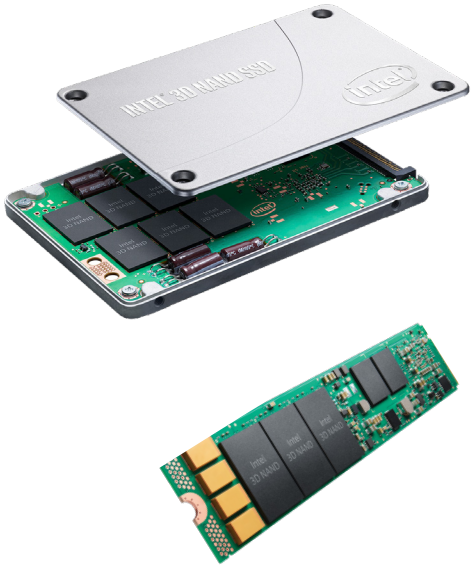
PRODUCT BRIEF

Intel® 3D NAND SSD DC P4501 Series
Data Center (DC), PCIe* (P)

Cloud Inspired. Optimized for Low Power Storage.

Designed for power conscious and space constrained cloud storage solutions.



The cloud continues to drive innovation, new services, and agility for businesses, which need to deploy services faster, scale effectively, and reduce the human costs of managing assets. Software-defined and converged infrastructures are central to cloud solutions that help businesses meet these goals. In addition, today's data centers face space and power constraints.

To meet these challenges, Intel offers space and power optimized SSD options in a variety of form factors to give solution designers choices to reduce Opex, increase agility, and reduce Capex.

Power-Efficient, High-Performance SSDs for Cloud Storage

The Intel® Solid State Drive Data Center P4501 Series—a member of the 2nd Gen Intel® 3D NAND SSD family—combines a new Intel-developed controller, unique firmware innovations, and industry-leading 3D NAND density in efficient, low power, small form factor designs. These drives are optimized for the storage needs of cloud and software-defined infrastructures and enable data centers to do more per server. To minimize service disruptions and help efficiently manage at scale, the Intel SSD DC P4501 Series integrates industry-leading reliability, durable performance, and advanced manageability features.

The DC P4501 Series is optimized for the read intensive workloads of cloud storage solutions and is architected to maximize CPU utilization. With controller support for up to 128 queues, these SSDs minimize the risk of idle CPU cores and perform most effectively on Intel® Xeon® processor-based platforms.

Solutions Optimized for Space and Power Efficient Capacity

Available in U.2 (2.5 in x 7mm) and M.2 (110mm) form factors, the DC P4501 Series enables data centers to optimize for space and power efficient capacity. The drives pack up to 4 TB in 7mm U.2 form factors, so data centers can deliver up to 4x more storage in the same space compared to current generation PCIe*-based SSDs.[1] Optimized for power efficiency, the drives can free up to 45% of a rack's power budget at equivalent capacity to standard power drives.[2] This savings enables data centers to increase rack compute capability to address the needs of emerging workloads or increase storage density.

Manageability to Maximize IT Efficiency

DC P4501 drives are built to maximize IT efficiency within existing server footprints. New firmware manageability features—including improved firmware updates, health monitoring, and secure erase—help reduce server downtime through improved update processes and expanded monitoring capabilities. In addition, the DC P4501 is platform-compatible with Intel® Volume Management Device (VMD) which delivers seamless management of PCIe-based NVMe* SSDs and enables enhanced serviceability and hot-plug to minimize service interruptions during drive swaps.

SMART management and Intel custom log pages provide advanced drive telemetry to manage thermals, monitor endurance, and track drive health status. Management coverage is now expanded across a wider range of drive states with support for the NVM Express* Management Interface (NVMe-MI) specification, an industry standard way to manage the SSD out-of-band.

Industry-Leading Reliability and Security

As capacity per server continues to scale, the risk of data corruption and errors increases. With an eye toward this risk, Intel has built industry-leading end-to-end data protection[4] into the DC P4501. This includes protection from silent data corruption, which can cause catastrophic downtime and errors in major businesses.

Power Loss Imminent (PLI) provides protection from unplanned power loss, and is obtained through a propriety combination of power management chips, capacitors, firmware algorithms, and a built-in PLI self-test. Intel's PLI feature provides data centers with high confidence of preventing data loss during unplanned power interrupts.

Future Proof Your Data Center with Low Power Storage Solutions

Built with the same cloud inspired design as the Intel® SSD DC P4500 Series, the low power Intel® SSD DC P4501 Series enables energy and space efficient storage solutions to help data centers do more per server, minimize service disruptions and efficiently manage at scale.

Learn more now at www.intel.com/ssd

FEATURES AT A GLANCE	
Capacity	500 GB, 1 TB, 2 TB, 4 TB
Performance[3]	64k Sequential Read/Write: up to 3200/900 MB/s 4k Random Read/Write: up to 360,000/46,000 IOPS
Manageability	Support for NVM Express Management Interface (NVMe-MI), NVMe SMART/Health and Log Pages
Reliability[4]	End-to-end data protection, including silent data corruption; uncorrectable bit error rate < 1 sector per 10^{17} bits read Power Loss Imminent (PLI) protects data during power loss
Interface	PCIe 3.1 x4, NVMe 1.2
Form Factors	U.2 2.5in x 7mm (for serviceability, hot-plug, and density) M.2 110mm (for ultra-high density)
Media	Intel 3D NAND, TLC
Endurance	Random/JEDEC up to 1 DWPD or 5PBW, sequential up to 3 DWPD or 20PBW
Tunable Maximum Power	U.2: 8, 10, 12.5 W M.2: 6 to 8.25 W
Idle Power	U.2 <5 watts M.2 <3 watts
Warranty	5-year warranty

1. Space/capacity comparison: 2 TB U.2 15mm Intel® SSD DC P3520 at up to 48 TB compared to 4 TB U.2 7mm Intel® SSD DC P4501, capable of up to 192 TB.

2. Power efficient capacity. Sources – Intel and Facebook. Facebook Lightening JBOF: https://code.facebook.com/posts/989638804458007/introducing-lightning-a-flexible-nvme-jbof/. Intel – Specifications for Intel® SSD DC P4500 and Intel® SSD DC P4501. Each rack populates 24U with 15x 4 TB drives in each rack unit. Storage on the DC P4500 48U rack consumes 9kW (24U x 15 SSDs/U x 25 W/drive) while the DC P4501 rack consumes 3.6 kW (24U x 15 SSDs/U x 10 W/drive).

3. Test and System Configuration: Intel® Server Board S2600WTTR, Intel® Xeon® E5-2699 v3, Speed: 2.30GHz, Intel BIOS: Internal Release, DRAM: DDR3 – 32GB, OS: Linux* Centos* 7.0 kernel 4.8, Intel® SSD DC P4500 Series, 1 TB, 2 TB, 4 TB. Testing performed by Intel.

4. Source - Intel. End-to-end data protection refers to the set of methods used to detect and correct the integrity of data across the full path as it is read or written between the host and the SSD controller and media. Test performed on Intel® SSD DC S3520, Intel® SSD DC P3520, Intel® SSD DC P3510, Intel® SSD DC P4500, Samsung* PM953, Samsung PM1725, Samsung PM961, Samsung PM863, Micron* 7100, Micron 510DC, Micron 9100, HGST* SN100, Seagate* 1200.2, SanDisk* CS ECO drives. Claim is based on average of Intel drive error rates vs. average of competitor drive error rates. Neutron radiation is used to determine silent data corruption rates and as a measure of overall end-to-end data protection effectiveness. Among the causes of data corruption in an SSD controller are ionizing radiation, signal noise and crosstalk, and SRAM instability. Silent errors were measured at run-time and at post-reboot after a drive "hang" by comparing expected data vs actual data returned by drive. The annual rate of data corruption was projected from the rate during accelerated testing divided by the acceleration of the beam (see JEDEC standard JESD89A).

Benchmark results were obtained prior to implementation of recent software patches and firmware updates intended to address exploits referred to as "Spectre" and "Meltdown". Implementation of these updates may make these results inapplicable to your device or system.

Tests document performance of components on a particular test, in specific systems. Differences in hardware, software, or configuration will affect actual performance. Consult other sources of information to evaluate performance as you consider your purchase.

Cost reduction scenarios described are intended as examples of how a given Intel- based product, in the specified circumstances and configurations, may affect future costs and provide cost savings. Circumstances will vary. Intel does not guarantee any costs or cost reduction.

Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software or service activation. Performance varies depending on system configuration. No computer system can be absolutely secure. Check with your system manufacturer or retailer or learn more at intel.com.

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