Western Digital.

# Data Center Storage Solutions

# Powering the Data Revolution


For nearly 50 years, Western Digital has been enabling data at scale. Our data center SSDs, HDDs and platforms enable our customers to gain and leverage insights that they can extract from the zettabytes of data being generated by smart factories, connected endpoints, autonomous vehicles, IoT devices and more. Our robust portfolio and our outstanding customer service help companies and individuals transform their businesses with data.

# Essential Data Infrastructure for the Zettabyte Age

Western Digital.

## Ultrastar® Data Center SSDs

Portfolio breadth and depth for cloud computing to high-performance servers

Industry leading NAND

Vertically integrated controllers and firmware

## Ultrastar Data Center HDDs

1st with 18TB CMR HDDs, the industry's highest capacity

1st with Energy-Assisted Magnetic Recording technology

1st with Triple Stage Actuator

1st with helium-filled HDDs

## Ultrastar and OpenFlex™ Platforms

High capacity disk storage platforms

High performance flash storage platforms

Innovative ArcticFlow™ & IsoVibe™ technologies

Open Composable Infrastructure Solutions

# Trusted Storage Delivering Innovation Across All Technologies


## NVMe™ SSDs

Full range of NVMe solutions from Main-stream to Performance for modern data center performance and scale-out designs


## Boot & Edge SSDs

SATA and NVMe for boot, cache and edge compute

SATA


## Memory Extension Drive

Scale in-memory computing infrastructure at a better TCO


## Helium-filled HDDs

Highest capacity HDDs drive lower TCO for hyperscale, cloud and enterprise storage


## Air-filled HDDs

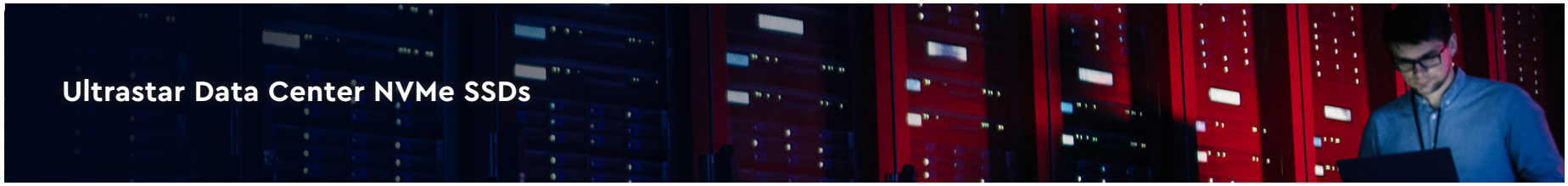
Economical and reliable data access for traditional data center application

## Platforms

Complete portfolio of storage platforms and servers for SATA, SAS, NVMe and NVMe-oF™

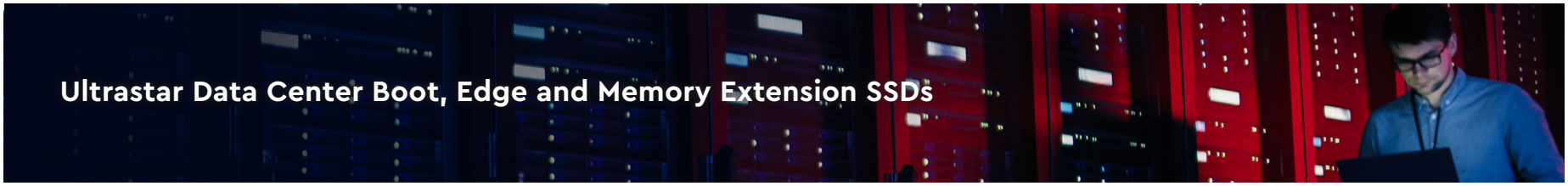
# Optimize Your Data Center with Ultrastar SSDs

| | Performance NVMe | Mainstream NVMe | Boot & Edge | | Memory |
|---|---|---|---|---|---|
| | Ultrastar DC SN840 | Ultrastar DC SN640 | Western Digital CL SN720 | Ultrastar DC SA210 | Ultrastar DC ME200 |
| Compute Intensive/HPC | ✓ | | | | |
| All Flash Array Primary Storage | ✓ | | | | |
| Relational Databases | ✓ | | | | |
| Artificial Intelligence/ Machine Learning | ✓ | | | | |
| Converged/ Hyperconverged Infrastructure | ✓ | ✓ | | | |
| OLTP | ✓ | ✓ | | | |
| OLAP | ✓ | ✓ | | | |
| Virtualization | ✓ | ✓ | | | |
| noSQL Databases | ✓ | ✓ | | | |
| Content Caching | ✓ | ✓ | ✓ | | |
| File/Object Storage | ✓ | ✓ | ✓ | | |
| Cloud Compute/Cloud Storage | | ✓ | | | |
| Edge Compute | | | ✓ | ✓ | |
| Boot | | | ✓ | ✓ | |
| In Memory Compute | | | | | ✓ |




| | Performance NVMe | Mainstream NVMe |
|---|---|---|
| |  |  |
| | **Ultrastar DC SN840** | **Ultrastar DC SN640** |
| Interface | PCIe 3.1 1×4, 2×2, NVMe 1.3c | PCIe 3.1 1×4, NVMe 1.3c |
| Form Factor | U.2. 15mm | U.2. 7mm |
| Endurance/Capacity (GB)[1,2] | 3 DW/D: 1600, 3200, 6400<br>1 DW/D: 1920, 3840, 7680, 15360 | 2 DW/D: 800, 1600, 3200, 6400<br>0.8 DW/D: 960, 1920, 3840, 7680 |
| NAND | 3D TLC | |
| Seq R/W (MB/s), up to[3] | 3,470/3,300 | 3,340/2,190* |
| Random R/W (KIOPS), up to | 780/257 | 515/161* |
| Reliability[4] | Unrecoverable Bit Error Rate (UBER): 1 in $10^{17}$<br>MTBF (M hours): 2.5, projected<br>AFR: 0.35%, projected | Unrecoverable Bit Error Rate (UBER): 1 in $10^{17}$<br>MTBF (M hours): 2<br>AFR: 0.44% |
| Security | SE, ISE, TCG Ruby, (FIPS 140–2 coming later) | SE, ISE, TCG Ruby |

* TCG Ruby Performance Values



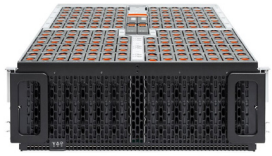
# Ultrastar Data Center Boot, Edge and Memory Extension SSDs

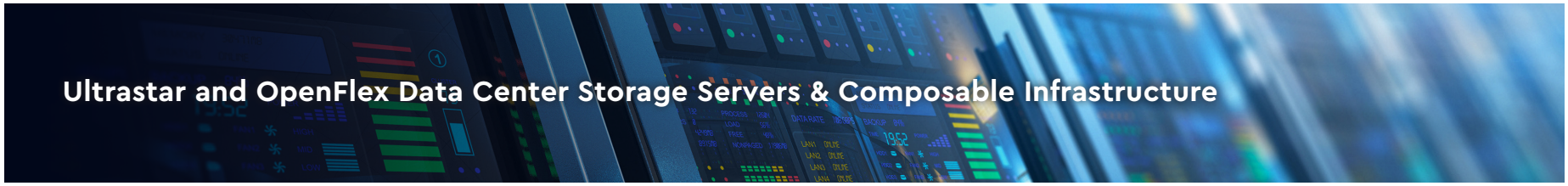
| | VRI NVMe | SATA | Memory Extension |
|---|---|---|---|
| |  |  |  |
| | **Western Digital CL SN720** | **Ultrastar DC SA210** | **Ultrastar DC ME200** |
| Interface | PCIe Gen3 x4 NVMe 1.3 | SATA 6Gb/s | PCIe Gen3 |
| Form Factor | M.2 2280 | M.2 2280<br>U.2 7mm | U.2 15mm<br>HH-HL Add-in card (AIC) |
| Capacity<br>Endurance | 256, 512, 1000, 2000GB<br>200/400/800/1600 TBW | 120, 240, 480, 960, 1920GB<br>21/43/87/175/350 TBW | Software-defined Memory Capacity:<br>1024, 2048, 4096 GiB |
| NAND | 3D TLC | | N/A |
| Seq R/W, up to | 3,470/2,800 (MB/s) | 510/475 (MiB/s) | N/A |
| Random R/W/Mixed (KIOPS), up to | 500/410/- | 64/5/11 | N/A |
| Reliability | Unrecoverable Bit Error Rate (UBER): 1 in $10^{17}$<br>MTBF (M hours): 2<br>AFR: 0.44% | | |
| Security | TCG Opal 2.01 support | | N/A |

# Ultrastar Data Center Helium-filled HDDs

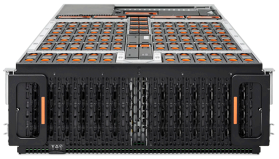
| | CMR with HelioSeal® | | |
|---|---|---|---|
| |  |  |  |
| | **Ultrastar DC HC550** | **Ultrastar DC HC530** | **Ultrastar DC HC520** |
| Interface | SATA 6Gb/s, SAS 12Gb/s | | |
| Rotational speed (RPM) | 7200 | | |
| Form Factor | 3.5-inch data center HDD | | |
| Capacity (TB) | 18, 16 | 14 | 12 |
| Format | 512e | | |
| Sustained transfer rate (MB/s, max)[5] | 269 (18TB)<br>262 (16TB) | 267 | 243 |
| Idle_A (W), SATA/SAS[6] | 5.6/5.8 | 5.5/5.9 | 5.0/6.1 |
| Reliability[7] | MTBF (M hours): 2.5, projected<br>AFR: 0.35%, projected<br>Workloads: up to 550TB/year | MTBF (M hours): 2.5<br>AFR: 0.35%<br>Workloads: up to 550TB/year | |
| Security | Base (SE), SED, SED-FIPS | | |


| | CMR, Air-filled | | | |
|---|---|---|---|---|
| |  |  |  |  |
| | **Ultrastar DC HC330** | **Ultrastar DC HC320** | **Ultrastar DC HC310** | **Ultrastar DC HA210** |
| Interface | SATA 6Gb/s, SAS 12Gb/s | | | SATA 6Gb/s |
| Rotational speed (RPM) | 7200 | | | |
| Form Factor | 3.5-inch data center HDD | | | |
| Capacity (TB) | 10 | 8 | 6, 4 | 2, 1 |
| Format | 512e<br>512n available on 4TB capacity | | | 512n |
| Sustained transfer rate (MB/s, max) | 262 | 255 | 255<br>233 w/512n | 200 (2TB)<br>184 (1TB) |
| Idle (W), SATA/SAS | 8.0/9.0 | 7.4/8.4 | 5.9/7.0 | 5.9/NA |
| Reliability | MTBF (M hours): 2<br>AFR: 0.44%<br>Workloads: up to 550TB/year | | | |
| Security | Base (SE), SED, SED-FIPS | | | SE |


| | JBOF/JBOD | | |
|---|---|---|---|
| |  |  |  |
| | **OpenFlex Data24** | **Ultrastar Data60** | **Ultrastar Data102** |
| Storage Type | SSD | HDD & SSD | |
| Interface | NVMe (NVMe-oF) | SATA/SAS | |
| # Drives (up to) | 24 | 60 (up to 24 can be SSD) | 102 (up to 24 can be SSD) |
| Capacity (up to) | 368TB | 1.2PB | 2.0PB |
| Dimension | 2U | 4U | |
| Features | Low Latency | IsoVibe<br>ArcticFlow | |



# Ultrastar and OpenFlex Data Center Storage Servers & Composable Infrastructure

| | Storage Servers | | Composable Infrastructure |
|---|---|---|---|
| |  |  |  |
| | **Ultrastar Serv24-A** | **Ultrastar Serv60+8** | **OpenFlex F3200** |
| Storage Type | SSD | HDD & SSD | SSD |
| Interface | SATA | SATA/SAS | NVMe-oF |
| # Drives (up to) | 24 | 60 HDDs (up to 24 can be SSDs)<br>8 SSDs | 10 |
| Capacity (up to) | 368TB | 1.2PB | 61TB |
| Dimension | 2U | 4U | 3U |
| Features | Portable | IsoVibe<br>ArcticFlow | Low Latency |

[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 4KiB random write workload 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] MTBF and AFR specifications are/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.

[5] Based on internal testing; performance may vary depending on host environment, drive capacity and other factors. 1MB = 1,000,000 bytes ($10^6$)

[6] Idle specification is based on use of Idle_A

[7] MTBF and AFR specifications are/will be based on a sample population and are estimated by statistical measurements and acceleration algorithms under typical operating conditions, workload 220TB/year and temperature 40C. Derating of MTBF and AFR will occur above these parameters, up to 550TB writes per year and 60°C ambient (65°C device temp). MTBF and AFR ratings do not predict an individual drive's reliability and do not constitute a warranty.

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