Lenovo PX04PMB NVMe Performance PCIe SSDs

Product Guide (withdrawn product)

The Lenovo PX04PMB NVMe Performance PCIe solid-state drives (SSDs) are advanced data center SSDs optimized for write-intensive performance, endurance, and strong data protection for Lenovo servers. They are engineered for greater performance and endurance in a cost-effective design, and to support a broader set of workloads.

Figure 1. Lenovo PX04PMB NVMe Performance PCIe 2.5-inch 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. The use of NVMe drives means data is transferred more efficiently from the processor to the drives 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.

Lenovo Enterprise Performance SSDs are suitable for write-intensive data center workloads, and their NVMe PCIe interface means the drives also offer high performance. Overall, these SSDs provide outstanding IOPS/watt and cost/IOPS for enterprise solutions.

Part number information

The following table lists the ordering information.

Withdrawn from marketing: All SSDs described in this product guide are now withdrawn from marketing.

Table 1. Part numbers and feature codes for ThinkSystem

Part number	Feature code	Description
7XB7A05923	AWG6	ThinkSystem U.2 PX04PMB 800GB Performance NVMe PCIe 3.0 x4 Hot Swap SSD
7XB7A05922	AWG7	ThinkSystem U.2 PX04PMB 1.6TB Performance NVMe PCIe 3.0 x4 Hot Swap SSD

The part numbers include the following items:

- One 2.5-inch solid-state drive
- Documentation flyer
- Support flyer for SSDs

Features

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 contemporary NAND flash memory. Each NVMe PCI SSD has direct PCIe 3.0 x4 connection, which provides at least 2x more bandwidth and 2x less 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 Lenovo PX04PMB NVMe Performance PCIe SSD have the following features:

- 2.5-inch drive bay (U.2) form factor
- Based on the Toshiba PX04P drives, PX04PMBxxx
- 19nm MLC NAND (128 Gb/die)
- 10 drive-write-per-day (DWPD) SSD for write-intensive workloads
- Direct PCIe 3.0 x4 connection for each NVMe drive, resulting in up to 4 GBps overall throughput.
- Full Power-Loss-Protection and End-to-End Data Protection
- Low power consumption (maximum 18.5 W)

Enterprise Mainstream SSDs and Enterprise Performance SSDs have similar read and write IOPS performance, but the key difference between them is their endurance (or lifetime) (that is, how long they can perform write operations because SSDs have a finite number of program/erase (P/E) cycles). Enterprise Performance SSDs have higher endurance compared to Enterprise Mainstream SSDs. SSD write endurance is typically measured by the number of program/erase (P/E) cycles that the drive incurs over its lifetime, listed as the total bytes of written data (TBW) in the device specification.

The TBW value assigned to a solid-state device is the total bytes of written data (based on the number of P/E cycles) that a drive can be guaranteed to complete (% of remaining P/E cycles = % of remaining TBW). Reaching this limit does not cause the drive to immediately fail. It simply denotes the maximum number of writes that can be guaranteed. A solid-state device will not fail upon reaching the specified TBW. At some point based on manufacturing variance margin, after surpassing the TBW value, the drive will reach the end-of-life point, at which the drive will go into a read-only mode.

Even though Enterprise Performance SSDs have high endurance, careful planning must still be done to ensure that the total amount of data expected to be written to the drive over its life will not exceed the stated total bytes written (TBW) property of the drive.

For example, the 1.6TB drive has an endurance of 29,200 TB of total bytes written (TBW). This means that for full operation over five years, write workload must be limited to no more than 16TB GB of writes per day, which is equivalent to 10.0 full drive writes per day (DWPD). For the device to last three years, the drive write workload must be limited to no more than 26,667 GB of writes per day, which is equivalent to 16.7 full drive writes per day.

Technical specifications

The following table presents technical specifications for the Lenovo PX04PMB NVMe Performance PCIe SSDs.

Table 2. Technical specifications

Feature	**800 GB drive**	**1.6 TB drive***
Host interface	PCIe 3.0 x4	PCIe 3.0 x4
Capacity	800 GB	1.6 TB
Endurance (total bytes written)	14,600 TB	29,200 TB
Endurance (drive writes per day for 5 years)	10.0 DWPD	10.0 DWPD
Data reliability (UBER)	< 1 in 10^{17} bits read	< 1 in 10^{17} bits read
MTBF	2,000,000 hours	2,000,000 hours
IOPS reads (4 KB blocks)	660,000	660,000
IOPS writes (4 KB blocks)	185,000	185,000
Sequential read rate (128 KB blocks)	3100 MBps	3100 MBps
Sequential write rate (128 KB blocks)	2350 MBps	2350 MBps
Latency (random read)	100 µs	100 µs
Latency (random write)	30 µs	30 µs
Maximum power	18.5 W	18.5 W

* The 1.6 TB drive is withdrawn from marketing

Server support

The following table lists the ThinkSystem servers that are compatible.

Table 3. ThinkSystem server support

Part number	Description	1S Rack & Tower				2S Rack & Tower								4S Rack			Dense/ Blade			
		ST50 (7Y48/7Y50)	ST250 (7Y45/7Y46)	SR150 (7Y54)	SR250 (7Y51/7Y52)	ST550 (7X09/7X10)	SR530 (7X07/7X08)	SR550 (7X03/7X04)	SR570 (7Y02/7Y03)	SR590 (7X98/7X99)	SR630 (7X01/7X02)	SR650 (7X05/7X06)	SR670 (7Y36/7Y37/7Y38)	SR850 (7X18/7X19)	SR860 (7X69/7X70)	SR950 (7X11/12/13)	SD530 (7X21)	SD650 (7X58)	SN550 (7X16)	SN850 (7X15)
7XB7A05923	ThinkSystem U.2 PX04PMB 800GB Performance NVMe PCIe 3.0 x4 Hot Swap SSD	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	N	Y	Y
7XB7A05922	ThinkSystem U.2 PX04PMB 1.6TB Performance NVMe PCIe 3.0 x4 Hot Swap SSD	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	N	Y	Y

Storage controller support

NVMe PCIe SSDs require a NVMe drive backplane and some form of PCIe connection to processors. PCIe connections can take the form of either an adapter (PCIe Interposer or PCIe extender/switch adapter) or simply a cable that connects to an onboard NVMe connector.

Consult the relevant server product guide for details about required components for NVMe drive support.

Operating system support

The following table lists the supported operating systems:

Tip: This table is automatically generated based on data from Lenovo ServerProven.

Table 4. Operating system support for ThinkSystem U.2 PX04PMB 800GB Performance NVMe PCIe 3.0 x4 Hot Swap SSD, 7XB7A05923

Operating systems	SD530 (Xeon Gen 2)	SN550 (Xeon Gen 2)	SN850 (Xeon Gen 2)	SR630 (Xeon Gen 2)	SR650 (Xeon Gen 2)	SR850 (Xeon Gen 2)	SR860 (Xeon Gen 2)	SR950 (Xeon Gen 2)	SD530 (Xeon Gen 1)	SN550 (Xeon Gen 1)	SN850 (Xeon Gen 1)	SR630 (Xeon Gen 1)	SR650 (Xeon Gen 1)	SR850 (Xeon Gen 1)	SR860 (Xeon Gen 1)	SR950 (Xeon Gen 1)
Microsoft Windows Server 2012 R2	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Microsoft Windows Server 2016	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Microsoft Windows Server 2019	N	N	N	Y	Y	Y	Y	Y	N	N	N	Y	N	N	N	Y
Microsoft Windows Server 2022	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Operating systems	SD530 (Xeon Gen 2)	SN550 (Xeon Gen 2)	SN850 (Xeon Gen 2)	SR630 (Xeon Gen 2)	SR650 (Xeon Gen 2)	SR850 (Xeon Gen 2)	SR860 (Xeon Gen 2)	SR950 (Xeon Gen 2)	SD530 (Xeon Gen 1)	SN550 (Xeon Gen 1)	SN850 (Xeon Gen 1)	SR630 (Xeon Gen 1)	SR650 (Xeon Gen 1)	SR850 (Xeon Gen 1)	SR860 (Xeon Gen 1)	SR950 (Xeon Gen 1)
Microsoft Windows Server version 1709	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	Y	Y	N	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 6.10	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	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 7.3	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	N	Y
Red Hat Enterprise Linux 7.4	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	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
Red Hat Enterprise Linux 7.7	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
Red Hat Enterprise Linux 7.9	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
Red Hat Enterprise Linux 8.1	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
Red Hat Enterprise Linux 8.3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 8.4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 8.5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 9.0	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N
SUSE Linux Enterprise Server 11 SP4	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 12 SP2	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	N	Y
SUSE Linux Enterprise Server 12 SP2 with Xen	N	N	N	N	N	N	N	N	Y	N	Y	Y	Y	Y	N	Y
SUSE Linux Enterprise Server 12 SP3	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 12 SP3 with Xen	N	N	N	N	N	N	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
SUSE Linux Enterprise Server 12 SP4 with Xen	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	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 12 SP5 with Xen	Y	Y	Y	Y	Y	Y	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
SUSE Linux Enterprise Server 15 SP1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 15 SP1 with Xen	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
SUSE Linux Enterprise Server 15 SP2 with Xen	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 15 SP3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 15 SP3 with Xen	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 15 SP4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 15 SP4 with Xen	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Operating systems	SD530 (Xeon Gen 2)	SN550 (Xeon Gen 2)	SN850 (Xeon Gen 2)	SR630 (Xeon Gen 2)	SR650 (Xeon Gen 2)	SR850 (Xeon Gen 2)	SR860 (Xeon Gen 2)	SR950 (Xeon Gen 2)	SD530 (Xeon Gen 1)	SN550 (Xeon Gen 1)	SN850 (Xeon Gen 1)	SR630 (Xeon Gen 1)	SR650 (Xeon Gen 1)	SR850 (Xeon Gen 1)	SR860 (Xeon Gen 1)	SR950 (Xeon Gen 1)
SUSE Linux Enterprise Server 15 with Xen	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ubuntu 22.04 LTS	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	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 6.5	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	N	Y
VMware vSphere Hypervisor (ESXi) 6.5 U1	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
VMware vSphere Hypervisor (ESXi) 6.7	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
VMware vSphere Hypervisor (ESXi) 6.7 U2	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
VMware vSphere Hypervisor (ESXi) 7.0 U1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 7.0 U2	Y	Y	Y	Y	Y	Y	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	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 8.0	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Warranty

The Lenovo PX04PMB NVMe Performance PCIe SSDs carry a one-year, customer-replaceable unit (CRU) limited warranty. When the SSDs are installed in a supported server, these drives assume the system's base warranty and any warranty upgrades.

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 Lenovo PX04PMB NVMe Performance PCIe SSDs have the following physical specifications:

Dimensions and weight (approximate, without the drive tray):

- Height: 15 mm (0.6 in.)
- Width: 70 mm (2.8 in.)
- Depth: 100 mm (4.0 in.)
- Weight: 150 g (5.3 oz)

Shipping dimensions and weight for the 2.5-inch drives (approximate):

- Height: 63 mm (2.5 in.)
- Width: 133 mm (5.2 in.)
- Depth: 174 mm (6.9 in.)
- Weight (with drive tray): 500 g (1.0 lb)

Operating environment

The Lenovo PX04PMB NVMe Performance PCIe SSDs are supported in the following environment:

- Temperature:
  - Operating: 0 to 40 °C (32 to 104 °F)
  - Non-operating: -40 to 70 °C (-40 to 158 °F)
  - Transport: -40 to 70 °C (-40 to 158 °F)
- Relative humidity: 5 to 95% (non-condensing)
- Maximum altitude:
  - Operating: 5,486 m (18,000 ft)
  - Non-operating: 12,192 m (40,000 ft)
- Shock: 1,000 G (Max) at 0.5 ms
- Vibration: 2.17 G_{RMS} (5-800 Hz)

Agency approvals

The Lenovo PX04PMB NVMe Performance PCIe SSDs conform to the following regulations:

- Underwriters Laboratories: UL60950-1
- Canada: CAN/CSA-C22.2 No.60950-1
- TUV: EN 60950-1
- BSMI (Taiwan): CNS 13438 (CISPR Pub. 22 Class B): D33003
- MSIP: KN22, KN24 (CISPR Pub. 22 Class B)
- Australia/New Zealand: AS/NZS CISPR22
- EMC: EN55022 (2010) Class B
- EMC: EN55024 (2010)
- RoHS 2011/65/EU: EN50581 (2012) Category 3

Related publications and links

For more information, see the following documents:

- Lenovo ThinkSystem storage options product web page
  https://lenovopress.com/lp0761-storage-options-for-thinksystem-servers
- Implementing NVMe Drives on Lenovo Servers
  https://lenovopress.com/lp0508-implementing-nvme-drives-on-lenovo-servers
- Toshiba product page for PC04PMBxxx 2.5-inch NVMe PCIe SSDs
  https://toshiba.semicon-storage.com/us/product/storage-products/enterprise-ssd/px04pmbxxx.html
- ThinkServer Option Compatibility Matrix (OCM)
  http://www.lenovo.com/accessoriesguide

Related product families

Product families related to this document are the following:

- Drives

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This document, LP0694, was created or updated on October 9, 2019.

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