ThinkSystem P5800X Write Intensive NVMe PCIe 4.0 SSDs

Product Guide

The ThinkSystem U.2 P5800X Write Intensive NVMe PCIe 4.0 x4 SSD is the ultimate in high performance solid state drive with ultra-low latency, very high bandwidth, and an endurance of up to 100 drive writes per day, making this drive the best choice for write-intensive high-performance workloads.

Intel's next-gen Optane storage solution brings outstanding quality of service for predictable performance, leading IOPS performance across workloads, and the best endurance value in the industry. With a PCIe 4.0 host interface, the P5800X performs over three times faster than the previous generation P4800X SSD, which has already carved out an important niche in data center storage thanks to its excellent endurance and overall performance.

Figure 1. ThinkSystem U.2 P5800X Write Intensive NVMe PCIe 4.0 x4 SSD

Did You Know?

The P5800X SSDs have a PCIe 4.0 (Gen 4) host interface, where sequential performance is doubled over the PCIe 3.0 host interface. The drives are also fully compatible with a PCIe 3.0 host interface providing optimal performance and enabling compatibility across server families.

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	Supplier part number
2.5-inch hot-swap drives			
4XB7A17158	BKKY	ThinkSystem 2.5" U.2 P5800X 400GB Write Intensive NVMe PCIe 4.0 x4 HS SSD	SSDPF21Q400GB
4XB7A17159	BKKZ	ThinkSystem 2.5" U.2 P5800X 800GB Write Intensive NVMe PCIe 4.0 x4 HS SSD	SSDPF21Q800GB
4XB7A17160	BMM8	ThinkSystem 2.5" U.2 P5800X 1.6TB Write Intensive NVMe PCIe 4.0 x4 HS SSD	SSDPF21Q016TB
3.5-inch hot-swap drives			
4XB7A17161	BMM7	ThinkSystem 3.5" U.2 P5800X 400GB Write Intensive NVMe PCIe 4.0 x4 HS SSD	SSDPF21Q400GB
4XB7A17162	BMM5	ThinkSystem 3.5" U.2 P5800X 800GB Write Intensive NVMe PCIe 4.0 x4 HS SSD	SSDPF21Q800GB
4XB7A77070	BMM6	ThinkSystem 3.5" U.2 P5800X 1.6TB Write Intensive NVMe PCIe 4.0 x4 HS SSD	SSDPF21Q016TB

The part numbers for the adapters include the following items:

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

Features

The ThinkSystem U.2 P5800X Write Intensive NVMe PCIe 4.0 x4 SSD series is Intel's next-generation 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 PCIe 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 contemporary NAND flash memory. Each NVMe PCI SSD has direct PCIe x4 connection, which provides at significantly greater 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.

With a PCIe 4.0 host interface, the P5800X drives offer significant increase in maximum throughputs supported, from 2.5 GB/s for sequential reads with the P4800X drives to up to 7.2 GB/s with the P5800X drives, almost triple the performance. Sequential writes also increase from 2.2 GB/s with the P4800X to up to 6.1 GB/s with the P5800X drives.

The P5800X drives have the following key characteristics:

- PCIe 4.0 connection for each NVMe drive
- Also supports PCIe 3.0 host connection for servers with first and second-generation Intel Xeon Scalable processors or with PCIe 3.0 NVMe switch adapters

- Ultra-low I/O latency, with a read/write latency of as low as 5 µs.
- Consistently reliable quality of service
- Excellent read and write performance at low queue depths
- Near symmetrical read and write performance
- Very high endurance at 100 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.

For example, the P5800X 800 GB drive has an endurance of 146 PB of total bytes written (TBW). This means that for full operation over five years, write workload must be limited to no more than 80,000 GB of writes per day, which is equivalent to 100.0 full drive writes per day (DWPD). For the device to last three years, the drive write workload must be limited to no more than 133,333 GB of writes per day, which is equivalent to 166.7 full drive writes per day.

Technical specifications

The following table present technical specifications for the ThinkSystem U.2 P5800X Write Intensive NVMe PCIe 4.0 x4 SSD family.

Table 2. Technical specifications

Feature	**400 GB drive**	**800 GB drive**	**1.6 TB drive**
Interface	PCIe 4.0 x4	PCIe 4.0 x4	PCIe 4.0 x4
Capacity	400 GB	800 GB	1.6 TB
SED encyption	None	None	None
Endurance (total bytes written)	73 PB	146 PB	292 PB
Endurance (drive writes per day over 5 years)	100 DWPD	100 DWPD	100 DWPD
Data reliability (Uncorrectable Bit Error Rate UBER)	< 1 in 10^{17} bits read	< 1 in 10^{17} bits read	< 1 in 10^{17} bits read
MTBF, hours	2,000,000	2,000,000	2,000,000
IOPS read (4 KB blocks)	1,500,000	1,500,000	1,500,000
IOPS write (4 KB blocks)	1,150,000	1,350,000	1,500,000
Sequential read rate	7.2 GB/s	7.2 GB/s	7.2 GB/s
Sequential write rate	4.8 GB/s	6.1 GB/s	6.2 GB/s
Read access latency (random)	5 µs	5 µs	5 µs
Write access latency (random)	5 µs	5 µs	5 µs
Shock, operating	1,000 G (Max) at 0.5 ms	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)	2.17 G_{RMS} (5-700 Hz)
Average power (Active Read / Active Write)	12 W / 14 W	13 W / 18 W	14 W / 21 W

Server support

The following tables list the ThinkSystem servers that are compatible.

Table 3. Server support (Part 1 of 3)

Part Number	Description	Edge		1S Intel V2			AMD V3			Intel V3				Dense V3				2S Intel V2			
		SE350 (7Z46 / 7D1X)	SE450 (7D8T)	ST50 V2 (7D8K / 7D8J)	ST250 V2 (7D8G / 7D8F)	SR250 V2 (7D7R / 7D7Q)	SR645 V3 (7D9D / 7D9C)	SR665 V3 (7D9B / 7D9A)	SR675 V3 (7D9Q / 7D9R)	SR630 V3 (7D72 / 7D73)	SR650 V3 (7D75 / 7D76)	SR850 V3 (7D97 / 7D96)	SR860 V3 (7D94 / 7D93)	SD665 V3 (7D9P)	SD665-N V3 (7DAZ)	SD650 V3 (7D7M)	SD650-I V3 (7D7L)	ST650 V2 (7Z75 / 7Z74)	SR630 V2 (7Z70 / 7Z71)	SR650 V2 (7Z72 / 7Z73)	SR670 V2 (7Z22 / 7Z23)
2.5-inch hot-swap drives																					
4XB7A17158	ThinkSystem 2.5" U.2 P5800X 400GB Write Intensive NVMe PCIe 4.0 x4 HS SSD	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	Y	Y	Y
4XB7A17159	ThinkSystem 2.5" U.2 P5800X 800GB Write Intensive NVMe PCIe 4.0 x4 HS SSD	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	Y	Y	Y
4XB7A17160	ThinkSystem 2.5" U.2 P5800X 1.6TB Write Intensive NVMe PCIe 4.0 x4 HS SSD	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	Y	Y	Y
3.5-inch hot-swap drives																					
4XB7A17161	ThinkSystem 3.5" U.2 P5800X 400GB Write Intensive NVMe PCIe 4.0 x4 HS SSD	N	N	N	N	N	Y	Y	N	Y	Y	N	N	N	N	N	N	N	Y	Y	N
4XB7A17162	ThinkSystem 3.5" U.2 P5800X 800GB Write Intensive NVMe PCIe 4.0 x4 HS SSD	N	N	N	N	N	Y	Y	N	Y	Y	N	N	N	N	N	N	N	Y	Y	N
4XB7A77070	ThinkSystem 3.5" U.2 P5800X 1.6TB Write Intensive NVMe PCIe 4.0 x4 HS SSD	N	N	N	N	N	Y	Y	N	Y	Y	N	N	N	N	N	N	N	Y	Y	N

Table 4. Server support (Part 2 of 3)

Part Number	Description	AMD V1					4S/8S V2			4S V1			Dense V2				1S Intel V1			
		SR635 (7Y98 / 7Y99)	SR655 (7Y00 / 7Z01)	SR655 Client OS	SR645 (7D2Y / 7D2X)	SR665 (7D2W / 7D2V)	SR850 V2 (7D31 / 7D32)	SR860 V2 (7Z59 / 7Z60)	SR950 (7X11 / 7X12)	SR850 (7X18 / 7X19)	SR850P (7D2F / 2D2G)	SR860 (7X69 / 7X70)	SD630 V2 (7D1K)	SD650 V2 (7D1M)	SD650-N V2 (7D1N)	SN550 V2 (7Z69)	ST50 (7Y48 / 7Y50)	ST250 (7Y45 / 7Y46)	SR150 (7Y54)	SR250 (7Y52 / 7Y51)
2.5-inch hot-swap drives																				
4XB7A17158	ThinkSystem 2.5" U.2 P5800X 400GB Write Intensive NVMe PCIe 4.0 x4 HS SSD	N	N	N	Y	Y	Y	N	N	Y	Y	Y	N	N	N	N	N	N	N	N
4XB7A17159	ThinkSystem 2.5" U.2 P5800X 800GB Write Intensive NVMe PCIe 4.0 x4 HS SSD	N	N	N	Y	Y	Y	N	N	Y	Y	Y	N	N	N	N	N	N	N	N
4XB7A17160	ThinkSystem 2.5" U.2 P5800X 1.6TB Write Intensive NVMe PCIe 4.0 x4 HS SSD	N	N	N	Y	Y	Y	N	N	Y	Y	Y	N	N	N	N	N	N	N	N
3.5-inch hot-swap drives																				
4XB7A17161	ThinkSystem 3.5" U.2 P5800X 400GB Write Intensive NVMe PCIe 4.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A17162	ThinkSystem 3.5" U.2 P5800X 800GB Write Intensive NVMe PCIe 4.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A77070	ThinkSystem 3.5" U.2 P5800X 1.6TB Write Intensive NVMe PCIe 4.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Table 5. Server support (Part 3 of 3)

Part Number	Description	2S Intel V1								Dense V1			
		ST550 (7X09 / 7X10)	SR530 (7X07 / 7X08)	SR550 (7X03 / 7X04)	SR570 (7Y02 / 7Y03)	SR590 (7X98 / 7X99)	SR630 (7X01 / 7X02)	SR650 (7X05 / 7X06)	SR670 (7Y36 / 7Y37)	SD530 (7X21)	SD650 (7X58)	SN550 (7X16)	SN850 (7X15)
2.5-inch hot-swap drives													
4XB7A17158	ThinkSystem 2.5" U.2 P5800X 400GB Write Intensive NVMe PCIe 4.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A17159	ThinkSystem 2.5" U.2 P5800X 800GB Write Intensive NVMe PCIe 4.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A17160	ThinkSystem 2.5" U.2 P5800X 1.6TB Write Intensive NVMe PCIe 4.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N
3.5-inch hot-swap drives													
4XB7A17161	ThinkSystem 3.5" U.2 P5800X 400GB Write Intensive NVMe PCIe 4.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A17162	ThinkSystem 3.5" U.2 P5800X 800GB Write Intensive NVMe PCIe 4.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A77070	ThinkSystem 3.5" U.2 P5800X 1.6TB Write Intensive NVMe PCIe 4.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N

Operating system support

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

Tip: These tables are automatically generated based on data from Lenovo ServerProven.

Table 6. Operating system support for ThinkSystem 2.5" U.2 P5800X 800GB Write Intensive NVMe PCIe 4.0 x4 HS SSD, 4XB7A17159

Operating systems	SD630 V2	SN550 V2	SR630 V2	SR650 V2	SR670 V2	SR850 V2	SR860 V2	ST650 V2	SR645	SR665
Microsoft Windows Server 2016	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Microsoft Windows Server 2019	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Microsoft Windows Server 2022	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 7.6	N	N	N	N	N	N	N	N	Y [3]	Y [3]
Red Hat Enterprise Linux 7.7	N	N	N	N	N	N	N	N	Y [3]	Y [3]
Red Hat Enterprise Linux 7.8	N	N	N	N	N	N	N	N	Y [3]	Y [3]
Red Hat Enterprise Linux 7.9	Y	Y	Y	Y	Y	Y	Y	Y	Y [3]	Y [3]
Red Hat Enterprise Linux 8.1	N	N	N	N	N	N	N	N	Y [3]	Y [3]
Red Hat Enterprise Linux 8.2	Y	Y	Y	Y	Y	Y	Y	Y	Y [3]	Y [3]
Red Hat Enterprise Linux 8.3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 8.4	Y	Y [1]	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 8.5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 8.6	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 8.7	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 9.0	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 9.1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 12 SP5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 15 SP1	N	N	N	N	N	N	N	N	Y [3]	Y [3]
SUSE Linux Enterprise Server 15 SP2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 15 SP3	Y	Y [2]	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 15 SP4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ubuntu 18.04.5 LTS	Y	Y	Y	Y	Y	N	N	Y	N	N
Ubuntu 20.04 LTS	N	N	N	Y	N	N	N	N	N	N
Ubuntu 22.04 LTS	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 6.7 U3	Y	Y	Y	Y	Y	N	N	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 7.0	N	N	N	N	N	N	N	N	Y [3]	Y [3]
VMware vSphere Hypervisor (ESXi) 7.0 U1	N	N	N	N	N	Y	Y	N	Y	Y
VMware vSphere Hypervisor (ESXi) 7.0 U2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 7.0 U3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 8.0	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

[1] Bug 231715 - [PA_Anarky_SIT_IEC_Storage] Intel SSD P5800X slot number is wrong under UEFI Intel VROC controller page

[2] Bug 239532 - [PA_AU_RMK-4876_IEC_Storage_Vulcan] Intel SSD P5800X FW(OSS:123106) can’t comparing update ; Bug 231715 - [PA_Anarky_SIT_IEC_Storage] Intel SSD P5800X slot number is wrong under UEFI Intel VROC controller page by onecli under sles15.3.

[3] The OS is not supported with EPYC 7003 processors.

Warranty

The ThinkSystem U.2 P5800X Write Intensive NVMe PCIe 4.0 x4 SSD carries 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 P5800X drives 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 P5800X drives 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 P5800X drives conform to the following regulations:

- CE Compliance
- Low Voltage Directive 2014/35/EU
- EMC Directive 2014/30/EU
- RoHS Directive 2011/65/EU
- EU WEEE Directive 2012/19/EU
- UL 60950-1, 2nd Edition, 2014-10-14
- CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-010
- UL/CSA 62368-1, 2nd Edition
- Australia/New Zealand Standards AS/NZ CISPR 32:2015
- Taiwan EMC standard CNS 13438
- CISPR 22: 2005.04
- Taiwan CNS 15663
- Korea KCC Compliance with Article 11.1
- Morocco Maghreb Compliant with Decree # 2574-14 (EMC)
- Canada CAN ICES-3 (A)/ NMB-3(A)
- Japan VCCI
- China EFUP Compliance with GB/T 26572

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
- P5800X drive specifications
  https://www.intel.com/content/www/us/en/products/details/memory-storage/data-center-ssds/optane-dc-ssd-series.html

Related product families

Product families related to this document are the following:

- Drives

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