ThinkSystem PM9D3a Read Intensive NVMe PCIe 5.0 x4 SSDs

Product Guide

The ThinkSystem PM9D3a Read Intensive NVMe PCIe 5.0 x4 SSDs, available in capacities up to 15.36TB, are general-purpose yet high-performance NVMe PCIe Gen 5 SSDs. They are engineered for greater performance and endurance in a cost-effective design, and to support a broader set of workloads. Now with SED encryption as standard, these drives help ensure data security, even when the drive is removed from the server.

The PM9D3a SSDs are available in E3.S 1T EDSFF and 2.5-inch form factors.

SED support: All drives listed in this product guide include SED drive encryption. Our naming convention for new drives doesn't include SED in the name.

Figure 1. ThinkSystem PM9D3a Read Intensive NVMe PCIe 5.0 x4 SSDs

Did you know?

The PM9D3a SSDs are part of the new family of PCIe 5.0 SSDs that match the performance of the ThinkSystem V3 and V4 families of servers. By having a Gen 5 host interface, sequential performance is doubled compared to Gen 4 SSDs. The NVMe host interface also maximizes flash storage performance and minimizes latency.

Lenovo Read Intensive SSDs like the PM9D3a SSDs are suitable for read-intensive and general-purpose data center workloads, however 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 part numbers and feature codes for ThinkSystem servers.

Table 1. Ordering information

Part number	Feature	Description	Vendor part number
2.5-inch hot-swap drives			
4XB7A93066	C0GK	ThinkSystem 2.5" U.2 PM9D3a 960GB Read Intensive NVMe PCIe 5.0 x4 HS SSD	MZWL6960HFJA-00AW7
4XB7A93067	C0GL	ThinkSystem 2.5" U.2 PM9D3a 1.92TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	MZWL61T9HFLT-00AW7
4XB7A93068	C0GN	ThinkSystem 2.5" U.2 PM9D3a 3.84TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	MZWL63T8HFLT-00AW7
4XB7A93069	C0GP	ThinkSystem 2.5" U.2 PM9D3a 7.68TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	MZWL67T6HBLC-00AW7
4XB7A93095	C1WL	ThinkSystem 2.5" U.2 PM9D3a 15.36TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	MZWL615THBLF-00AW7
E3.S 1T hot-swap drives			
4XB7A93078	C1AF	ThinkSystem E3.S PM9D3a 1.92TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	MZ3L61T9HFLT-00AW7
4XB7A93079	C1AE	ThinkSystem E3.S PM9D3a 3.84TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	MZ3L63T8HFLT-00AW7
4XB7A93080	C1AB	ThinkSystem E3.S PM9D3a 7.68TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	MZ3L67T6HBLC-00AW7
4XB7A93081	C1WU	ThinkSystem E3.S PM9D3a 15.36TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	MZ3L615THBLF-00AW7

The part numbers include the following items:

- One solid-state drive
- Attached hot-swap tray (for hot-swap drives)
- Documentation flyer

Features

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 of the PM9D3a SSDs have direct PCIe 5.0 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.

The ThinkSystem PM9D3a Read Intensive NVMe PCIe 5.0 x4 SSDs have the following features:

- Available in two form factors:
  - 2.5-inch drive in a hot-swap tray
  - E3.S 1T EDSFF drive in a hot-swap tray
- Direct PCIe 5.0 x4 connection for each NVMe drive, resulting in up to 14 GBps overall throughput, compared to 7.5 GBps for a PCIe 4.0 connection.
- Based on Samsung TLC flash technology

- Advanced ECC Engine and End-to-End Data Protection
- Samsung’s SSD virtualization technology allows a single SSD to be subdivided into smaller SSDs, up to 64, providing independent virtual workspaces. It also enables SSDs to take on certain tasks typically carried out by the server CPUs, such as Single-Root I/O Virtualization (SR-IOV), requiring fewer server CPUs and SSDs.
- V-NAND Machine Learning enables the SSD to accurately predict and verify cell characteristics, as well as detect any variations in circuit patterns.
- Fail-In-Place technology ensures the SSD operates normally even when errors occur at the chip level. It allows the SSD to identify failing NAND cells, and actually recover then relocate the data without interrupting normal operations or impacting performance.
- Protect data integrity from unexpected power loss with Samsung's advanced power-loss protection architecture
- Supports Self-Monitoring, Analysis and Reporting Technology (S.M.A.R.T).
- Supports the following specifications:
    - PCI Express Base Specification Rev. 5.0
    - NVM Express Specification Rev. 2.0
    - NVM Express Management Interface Specification Rev. 1.2

SSDs have a huge but finite number of program/erase (P/E) cycles, which affect how long they can perform write operations and thus their life expectancy. Mixed Use SSDs have a higher write endurance compared to Read Intensive 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 total bytes written (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. However, 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 PM9D3a 3.84 TB drive has an endurance of 7,008 TB of total bytes written (TBW). This means that for full operation over five years, write workload must be limited to no more than 3,840 GB of writes per day, which is equivalent to 1.0 full drive writes per day (DWPD). For the device to last three years, the drive write workload must be limited to no more than 6,400 GB of writes per day, which is equivalent to 1.7 full drive writes per day.

The benefits of drive encryption

All ThinkSystem PM9D3a Read Intensive NVMe PCIe 5.0 x4 SSDs support drive encryption.

Self-encrypting drives (SEDs) provide benefits in three main ways:

- By encrypting data on-the-fly at the drive level with no performance impact
- By providing instant secure erasure (cryptographic erasure, thereby making the data no longer readable)
- By enabling auto-locking to secure active data if a drive is misplaced or stolen from a system while in use

The following sections describe the benefits in more details.

Automatic encryption

It is vital that a company keep its data secure. With the threat of data loss due to physical theft or improper inventory practices, it is important that the data be encrypted. However, challenges with performance, scalability, and complexity have led IT departments to push back against security policies that require the use of encryption. In addition, encryption has been viewed as risky by those unfamiliar with key management, a process for ensuring a company can always decrypt its own data. Self-encrypting drives comprehensively resolve these issues, making encryption both easy and affordable.

When the self-encrypting drive is in normal use, its owner need not maintain authentication keys (otherwise known as credentials or passwords) in order to access the data on the drive. The self-encrypting drive will encrypt data being written to the drive and decrypt data being read from it, all without requiring an authentication key from the owner.

Drive retirement and disposal

When hard drives are retired and moved outside the physically protected data center into the hands of others, the data on those drives is put at significant risk. IT departments retire drives for a variety of reasons, including:

- Returning drives for warranty, repair, or expired lease agreements
- Removal and disposal of drives
- Repurposing drives for other storage duties

Nearly all drives eventually leave the data center and their owner's control. Corporate data resides on such drives, and when most leave the data center, the data they contain is still readable. Even data that has been striped across many drives in a RAID array is vulnerable to data theft because just a typical single stripe in today’s high-capacity arrays is large enough to expose for example, hundreds of names and bank account numbers.

In an effort to avoid data breaches and the ensuing customer notifications required by data privacy laws, companies use different methods to erase the data on retired drives before they leave the premises and potentially fall into the wrong hands. Current retirement practices that are designed to make data unreadable rely on significant human involvement in the process, and are thus subject to both technical and human failure.

The drawbacks of today’s drive retirement practices include the following:

- Overwriting drive data is expensive, tying up valuable system resources for days. No notification of completion is generated by the drive, and overwriting won’t cover reallocated sectors, leaving that data exposed.
- Methods that include degaussing or physically shredding a drive are expensive. It is difficult to ensure the degauss strength is optimized for the drive type, potentially leaving readable data on the drive. Physically shredding the drive is environmentally hazardous, and neither practice allows the drive to be returned for warranty or expired lease.
- Some companies have concluded the only way to securely retire drives is to keep them in their control, storing them indefinitely in warehouses. But this is not truly secure because a large volume of drives coupled with human involvement inevitably leads to some drives being lost or stolen.
- Professional disposal services is an expensive option and includes the cost of reconciling the services as well as internal reports and auditing. Transporting of the drives also has the potential of putting the data at risk.

Self-encrypting drives eliminate the need to overwrite, destroy, or store retired drives. When the drive is to be retired, it can be cryptographically erased, a process that is nearly instantaneous regardless of the capacity of the drive.

Instant secure erase

The self-encrypting drive provides instant data encryption key destruction via cryptographic erasure. When it is time to retire or repurpose the drive, the owner sends a command to the drive to perform a cryptographic erasure. Cryptographic erasure simply replaces the encryption key inside the encrypted drive, making it impossible to ever decrypt the data encrypted with the deleted key.

Self-encrypting drives reduce IT operating expenses by reducing asset control challenges and disposal costs. Data security with self-encrypting drives helps ensure compliance with privacy regulations without hindering IT efficiency. So called "Safe Harbor" clauses in government regulations allow companies to not have to notify customers of occurrences of data theft if that data was encrypted and therefore unreadable.

Furthermore, self-encrypting drives simplify decommissioning and preserve hardware value for returns and repurposing by:

- Eliminating the need to overwrite or destroy the drive
- Securing warranty returns and expired lease returns
- Enabling drives to be repurposed securely

Auto-locking

Insider theft or misplacement is a growing concern for businesses of all sizes; in addition, managers of branch offices and small businesses without strong physical security face greater vulnerability to external theft. Self-encrypting drives include a feature called auto-lock mode to help secure active data against theft.

Using a self-encrypting drive when auto-lock mode is enabled simply requires securing the drive with an authentication key. When secured in this manner, the drive's data encryption key is locked whenever the drive is powered down. In other words, the moment the self-encrypting drive is switched off or unplugged, it automatically locks down the drive's data.

When the self-encrypting drive is then powered back on, it requires authentication before being able to unlock its encryption key and read any data on the drive, thus protecting against misplacement and theft.

While using self-encrypting drives just for the instant secure erase is an extremely efficient and effective means to help securely retire a drive, using self-encrypting drives in auto-lock mode provides even more advantages. From the moment the drive or system is removed from the data center (with or without authorization), the drive is locked. No advance thought or action is required from the data center administrator to protect the data. This helps prevent a breach should the drive be mishandled and helps secure the data against the threat of insider or outside theft.

Technical specifications

The following tables present the technical specifications for the PM9D3a SSDs.

E3.S 1T drives

Table 2. Technical specifications

Feature	**1.92 TB drive**	**3.84 TB drive**	**7.68 TB drive**	**15.36 TB drive**
Interface	PCIe 5.0 x4	PCIe 5.0 x4	PCIe 5.0 x4	PCIe 5.0 x4
Capacity	1.92 TB	3.84 TB	7.68 TB	15.36 TB
SED encryption	TCG Opal 2.02	TCG Opal 2.02	TCG Opal 2.02	TCG Opal 2.02
Endurance (drive writes per day for 5 years)	1 DWPD	1 DWPD	1 DWPD	1 DWPD
Endurance (total bytes written)	3,504 TB	7,008 TB	14,016 TB	28,032 TB
Data reliability (UBER)	< 1 in 10^{17} bits read	< 1 in 10^{17} bits read	< 1 in 10^{17} bits read	< 1 in 10^{17} bits read
MTBF	2,500,000 hours	2,500,000 hours	2,500,000 hours	2,500,000 hours
Performance & Power - PCIe 5.0 host interface				
IOPS reads (4 KB blocks)	1,700,000	1,700,000	2,000,000	2,000,000
IOPS writes (4 KB blocks)	150,000	250,000	300,000	350,000
Sequential read rate (128 KB blocks)	12,000 MBps	12,000 MBps	12,000 MBps	12,000 MBps
Sequential write rate (128 KB blocks)	3500 MBps	6800 MBps	6800 MBps	6800 MBps
Latency (random R/W)	65 µs / 9 µs	65 µs / 9 µs	65 µs / 9 µs	65 µs / 9 µs
Latency (sequential R/W)	9 µs / 9 µs	9 µs / 9 µs	9 µs / 9 µs	9 µs / 9 µs
Typical power (R/W)	11.0 W / 10.8 W	12.5 W / 15.3 W	14.0 W / 16.0 W	14.7 W / 16.0 W
Performance & Power - PCIe 4.0 host interface				
IOPS reads (4 KB blocks)	1,700,000	1,700,000	1,700,000	1,700,000
IOPS writes (4 KB blocks)	150,000	250,000	300,000	350,000
Sequential read rate (128 KB blocks)	7000 MBps	7000 MBps	7000 MBps	7000 MBps
Sequential write rate (128 KB blocks)	3500 MBps	6200 MBps	6200 MBps	6200 MBps
Latency (random R/W)	65 µs / 9 µs	65 µs / 9 µs	65 µs / 9 µs	65 µs / 9 µs
Latency (sequential R/W)	9 µs / 9 µs	9 µs / 9 µs	9 µs / 9 µs	9 µs / 9 µs
Typical power (R/W)	9.8 W / 10.2 W	10.4 W / 14.1 W	11.5 W / 14.8 W	12.3 W / 14.8 W

2.5-inch drives

Table 3. Technical specifications

Feature	960 GB drive	1.92 TB drive	3.84 TB drive	7.68 TB drive	15.36 TB drive
Interface	PCIe 5.0 x4	PCIe 5.0 x4	PCIe 5.0 x4	PCIe 5.0 x4	PCIe 5.0 x4
Capacity	960 GB	1.92 TB	3.84 TB	7.68 TB	15.36 TB
SED encryption	TCG Opal 2.02	TCG Opal 2.02	TCG Opal 2.02	TCG Opal 2.02	TCG Opal 2.02
Endurance (drive writes per day for 5 years)	1 DWPD	1 DWPD	1 DWPD	1 DWPD	1 DWPD
Endurance (total bytes written)	1,752 TB	3,504 TB	7,008 TB	14,016 TB	28,032 TB
Data reliability (UBER)	< 1 in 10^{17} bits read	< 1 in 10^{17} bits read	< 1 in 10^{17} bits read	< 1 in 10^{17} bits read	< 1 in 10^{17} bits read
MTBF	2,500,000 hours	2,500,000 hours	2,500,000 hours	2,500,000 hours	2,500,000 hours
Performance & Power - PCIe 5.0 host interface					
IOPS reads (4 KB blocks)	1,000,000	1,700,000	2,000,000	2,000,000	2,000,000
IOPS writes (4 KB blocks)	70,000	150,000	250,000	300,000	350,000
Sequential read rate (128 KB blocks)	12,000 MBps	12,000 MBps	12,000 MBps	12,000 MBps	12,000 MBps
Sequential write rate (128 KB blocks)	1600 MBps	3500 MBps	6200 MBps	6200 MBps	6200 MBps
Latency (random R/W)	65 µs / 12 µs	65 µs / 9 µs	65 µs / 9 µs	65 µs / 9 µs	65 µs / 9 µs
Latency (sequential R/W)	9 µs / 9 µs	9 µs / 9 µs	9 µs / 9 µs	9 µs / 9 µs	9 µs / 9 µs
Typical power (R/W)	10.8 W / 7.8 W	11.0 W / 10.8 W	12.5 W / 15.3 W	14.0 W / 16.0 W	14.7 W / 16.0 W
Performance & Power - PCIe 4.0 host interface					
IOPS reads (4 KB blocks)	1,000,000	1,700,000	1,700,000	1,700,000	1,700,000
IOPS writes (4 KB blocks)	70,000	150,000	250,000	300,000	350,000
Sequential read rate (128 KB blocks)	7000 MBps	7000 MBps	7000 MBps	7000 MBps	7000 MBps
Sequential write rate (128 KB blocks)	1600 MBps	3500 MBps	6200 MBps	6200 MBps	6200 MBps
Latency (random R/W)	65 µs / 12 µs	65 µs / 9 µs	65 µs / 9 µs	65 µs / 9 µs	65 µs / 9 µs
Latency (sequential R/W)	9 µs / 9 µs	9 µs / 9 µs	9 µs / 9 µs	9 µs / 9 µs	9 µs / 9 µs
Typical power (R/W)	7.8 W / 7.2 W	9.8 W / 10.2 W	10.4 W / 14.1 W	11.5 W / 14.8 W	12.3 W / 14.8 W

Server support

The following tables list the ThinkSystem servers that are compatible.

Table 4. Server support (Part 1 of 4)

Part Number	Description	AMD V3				2S Intel V3/V4				4S 8S Intel V3			Multi Node V3/V4				GPU Rich				
		SR635 V3 (7D9H / 7D9G)	SR655 V3 (7D9F / 7D9E)	SR645 V3 (7D9D / 7D9C)	SR665 V3 (7D9B / 7D9A)	ST650 V3 (7D7B / 7D7A)	SR630 V3 (7D72 / 7D73)	SR650 V3 (7D75 / 7D76)	SR630 V4 (7DG8 / 7DG9)	SR850 V3 (7D97 / 7D96)	SR860 V3 (7D94 / 7D93)	SR950 V3 (7DC5 / 7DC4)	SD535 V3 (7DD8 / 7DD1)	SD530 V3 (7DDA / 7DD3)	SD550 V3 (7DD9 / 7DD2)	SD520 V4 (7DFZ / 7DFY)	SR670 V2 (7Z22 / 7Z23)	SR675 V3 (7D9Q / 7D9R)	SR680a V3 (7DHE)	SR685a V3 (7DHC)	SR780a V3 (7DJ5)
2.5-inch hot-swap drives																					
4XB7A93066	ThinkSystem 2.5" U.2 PM9D3a 960GB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N
4XB7A93067	ThinkSystem 2.5" U.2 PM9D3a 1.92TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N
4XB7A93068	ThinkSystem 2.5" U.2 PM9D3a 3.84TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N
4XB7A93069	ThinkSystem 2.5" U.2 PM9D3a 7.68TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N
4XB7A93095	ThinkSystem 2.5" U.2 PM9D3a 15.36TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N
E3.S 1T hot-swap drives																					
4XB7A93078	ThinkSystem E3.S PM9D3a 1.92TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N
4XB7A93079	ThinkSystem E3.S PM9D3a 3.84TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N
4XB7A93080	ThinkSystem E3.S PM9D3a 7.68TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N
4XB7A93081	ThinkSystem E3.S PM9D3a 15.36TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N

Table 5. Server support (Part 2 of 4)

Part Number	Description	1S V3			Edge					Super Computing					1S Intel V2			2S Intel V2		
		ST50 V3 (7DF4 / 7DF3)	ST250 V3 (7DCF / 7DCE)	SR250 V3 (7DCM / 7DCL)	SE350 (7Z46 / 7D1X)	SE350 V2 (7DA9)	SE360 V2 (7DAM)	SE450 (7D8T)	SE455 V3 (7DBY)	SD665 V3 (7D9P)	SD665-N V3 (7DAZ)	SD650 V3 (7D7M)	SD650-I V3 (7D7L)	SD650-N V3 (7D7N)	ST50 V2 (7D8K / 7D8J)	ST250 V2 (7D8G / 7D8F)	SR250 V2 (7D7R / 7D7Q)	ST650 V2 (7Z75 / 7Z74)	SR630 V2 (7Z70 / 7Z71)	SR650 V2 (7Z72 / 7Z73)
2.5-inch hot-swap drives																				
4XB7A93066	ThinkSystem 2.5" U.2 PM9D3a 960GB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A93067	ThinkSystem 2.5" U.2 PM9D3a 1.92TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A93068	ThinkSystem 2.5" U.2 PM9D3a 3.84TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A93069	ThinkSystem 2.5" U.2 PM9D3a 7.68TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A93095	ThinkSystem 2.5" U.2 PM9D3a 15.36TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
E3.S 1T hot-swap drives																				
4XB7A93078	ThinkSystem E3.S PM9D3a 1.92TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A93079	ThinkSystem E3.S PM9D3a 3.84TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A93080	ThinkSystem E3.S PM9D3a 7.68TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A93081	ThinkSystem E3.S PM9D3a 15.36TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Table 6. Server support (Part 3 of 4)

Part Number	Description	AMD V1					Dense V2				4S V2		8S	4S V1			1S Intel V1			
		SR635 (7Y98 / 7Y99)	SR655 (7Y00 / 7Z01)	SR655 Client OS	SR645 (7D2Y / 7D2X)	SR665 (7D2W / 7D2V)	SD630 V2 (7D1K)	SD650 V2 (7D1M)	SD650-N V2 (7D1N)	SN550 V2 (7Z69)	SR850 V2 (7D31 / 7D32)	SR860 V2 (7Z59 / 7Z60)	SR950 (7X11 / 7X12)	SR850 (7X18 / 7X19)	SR850P (7D2F / 2D2G)	SR860 (7X69 / 7X70)	ST50 (7Y48 / 7Y50)	ST250 (7Y45 / 7Y46)	SR150 (7Y54)	SR250 (7Y52 / 7Y51)
2.5-inch hot-swap drives																				
4XB7A93066	ThinkSystem 2.5" U.2 PM9D3a 960GB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A93067	ThinkSystem 2.5" U.2 PM9D3a 1.92TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A93068	ThinkSystem 2.5" U.2 PM9D3a 3.84TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A93069	ThinkSystem 2.5" U.2 PM9D3a 7.68TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A93095	ThinkSystem 2.5" U.2 PM9D3a 15.36TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
E3.S 1T hot-swap drives																				
4XB7A93078	ThinkSystem E3.S PM9D3a 1.92TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A93079	ThinkSystem E3.S PM9D3a 3.84TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A93080	ThinkSystem E3.S PM9D3a 7.68TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A93081	ThinkSystem E3.S PM9D3a 15.36TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Table 7. Server support (Part 4 of 4)

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													
4XB7A93066	ThinkSystem 2.5" U.2 PM9D3a 960GB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A93067	ThinkSystem 2.5" U.2 PM9D3a 1.92TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A93068	ThinkSystem 2.5" U.2 PM9D3a 3.84TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A93069	ThinkSystem 2.5" U.2 PM9D3a 7.68TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A93095	ThinkSystem 2.5" U.2 PM9D3a 15.36TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N
E3.S 1T hot-swap drives													
4XB7A93078	ThinkSystem E3.S PM9D3a 1.92TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A93079	ThinkSystem E3.S PM9D3a 3.84TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A93080	ThinkSystem E3.S PM9D3a 7.68TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A93081	ThinkSystem E3.S PM9D3a 15.36TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	N	N	N	N	N	N	N	N	N	N	N	N

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.

PCIe 4.0 & 3.0 support: The PM9D3a SSDs offer a PCIe 5.0 host interface, however they are backward compatible with a PCIe 4.0 or PCIe 3.0 host interface. Note however that servers or NVMe retimer/switch adapters with a PCIe 4.0 or 3.0 host interface will not see the same performance levels (especially sequential read and write rates).

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

Operating system support

Table 8. Operating system support for ThinkSystem E3.S PM9D3a 3.84TB Read Intensive NVMe PCIe 5.0 x4 HS SSD, 4XB7A93079

Operating systems	SD530 V3
Microsoft Windows Server 2022	Y
Red Hat Enterprise Linux 8.10	Y
Red Hat Enterprise Linux 8.8	Y
Red Hat Enterprise Linux 8.9	Y
Red Hat Enterprise Linux 9.2	Y
Red Hat Enterprise Linux 9.3	Y
Red Hat Enterprise Linux 9.4	Y
SUSE Linux Enterprise Server 15 SP5	Y
SUSE Linux Enterprise Server 15 SP5 with Xen	Y
SUSE Linux Enterprise Server 15 SP6	Y
Ubuntu 22.04.3 LTS	Y
VMware vSphere Hypervisor (ESXi) 7.0 U3	Y
VMware vSphere Hypervisor (ESXi) 8.0 U2	Y
VMware vSphere Hypervisor (ESXi) 8.0 U3	Y

IBM SKLM Key Management support

To effectively manage a large deployment of SEDs in Lenovo servers, IBM Security Key Lifecycle Manager (SKLM) offers a centralized key management solution. Certain Lenovo servers support Features on Demand (FoD) license upgrades that enable SKLM support.

The following table lists the part numbers and feature codes to enable SKLM support in the management processor of the server.

Table 9. FoD upgrades for SKLM support

Part number	Feature code	Description
Security Key Lifecycle Manager - FoD (United States, Canada, Asia Pacific, and Japan)		
00D9998	A5U1	SKLM for System x/ThinkSystem w/SEDs - FoD per Install w/1Yr S&S
00D9999	AS6C	SKLM for System x/ThinkSystem w/SEDs - FoD per Install w/3Yr S&S
Security Key Lifecycle Manager - FoD (Latin America, Europe, Middle East, and Africa)		
00FP648	A5U1	SKLM for System x/ThinkSystem w/SEDs - FoD per Install w/1Yr S&S
00FP649	AS6C	SKLM for System x/ThinkSystem w/SEDs - FoD per Install w/3Yr S&S

The IBM Security Key Lifecycle Manager software is available from Lenovo using the ordering information listed in the following table.

Table 10. IBM Security Key Lifecycle Manager licenses

Part number	Description
7S0A007FWW	IBM Security Key Lifecycle Manager Basic Edition Install License + SW Subscription & Support 12 Months
7S0A007HWW	IBM Security Key Lifecycle Manager For Raw Decimal Terabyte Storage Resource Value Unit License + SW Subscription & Support 12 Months
7S0A007KWW	IBM Security Key Lifecycle Manager For Raw Decimal Petabyte Storage Resource Value Unit License + SW Subscription & Support 12 Months
7S0A007MWW	IBM Security Key Lifecycle Manager For Usable Decimal Terabyte Storage Resource Value Unit License + SW Subscription & Support 12 Months
7S0A007PWW	IBM Security Key Lifecycle Manager For Usable Decimal Petabyte Storage Resource Value Unit License + SW Subscription & Support 12 Months

The following tables list the ThinkSystem servers that support the FoD license upgrade.

Table 11. IBM SKLM Key Management license upgrade support (Part 1 of 4)

		AMD V3				2S Intel V3/V4				4S 8S Intel V3			Multi Node V3/V4				GPU Rich				
Part Number	Description	SR635 V3 (7D9H / 7D9G)	SR655 V3 (7D9F / 7D9E)	SR645 V3 (7D9D / 7D9C)	SR665 V3 (7D9B / 7D9A)	ST650 V3 (7D7B / 7D7A)	SR630 V3 (7D72 / 7D73)	SR650 V3 (7D75 / 7D76)	SR630 V4 (7DG8 / 7DG9)	SR850 V3 (7D97 / 7D96)	SR860 V3 (7D94 / 7D93)	SR950 V3 (7DC5 / 7DC4)	SD535 V3 (7DD8 / 7DD1)	SD530 V3 (7DDA / 7DD3)	SD550 V3 (7DD9 / 7DD2)	SD520 V4 (7DFZ / 7DFY)	SR670 V2 (7Z22 / 7Z23)	SR675 V3 (7D9Q / 7D9R)	SR680a V3 (7DHE)	SR685a V3 (7DHC)	SR780a V3 (7DJ5)
A5U1	SKLM for System x w/SEDs - FoD per Install w/1Yr S&S	N	N	Y	N	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N
AS6C	SKLM for System x w/SEDs - FoD per Install w/3Yr S&S	N	N	Y	N	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N

Table 12. IBM SKLM Key Management license upgrade support (Part 2 of 4)

Part Number	Description	1S V3			Edge					Super Computing					1S Intel V2			2S Intel V2		
		ST50 V3 (7DF4 / 7DF3)	ST250 V3 (7DCF / 7DCE)	SR250 V3 (7DCM / 7DCL)	SE350 (7Z46 / 7D1X)	SE350 V2 (7DA9)	SE360 V2 (7DAM)	SE450 (7D8T)	SE455 V3 (7DBY)	SD665 V3 (7D9P)	SD665-N V3 (7DAZ)	SD650 V3 (7D7M)	SD650-I V3 (7D7L)	SD650-N V3 (7D7N)	ST50 V2 (7D8K / 7D8J)	ST250 V2 (7D8G / 7D8F)	SR250 V2 (7D7R / 7D7Q)	ST650 V2 (7Z75 / 7Z74)	SR630 V2 (7Z70 / 7Z71)	SR650 V2 (7Z72 / 7Z73)
A5U1	SKLM for System x w/SEDs - FoD per Install w/1Yr S&S	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	Y
AS6C	SKLM for System x w/SEDs - FoD per Install w/3Yr S&S	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	Y

Table 13. IBM SKLM Key Management license upgrade support (Part 3 of 4)

Part Number	Description	AMD V1					Dense V2				4S V2		8S	4S V1			1S Intel V1			
		SR635 (7Y98 / 7Y99)	SR655 (7Y00 / 7Z01)	SR655 Client OS	SR645 (7D2Y / 7D2X)	SR665 (7D2W / 7D2V)	SD630 V2 (7D1K)	SD650 V2 (7D1M)	SD650-N V2 (7D1N)	SN550 V2 (7Z69)	SR850 V2 (7D31 / 7D32)	SR860 V2 (7Z59 / 7Z60)	SR950 (7X11 / 7X12)	SR850 (7X18 / 7X19)	SR850P (7D2F / 2D2G)	SR860 (7X69 / 7X70)	ST50 (7Y48 / 7Y50)	ST250 (7Y45 / 7Y46)	SR150 (7Y54)	SR250 (7Y52 / 7Y51)
A5U1	SKLM for System x w/SEDs - FoD per Install w/1Yr S&S	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	N	N	N	N	N
AS6C	SKLM for System x w/SEDs - FoD per Install w/3Yr S&S	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	N	N	N	N	N

Table 14. IBM SKLM Key Management license upgrade support (Part 4 of 4)

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)
A5U1	SKLM for System x w/SEDs - FoD per Install w/1Yr S&S	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N
AS6C	SKLM for System x w/SEDs - FoD per Install w/3Yr S&S	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N

Warranty

The PM9D3a SSDs carry a one-year, customer-replaceable unit (CRU) limited warranty. When the SSDs are installed in a supported server, these drives assume the server'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 PM9D3a SSDs have the following physical specifications:

Dimensions and weight of the 2.5-inch drives (approximate, without the drive tray):

- Height: 15 mm (0.6 in.)
- Width: 70 mm (2.8 in.)
- Depth: 100 mm (4.0 in.)
- Weight: up to 170 g (6.0 oz)

Dimensions and weight of the E3.S 1T drives (approximate, without the drive tray):

- Height: 7.5 mm (0.3 in.)
- Width: 76 mm (3 in.)
- Depth: 113 mm (4.4 in.)
- Weight: up to 100 g (3.5 oz)

Operating environment

The PM9D3a SSDs are supported in the following environment:

- Temperature (operating): 0 to 70 °C (32 to 158 °F)
- Temperature (non-operating): -40 to 85 °C (-40 to 185 °F)
- Relative humidity (non-operating): 5 to 95% (noncondensing)
- Maximum altitude: 3,050 m (10,000 ft)
- Shock, non-operating: 1,500 G (Max) at 0.5 ms
- Vibration, non-operating: 20 G_{PEAK} (10-2000 Hz) at 4 min/cycle, 4 cycle/axis on 3 axis.

Agency approvals

The PM9D3a SSDs conform to the following regulations:

- Safety
  - cUL
  - CE
  - TUV-GS
  - CB
- EMC
  - CE (EU)
  - BSMI (Taiwan)
  - KC (South Korea)
  - VCCI (Japan)
  - RCM (Australia)
  - FCC (USA) / IC (Canada)

Related publications and links

For more information, see the following documents:

- Lenovo ThinkSystem SSD Portfolio Comparison
  https://lenovopress.com/lp1261-lenovo-thinksystem-ssd-portfolio
- Samsung product page for PM9D3a SSDs:
  https://semiconductor.samsung.com/us/ssd/datacenter-ssd/
- Samsung blog post on the PM9D3a SSDs:
  https://semiconductor.samsung.com/news-events/tech-blog/samsung-pm9d3a-solid-state-drive/

Related product families

Product families related to this document are the following:

- Drives

Notices

Lenovo may not offer the products, services, or features discussed in this document in all countries. Consult your local Lenovo representative for information on the products and services currently available in your area. Any reference to a Lenovo product, program, or service is not intended to state or imply that only that Lenovo product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any Lenovo intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any other product, program, or service. Lenovo may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:

Lenovo (United States), Inc.
8001 Development Drive
Morrisville, NC 27560
U.S.A.
Attention: Lenovo Director of Licensing

LENOVO PROVIDES THIS PUBLICATION ”AS IS” WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some jurisdictions do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. Lenovo may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

The products described in this document are not intended for use in implantation or other life support applications where malfunction may result in injury or death to persons. The information contained in this document does not affect or change Lenovo product specifications or warranties. Nothing in this document shall operate as an express or implied license or indemnity under the intellectual property rights of Lenovo or third parties. All information contained in this document was obtained in specific environments and is presented as an illustration. The result obtained in other operating environments may vary. Lenovo may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Any references in this publication to non-Lenovo Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this Lenovo product, and use of those Web sites is at your own risk. Any performance data contained herein was determined in a controlled environment. Therefore, the result obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurements may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

This document, LP2001, was created or updated on September 2, 2024.

Send us your comments in one of the following ways:

- Use the online Contact us review form found at:
  https://lenovopress.lenovo.com/LP2001
- Send your comments in an e-mail to:
  comments@lenovopress.com

This document is available online at https://lenovopress.lenovo.com/LP2001.

Trademarks

Lenovo and the Lenovo logo are trademarks or registered trademarks of Lenovo in the United States, other countries, or both. A current list of Lenovo trademarks is available on the Web at https://www.lenovo.com/us/en/legal/copytrade/.

The following terms are trademarks of Lenovo in the United States, other countries, or both:
Lenovo®
System x®
ThinkSystem®

The following terms are trademarks of other companies:

AMD is a trademark of Advanced Micro Devices, Inc.

Intel® is a trademark of Intel Corporation or its subsidiaries.

Linux® is the trademark of Linus Torvalds in the U.S. and other countries.

Microsoft®, Windows Server®, and Windows® are trademarks of Microsoft Corporation in the United States, other countries, or both.

Other company, product, or service names may be trademarks or service marks of others.