

Intel Optane P4800X Performance NVMe PCIe SSDs Product Guide

The ThinkSystem U.2 Intel Optane P4800X Performance NVMe PCIe SSD is the ultimate in high performance solid state drives with ultra-low latency, very high bandwidth, and an endurance of 30 drive writes per day (DWPD), making this drive an excellent storage choice for write-intensive high-performance workloads.

The Intel Optane P4800X SSD is a member of the Intel Optane family of data center solid state devices that are based on Intel-developed 3D XPoint memory, controller, interconnect technology and firmware, all providing significant gains in reducing latency and accelerating systems for workloads demanding large capacity and fast storage.



Figure 1. Intel Optane P4800X Performance NVMe PCIe SSD

Did You Know?

NVMe (Non-Volatile Memory Express) is a technology that overcomes SAS/SATA SSD performance limitations by optimizing hardware and software to take full advantage of flash technology. Intel Xeon processors efficiently transfer data in fewer clock cycles with the NVMe optimized software stack compared to the legacy Advance Host Controller Interface (AHCI) stack, thereby reducing latency and overhead. These SSDs connect directly to the processor via the PCIe bus, further reducing latency and TCO.

Part number information

The following table lists the ordering part numbers and feature codes.

Table 1. Ordering part numbers and feature codes

Part number	Feature	Description
7N47A00081	AUMJ	ThinkSystem U.2 Intel Optane P4800X 375GB Performance NVMe PCIe 3.0 x4 Hot Swap SSD
7N47A00083	B2ZJ	ThinkSystem U.2 Intel Optane P4800X 750GB Performance NVMe PCIe 3.0 x4 Hot Swap SSD

The part numbers for the adapters include the following items:

- One drive with a ThinkSystem hot-swap tray attached
- Documentation flyers

Features

The Intel Optane P4800X SSD series is Intel's first NVMe SSD that features 3D XPoint technology. 3D XPoint technology is a new class of memory that doesn't store data by trapping electrons in the memory cell but instead utilized the property-change of the memory material itself to store the data. The NVMe controller and firmware are optimized to take advantage of the unique aspects of 3D XPoint technology. I/O operations are accelerated by hardware, delivering leading performance, ultra-low latency and quality of service (QoS).

Non-Volatile Memory Express (NVMe) is new PCIe 3.0 high performance SSD technology that provides high I/O throughput and low latency. NVMe interfaces remove SAS/SATA bottlenecks and unleash all of the capabilities of flash memory. Each NVMe PCI SSD has direct PCIe 3.0 x4 connection, which provides increased bandwidth and lower latency than SATA/SAS-based SSD solutions. NVMe drives are also optimized for heavy multi-threaded workloads by using internal parallelism and many other improvements, such as enlarged I/O queues.

The Intel Optane P4800X NVMe drives have the following key characteristics:

- PCIe 3.0 connection for each NVMe drive.
- Ultra-low I/O latency, with an average read/write latency of 10 μ s.
- Consistently reliable quality of service
- Excellent read and write performance at low queue depths
- Near symmetrical read and write performance
- Very high endurance at 30 full drive writes per day
- Variable sector size and end-to-end data-path protection
- Enhanced power-loss data protection
- Thermal throttling and monitoring
- Supports the NVMe Management Interface (NVMe-MI) specification
- SMART health reporting

The key metric for solid state drives is their endurance (life expectancy). SSDs have a huge, but finite, number of program/erase (P/E) cycles, which determines how long the drives can perform write operations and thus their life expectancy. Performance SSDs have better endurance than Mainstream SSDs, which in turn have better endurance than Entry SSDs.

SSD write endurance is typically measured by the number of program/erase cycles that the drive can incur over its lifetime, which is listed as TBW in the device specification. The TBW value that is assigned to a solid-state device is the total bytes of written data that a drive can be guaranteed to complete. Reaching this limit does not cause the drive to immediately fail; the TBW simply denotes the maximum number of writes that can be guaranteed.

A solid-state device does not fail upon reaching the specified TBW, but at some point after surpassing the TBW value (and based on manufacturing variance margins), the drive reaches the end-of-life point, at which time the drive goes into read-only mode. Because of such behavior, careful planning must be done to use SSDs in the application environments to ensure that the TBW of the drive is not exceeded before the required life expectancy.

The Intel Optane P4800X 375 GB drive has an endurance of 20.5 PB (20,500 TB) of total bytes written (TBW). This means that for full operation over five years, write workload can be up to 11.2 TB of writes per day, which is equivalent to 30 full drive writes per day (DWPD). For the device to last three years, the drive write workload can be written to up to 18.7 TB of writes per day, which is equivalent to 49.9 full drive writes per day.

Technical specifications

The following table present technical specifications for the Intel Optane P4800X Performance NVMe PCIe SSDs.

Table 2. Technical specifications

Feature	375 GB drive	750 GB drive
Form factor	2.5-inch hot-swap	2.5-inch hot-swap
Interface	PCIe 3.0 x4	PCIe 3.0 x4
Capacity	375 GB	750 GB
Endurance (total bytes written)	20.5 PB	41 PB
Endurance (drive writes per day over 5 years)	30 DWPD	30 DWPD
Data reliability (Uncorrectable Bit Error Rate UBER)	< 1 in 10 ¹⁷ bits read	< 1 in 10 ¹⁷ bits read
MTBF, hours	2,000,000	2,000,000
IOPS read (4 KB blocks)	550,000	550,000
IOPS write (4 KB blocks)	550,000	550,000
Sequential read rate	2.5 GB/s	2.5 GB/s
Sequential write rate	2.2 GB/s	2.2 GB/s
Read access latency random	10 µs	10 µs
Write access latency random	10 µs	10 µs
Shock, operating	1,000 G (Max) at 0.5 ms	1,000 G (Max) at 0.5 ms
Vibration, max, operating	2.17 G _{RMS} (5-700 Hz)	2.17 G _{RMS} (5-700 Hz)
Average power (Active Read / Active Write)	8 W / 13 W	10 W / 15 W

Server support

The following tables list the ThinkSystem servers that are compatible.

Table 3. ThinkSystem server support (Part 1)

Part number	Description	Intel 2S						AMD					
		ST550 (7X09/7X10)	SR530 (7X07/7X08)	SR550 (7X03/7X04)	SR570 (7Y02/7Y03)	SR590 (7X98/7X99)	SR630 (7X01/7X02)	SR650 (7X05/7X06)	SR670 (7Y36/37/38)	SR635 (7Y98/7Y99)	SR655 (7Y00/7Z01)	SR645 (7D2Y/7D2X)	SR665 (7D2W/7D2V)
7N47A00081	ThinkSystem U.2 Intel Optane P4800X 375GB Performance NVMe PCIe 3.0 x4 Hot Swap SSD	N	N	N	N	N	Y	Y	N	N	N	N	N
7N47A00083	ThinkSystem U.2 Intel Optane P4800X 750GB Performance NVMe PCIe 3.0 x4 Hot Swap SSD	N	N	N	N	N	Y	Y	N	N	N	N	N

Table 4. ThinkSystem server support (Part 2)

Part number	Description	F	1S Intel			4S Intel			Dense/ Blade				
		SE350 (7Z46/7D1X)	ST150 (7Y48/7Y50)	ST250 (7Y45/7Y46)	SR150 (7Y54)	SR250 (7Y51/7Y52)	SR850 (7X18/7X19)	SR850P (7D2F/2D2G)	SR860 (7X69/7X70)	SR950 (7X11/12/13)	SD530 (7X21)	SD650 (7X58)	SN550 (7X16)
7N47A00081	ThinkSystem U.2 Intel Optane P4800X 375GB Performance NVMe PCIe 3.0 x4 Hot Swap SSD	N	N	N	N	N	Y	Y	Y	Y	N	Y	Y
7N47A00083	ThinkSystem U.2 Intel Optane P4800X 750GB Performance NVMe PCIe 3.0 x4 Hot Swap SSD	N	N	N	N	N	Y	Y	Y	Y	N	N	N

Operating system support

The following tables list the supported operating systems for the drives.

- [ThinkSystem U.2 Intel P4800X 375GB Performance NVMe PCIe 3.0 x4 Hot Swap SSD, 7N47A00081](#)
- [ThinkSystem U.2 Intel P4800X 750GB Performance NVMe PCIe 3.0 x4 Hot Swap SSD, 7N47A00083](#)

Tip: These tables are automatically generated based on data from [Lenovo ServerProven](#).

Table 5. Operating system support for ThinkSystem U.2 Intel Optane P4800X 375GB Performance NVMe PCIe 3.0 x4 Hot Swap SSD , 7N47A00081

Operating systems	SD530 (Gen 2)	SN550 (Gen 2)	SN850 (Gen 2)	SR630 (Gen 2)	SR650 (Gen 2)	SR850 (Gen 2)	SR850P	SR860 (Gen 2)	SR950 (Gen 2)	SD530 (Gen 1)	SN550 (Gen 1)	SN850 (Gen 1)	SR630 (Gen 1)	SR650 (Gen 1)	SR850 (Gen 1)	SR860 (Gen 1)	SR950 (Gen 1)
Microsoft Windows Server 2012 R2	N	N	N	N	N	N	N	N	N	Y	Y	Y	N	Y	Y	Y	N
Microsoft Windows Server 2016	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N
Microsoft Windows Server 2019	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
Microsoft Windows Server version 1709	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Microsoft Windows Server version 1803	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 6.10	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 6.9	N	N	N	N	N	N	N	N	N	Y	Y	Y	N	Y	Y	Y	N
Red Hat Enterprise Linux 7.3	N	N	N	N	N	N	N	N	N	Y	Y	Y	N	Y	Y	N	N
Red Hat Enterprise Linux 7.4	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 7.5	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 7.6	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 7.7	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 7.8	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 7.9	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 8.0	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 8.1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 8.2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 11 SP4	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N
SUSE Linux Enterprise Server 12 SP2	N	N	N	N	N	N	N	N	N	Y	N	Y	Y	Y	Y	N	N
SUSE Linux Enterprise Server 12 SP3	N	N	N	N	N	N	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 12 SP4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 12 SP5	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 12 SP5 with Xen	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 15	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 15 SP1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 15 SP2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 15 SP2 with Xen	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 6.0 U3	N	N	N	N	N	N	N	N	N	Y	Y	Y	N	Y	Y	Y	N
VMware vSphere Hypervisor (ESXi) 6.5	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N
VMware vSphere Hypervisor (ESXi) 6.5 U1	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 6.5 U2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 6.5 U3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 6.7	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 6.7 U1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 6.7 U2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Operating systems	SD530 (Gen 2)	SN550 (Gen 2)	SN850 (Gen 2)	SR630 (Gen 2)	SR650 (Gen 2)	SR850 (Gen 2)	SR850P	SR860 (Gen 2)	SR950 (Gen 2)	SD530 (Gen 1)	SN550 (Gen 1)	SN850 (Gen 1)	SR630 (Gen 1)	SR650 (Gen 1)	SR850 (Gen 1)	SR860 (Gen 1)	SR950 (Gen 1)
VMware vSphere Hypervisor (ESXi) 6.7 U3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 7.0	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 6. Operating system support for ThinkSystem U.2 Intel Optane P4800X 750GB Performance NVMe PCIe 3.0 x4 Hot Swap SSD, 7N47A00083

Operating systems	SD530 (Gen 2)	SN550 (Gen 2)	SN850 (Gen 2)	SF630 (Gen 2)	SF650 (Gen 2)	SF850P	SF950 (Gen 2)	SD530 (Gen 1)	SN550 (Gen 1)	SN850 (Gen 1)	SF630 (Gen 1)	SF650 (Gen 1)	SF860 (Gen 1)	SF950 (Gen 1)
Microsoft Windows Server 2012 R2	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	N	Y
Microsoft Windows Server 2016	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Microsoft Windows Server 2019	N	N	N	Y	Y	Y	Y	Y	N	Y	Y	Y	N	Y
Microsoft Windows Server version 1709	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y
Microsoft Windows Server version 1803	N	N	N	N	N	N	N	Y	Y	N	Y	Y	N	Y
Red Hat Enterprise Linux 6.10	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	N	Y
Red Hat Enterprise Linux 6.9	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	N	Y
Red Hat Enterprise Linux 7.3	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	N	Y
Red Hat Enterprise Linux 7.4	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	N	Y
Red Hat Enterprise Linux 7.5	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	N	Y
Red Hat Enterprise Linux 7.6	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Red Hat Enterprise Linux 7.7	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Red Hat Enterprise Linux 7.8	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Red Hat Enterprise Linux 7.9	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Red Hat Enterprise Linux 8.0	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Red Hat Enterprise Linux 8.1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Red Hat Enterprise Linux 8.2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
SUSE Linux Enterprise Server 11 SP4	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	N	Y
SUSE Linux Enterprise Server 12 SP2	N	N	N	N	N	N	N	Y	N	Y	Y	Y	N	Y
SUSE Linux Enterprise Server 12 SP3	N	N	N	N	N	Y	N	Y	Y	Y	Y	Y	N	Y
SUSE Linux Enterprise Server 12 SP4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
SUSE Linux Enterprise Server 12 SP5	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y
SUSE Linux Enterprise Server 12 SP5 with Xen	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y
SUSE Linux Enterprise Server 15	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
SUSE Linux Enterprise Server 15 SP1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
VMware vSphere Hypervisor (ESXi) 6.0 U3	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	N	Y
VMware vSphere Hypervisor (ESXi) 6.5	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	N	Y
VMware vSphere Hypervisor (ESXi) 6.5 U1	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	N	Y
VMware vSphere Hypervisor (ESXi) 6.5 U2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
VMware vSphere Hypervisor (ESXi) 6.5 U3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
VMware vSphere Hypervisor (ESXi) 6.7	N	N	N	N	N	N	N	Y	Y	Y	N	N	N	Y
VMware vSphere Hypervisor (ESXi) 6.7 U1	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y
VMware vSphere Hypervisor (ESXi) 6.7 U3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
VMware vSphere Hypervisor (ESXi) 7.0	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y

Warranty

The Intel Optane P4800X Performance NVMe PCIe SSDs carry a 1-year, customer-replaceable unit (CRU) limited warranty. When installed in a supported Lenovo server, these drives assume the server's base warranty and any warranty upgrade.

Solid State Memory cells have an intrinsic, finite number of program/erase cycles that each cell can incur. As a result, each solid state device has a maximum amount of program/erase cycles to which it can be subjected. The warranty for Lenovo solid state drives (SSDs) is limited to drives that have not reached the maximum guaranteed number of program/erase cycles, as documented in the Official Published Specifications for the SSD product. A drive that reaches this limit may fail to operate according to its Specifications.

Physical specifications

The Intel Optane P4800X SSDs have the following dimensions:

- Height: 15 mm (0.59 in.)
- Width: 70 mm (2.8 in.)
- Depth: 100 mm (4.0 in.)

Operating environment

The Intel Optane P4800X SSDs are supported in the following environment:

- Temperature (operational): 0 - 35 °C (32 - 95 °F) at 0 - 3,048 m (0 - 10,000 ft)
- Relative humidity: 5 - 95% (non-condensing)
- Maximum altitude (operational): 3,048 m (10,000 ft)
- Shock: 1,000 G (Max) at 0.5 ms
- Vibration: 2.17 G_{RMS} (5-700 Hz)

Agency approvals

The Intel Optane P4800X SSDs conform to the following regulations:

- FCC Title 47, Part 15B, Class B
- CA/CSA-CEI/IEC CISPR 22:02
- EN 55024: 1998
- EN 55022: 2006
- EN-60950-1 2nd Edition
- UL/CSA EN-60950-1 2nd Edition
- Low Voltage Directive 2006/95/EC
- C-Tick: AS/NZS3584
- BSMI: CNS 13438
- KCC Article 11.1
- RoHS DIRECTIVE 2011/65/EU
- WEEE Directive 2002/96/EC

Related publications and links

For more information, see the following documents:

- Storage Options for ThinkSystem Servers
<https://lenovopress.com/lp0761-storage-options-for-thinksystem-servers>
- ServerProven
<http://www.lenovo.com/us/en/serverproven>
- Intel Optane P4800X specifications
<https://www.intel.com/content/www/us/en/products/memory-storage/solid-state-drives/data-center-ssds/optane-dc-p4800x-series/p4800x-375gb-2-5-inch-20nm.html>
- Intel Optane P4800X product brief
<https://www.intel.com/content/www/us/en/solid-state-drives/optane-ssd-dc-p4800x-brief.html>

Related product families

Product families related to this document are the following:

- [Drives](#)

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