trillion bytes), and one petabyte (PB) is equal to 1,000TB. Actual user capacity may be less due to operating environment.

[2] Endurance rating based on DW/D using 128KiB 100% sequential write workloads over 5 years.

[3] Based on internal testing. Performance will vary by capacity point, or with the changes in useable capacity. Consult product manual for further details. All performance measurements are in full sustained mode and are peak values. Subject to change.

[4] Average random read latency at 4KiB, QD=1.

[5] MTBF and AFR specifications will be based on a sample population and are estimated by statistical measurements and acceleration algorithms under typical operating conditions for this drive model. MTBF and AFR ratings do not predict an individual drive's reliability and do not constitute a warranty.

[6] The warranty for the product will expire on the earlier of (i) the date when the flash media has reached one-percent (1%) of its remaining life or (ii) the expiration of the time period associated with the product.

[7] Values are based on ambient temperature. Avoid non-operational exposure to temperatures in excess of 40°C for periods exceeding three months and in excess of 70°C for periods exceeding two weeks.

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