ThinkSystem PM1653 Read Intensive SAS 24Gb SSDs
Product Guide

The ThinkSystem PM1653 Read Intensive SAS 24Gb SSDs are next-generation high-performance 24Gb SAS self-encrypting SSDs (SEDs) suitable for a wide range of applications of running on ThinkSystem servers. The drives are available in capacities of up to 30.72 TB.

The PM1653 SSDs are the follow-on to the PM1643a SSDs and offer improved performance.

Figure 1. ThinkSystem PM1653 Read Intensive SAS 24Gb SSDs

Did you know?

Unlike 6 Gb/s SATA drives, the 24 Gb/s SAS interface on these drives supports full duplex data transfer for higher performance, and enterprise-level error recovery for better availability. By combining the enhanced reliability of Samsung NAND flash memory silicon with NAND Flash management technologies, PM1653 SSDs deliver endurance of up to 1 drive writes per day (DWPD) for 5 years, which is suitable for many enterprise applications with read-intensive storage characteristics.

Self-encrypting drives (SEDs) provide benefits by encrypting data on-the-fly at the drive level with no performance impact, by providing instant secure erasure thereby making the data no longer readable, and by enabling auto-locking to secure active data if a drive is misplaced or stolen from a system while in use. These features are essential for many businesses, especially those storing customer data.

Part number information

The following tables list the information for ordering part numbers and feature codes.

Table 1. Ordering part numbers and feature codes

Part number	Feature	Description	Vendor part number
2.5-inch hot-swap drives			
4XB7A80318	BNWC	ThinkSystem 2.5" PM1653 960GB Read Intensive SAS 24Gb HS SSD	MZILG960HCHQ-V7
4XB7A80319	BNWE	ThinkSystem 2.5" PM1653 1.92TB Read Intensive SAS 24Gb HS SSD	MZILG1T9HCJR-V7
4XB7A80320	BNWF	ThinkSystem 2.5" PM1653 3.84TB Read Intensive SAS 24Gb HS SSD	MZILG3T8HCLS-V7
4XB7A80321	BP3E	ThinkSystem 2.5" PM1653 7.68TB Read Intensive SAS 24Gb HS SSD	MZILG7T6HBLA-V7
4XB7A80322	BP3J	ThinkSystem 2.5" PM1653 15.36TB Read Intensive SAS 24Gb HS SSD	MZILG15THBLA-V7
4XB7A80323	BP3D	ThinkSystem 2.5" PM1653 30.72TB Read Intensive SAS 24Gb HS SSD	MZILG30THBLA-V7
3.5-inch hot-swap drives			
4XB7A80324	BNWD	ThinkSystem 3.5" PM1653 960GB Read Intensive SAS 24Gb HS SSD	MZILG960HCHQ-V7
4XB7A80325	BNWG	ThinkSystem 3.5" PM1653 1.92TB Read Intensive SAS 24Gb HS SSD	MZILG1T9HCJR-V7
4XB7A80326	BNWH	ThinkSystem 3.5" PM1653 3.84TB Read Intensive SAS 24Gb HS SSD	MZILG3T8HCLS-V7
4XB7A80327	BP3F	ThinkSystem 3.5" PM1653 7.68TB Read Intensive SAS 24Gb HS SSD	MZILG7T6HBLA-V7
4XB7A80328	BP3H	ThinkSystem 3.5" PM1653 15.36TB Read Intensive SAS 24Gb HS SSD	MZILG15THBLA-V7

The part numbers include the following items:

- One solid-state drive with a hot-swap tray
- Documentation flyer

Features

The ThinkSystem PM1653 Read Intensive SAS 24Gb SSDs have the following features:

- Server-grade SSD suitable for read-intensive workloads
- Features Samsung’s latest sixth-generation, 128-layer V-NAND TLC storage technology
- Endurance of 1 drive-writes per day (DWPD)
- 2.5-inch or 3.5-inch industry standard form factor with hot-swap tray
- SAS 24 Gb/s interface
- Compliant with the Trusted Computing Group Enterprise Security Subsystem Class cryptographic standard (TCG Enterprise 1.01)
- 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)
- End-to-end data protection
- Support 16 Initiator with Tag Command Queuing (TCQ) Command Set with a queue-depth of up to 128 commands
- Compliant with SCSI Specification (SAS-3 / SPL-3 / SBC-4 / SPC-4 / SAM-5)
- RoHS Compliant

24 Gb/s SAS support: In order to support 24 Gb/s SAS connectivity, the drive, backplane and SAS controller must all support 24 Gb/s speeds.

Read Intensive SSDs and Mixed Use 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. Read Intensive SSDs typically have a better cost per read IOPS ratio but lower endurance and performance compared to Mixed Use SSDs.

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.

For example, the PM1653 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

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 technical specifications for the PM1653 SSDs.

Table 2. Technical specifications

Feature	**960 GB drive**	**1.92 TB drive**	**3.84 TB drive**	**7.68 TB drive**	**15.36 TB drive**	**30.72 TB drive**
Interface	24 Gbps SAS	24 Gbps SAS	24 Gbps SAS	24 Gbps SAS	24 Gbps SAS	24 Gbps SAS
Capacity	960 GB	1.92 TB	3.84 TB	7.68 TB	15.36 TB	30.72 TB
SED encryption	TCG Enterprise	TCG Enterprise	TCG Enterprise	TCG Enterprise	TCG Enterprise	TCG Enterprise
Endurance (drive writes per day for 5 years)	1 DWPD	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	56,064 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	< 1 in 10^{17} bits read
MTBF	2,000,000 hours	2,000,000 hours	2,000,000 hours	2,000,000 hours	2,000,000 hours	2,000,000 hours
Performance - 24 Gb/s single-port						
IOPS reads (4 KB blocks)	420,000	420,000	420,000	420,000	420,000	420,000
IOPS writes (4 KB blocks)	60,000	95,000	140,000	110,000	150,000	130,000

Feature	960 GB drive	1.92 TB drive	3.84 TB drive	7.68 TB drive	15.36 TB drive	30.72 TB drive
Sequential read rate (128 KB blocks)	2100 MB/s	2100 MB/s	2100 MB/s	2100 MB/s	2100 MB/s	2100 MB/s
Sequential write rate (128 KB blocks)	1300 MB/s	2000 MB/s	2000 MB/s	2000 MB/s	2000 MB/s	2000 MB/s
Read latency (random)	120 µs	120 µs	120 µs	120 µs	120 µs	120 µs
Write latency (random)	45 µs	45 µs	45 µs	45 µs	45 µs	45 µs
Performance - 12 Gb/s single-port						
IOPS reads (4 KB blocks)	240,000	240,000	240,000	240,000	240,000	240,000
IOPS writes (4 KB blocks)	50,000	80,000	105,000	105,000	110,000	100,000
Sequential read rate (128 KB blocks)	1100 MB/s	1100 MB/s	1100 MB/s	1100 MB/s	1100 MB/s	1100 MB/s
Sequential write rate (128 KB blocks)	1100 MB/s	1100 MB/s	1100 MB/s	1100 MB/s	1100 MB/s	1100 MB/s
Read latency (random)	120 µs	120 µs	120 µs	120 µs	120 µs	120 µs
Write latency (random)	40 µs	30 µs	30 µs	30 µs	30 µs	30 µs
Environment						
Shock, non-operating	1,500 G (Max) at 0.5 ms	1,500 G (Max) at 0.5 ms	1,500 G (Max) at 0.5 ms	1,500 G (Max) at 0.5 ms	1,500 G (Max) at 0.5 ms	1,500 G (Max) at 0.5 ms
Vibration, non-operating	20 G_{RMS} (20-2000 Hz)	20 G_{RMS} (20-2000 Hz)	20 G_{RMS} (20-2000 Hz)	20 G_{RMS} (20-2000 Hz)	20 G_{RMS} (20-2000 Hz)	20 G_{RMS} (20-2000 Hz)
Typical power (R/W)	11.5W / 14.7W	11.5W / 14.7W	11.5W / 14.7W	11.5W / 14.7W	11.5W / 14.7W	11.5W / 14.7W

Adapter support

The drives are supported with all ThinkSystem SAS/SATA adapters, except for:

- ThinkSystem RAID 730-8i 1GB Cache PCIe 12Gb Adapter, 7Y37A01083
- ThinkSystem RAID 730-8i 2GB Flash PCIe 12Gb Adapter, 4Y37A09722

Server support

The following tables list the ThinkSystem servers that are compatible.

Table 3. Server support (Part 1 of 4)

Part Number	Description	2S AMD V3				2S Intel V3			4S 8S Intel V3			Multi Node			GPU Rich		1S V3	
		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)	SR850 V3 (7D97 / 7D96)	SR860 V3 (7D94 / 7D93)	SR950 V3 (7DC5 / 7DC4)	SD535 V3 (7DD8 / 7DD1)	SD530 V3 (7DDA / 7DD3)	SD550 V3 (7DD9 / 7DD2)	SR670 V2 (7Z22 / 7Z23)	SR675 V3 (7D9Q / 7D9R)	ST250 V3 (7DCF / 7DCE)	SR250 V3 (7DCM / 7DCL)
2.5-inch hot-swap drives																		
4XB7A80318	ThinkSystem 2.5" PM1653 960GB Read Intensive SAS 24Gb HS SSD	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	N	N
4XB7A80319	ThinkSystem 2.5" PM1653 1.92TB Read Intensive SAS 24Gb HS SSD	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	N	N
4XB7A80320	ThinkSystem 2.5" PM1653 3.84TB Read Intensive SAS 24Gb HS SSD	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	N
4XB7A80321	ThinkSystem 2.5" PM1653 7.68TB Read Intensive SAS 24Gb HS SSD	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	N
4XB7A80322	ThinkSystem 2.5" PM1653 15.36TB Read Intensive SAS 24Gb HS SSD	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	N
4XB7A80323	ThinkSystem 2.5" PM1653 30.72TB Read Intensive SAS 24Gb HS SSD	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	N	N	Y	Y	N	N
3.5-inch hot-swap drives																		
4XB7A80324	ThinkSystem 3.5" PM1653 960GB Read Intensive SAS 24Gb HS SSD	N	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N	N
4XB7A80325	ThinkSystem 3.5" PM1653 1.92TB Read Intensive SAS 24Gb HS SSD	N	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N	N
4XB7A80326	ThinkSystem 3.5" PM1653 3.84TB Read Intensive SAS 24Gb HS SSD	N	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N	N
4XB7A80327	ThinkSystem 3.5" PM1653 7.68TB Read Intensive SAS 24Gb HS SSD	N	Y	Y	Y	N	Y	Y	N	N	N	N	N	N	N	N	N	N
4XB7A80328	ThinkSystem 3.5" PM1653 15.36TB Read Intensive SAS 24Gb HS SSD	N	Y	Y	Y	N	Y	Y	N	N	N	N	N	N	N	N	N	N

Table 4. Server support (Part 2 of 4)

Part Number	Description	Edge					Super Computing					1S Intel V2			2S Intel V2		
		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																	
4XB7A80318	ThinkSystem 2.5" PM1653 960GB Read Intensive SAS 24Gb HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y
4XB7A80319	ThinkSystem 2.5" PM1653 1.92TB Read Intensive SAS 24Gb HS SSD	N	N	N	Y	N	N	N	N	N	N	N	N	N	Y	Y	Y
4XB7A80320	ThinkSystem 2.5" PM1653 3.84TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y
4XB7A80321	ThinkSystem 2.5" PM1653 7.68TB Read Intensive SAS 24Gb HS SSD	N	N	N	Y	N	N	N	N	N	N	N	N	N	Y	Y	Y
4XB7A80322	ThinkSystem 2.5" PM1653 15.36TB Read Intensive SAS 24Gb HS SSD	N	N	N	Y	N	N	N	N	N	N	N	N	N	Y	Y	Y
4XB7A80323	ThinkSystem 2.5" PM1653 30.72TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y
3.5-inch hot-swap drives																	
4XB7A80324	ThinkSystem 3.5" PM1653 960GB Read Intensive SAS 24Gb HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y
4XB7A80325	ThinkSystem 3.5" PM1653 1.92TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y
4XB7A80326	ThinkSystem 3.5" PM1653 3.84TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y
4XB7A80327	ThinkSystem 3.5" PM1653 7.68TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y
4XB7A80328	ThinkSystem 3.5" PM1653 15.36TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y

Table 5. 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																				
4XB7A80318	ThinkSystem 2.5" PM1653 960GB Read Intensive SAS 24Gb HS SSD	Y	Y	N	Y	Y	N	N	N	N	Y	Y	Y	Y	Y	Y	N	N	N	N
4XB7A80319	ThinkSystem 2.5" PM1653 1.92TB Read Intensive SAS 24Gb HS SSD	Y	Y	N	Y	Y	N	N	N	N	Y	Y	Y	Y	Y	Y	N	N	N	N
4XB7A80320	ThinkSystem 2.5" PM1653 3.84TB Read Intensive SAS 24Gb HS SSD	Y	Y	N	Y	Y	N	N	N	N	Y	Y	Y	Y	Y	Y	N	N	N	N
4XB7A80321	ThinkSystem 2.5" PM1653 7.68TB Read Intensive SAS 24Gb HS SSD	Y	Y	N	Y	Y	N	N	N	N	Y	Y	Y	Y	Y	Y	N	N	N	N
4XB7A80322	ThinkSystem 2.5" PM1653 15.36TB Read Intensive SAS 24Gb HS SSD	Y	Y	N	Y	Y	N	N	N	N	Y	Y	Y	Y	Y	Y	N	N	N	N
4XB7A80323	ThinkSystem 2.5" PM1653 30.72TB Read Intensive SAS 24Gb HS SSD	Y	Y	N	Y	Y	N	N	N	N	Y	Y	Y	Y	Y	Y	N	N	N	N
3.5-inch hot-swap drives																				
4XB7A80324	ThinkSystem 3.5" PM1653 960GB Read Intensive SAS 24Gb HS SSD	Y	Y	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A80325	ThinkSystem 3.5" PM1653 1.92TB Read Intensive SAS 24Gb HS SSD	Y	Y	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A80326	ThinkSystem 3.5" PM1653 3.84TB Read Intensive SAS 24Gb HS SSD	Y	Y	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A80327	ThinkSystem 3.5" PM1653 7.68TB Read Intensive SAS 24Gb HS SSD	Y	Y	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7A80328	ThinkSystem 3.5" PM1653 15.36TB Read Intensive SAS 24Gb HS SSD	Y	Y	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Table 6. 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													
4XB7A80318	ThinkSystem 2.5" PM1653 960GB Read Intensive SAS 24Gb HS SSD	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N	Y
4XB7A80319	ThinkSystem 2.5" PM1653 1.92TB Read Intensive SAS 24Gb HS SSD	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N	Y
4XB7A80320	ThinkSystem 2.5" PM1653 3.84TB Read Intensive SAS 24Gb HS SSD	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N	Y
4XB7A80321	ThinkSystem 2.5" PM1653 7.68TB Read Intensive SAS 24Gb HS SSD	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N	Y
4XB7A80322	ThinkSystem 2.5" PM1653 15.36TB Read Intensive SAS 24Gb HS SSD	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y
4XB7A80323	ThinkSystem 2.5" PM1653 30.72TB Read Intensive SAS 24Gb HS SSD	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y
3.5-inch hot-swap drives													
4XB7A80324	ThinkSystem 3.5" PM1653 960GB Read Intensive SAS 24Gb HS SSD	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N
4XB7A80325	ThinkSystem 3.5" PM1653 1.92TB Read Intensive SAS 24Gb HS SSD	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N
4XB7A80326	ThinkSystem 3.5" PM1653 3.84TB Read Intensive SAS 24Gb HS SSD	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N
4XB7A80327	ThinkSystem 3.5" PM1653 7.68TB Read Intensive SAS 24Gb HS SSD	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N
4XB7A80328	ThinkSystem 3.5" PM1653 15.36TB Read Intensive SAS 24Gb HS SSD	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N

Operating system support

SAS SSDs operate transparently to users, storage systems, applications, databases, and operating systems.

Operating system support is based on the controller used to connect to the drives. Consult the controller propduct guide for more information:

- RAID controllers: https://lenovopress.com/servers/options/raid
- SAS HBAs: https://lenovopress.com/servers/options/hba

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 7. 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 8. 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 are compatible with the FoD upgrades for SKLM.

Table 9. IBM SKLM Key Management support (Part 1 of 4)

		2S AMD V3				2S Intel V3			4S 8S Intel V3			Multi Node			GPU Rich		1S V3	
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)	SR850 V3 (7D97 / 7D96)	SR860 V3 (7D94 / 7D93)	SR950 V3 (7DC5 / 7DC4)	SD535 V3 (7DD8 / 7DD1)	SD530 V3 (7DDA / 7DD3)	SD550 V3 (7DD9 / 7DD2)	SR670 V2 (7Z22 / 7Z23)	SR675 V3 (7D9Q / 7D9R)	ST250 V3 (7DCF / 7DCE)	SR250 V3 (7DCM / 7DCL)
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	Y	Y
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	Y	Y

Table 10. IBM SKLM Key Management support (Part 2 of 4)

Part Number	Description	Edge					Super Computing					1S Intel V2			2S Intel V2		
		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	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	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	Y

Table 11. IBM SKLM Key Management 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	N	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	N	Y	Y	Y	Y	Y	N	N	N	N	N

Table 12. IBM SKLM Key Management 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	N	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	N	Y	Y	Y	Y	N	N	N	N	N

Warranty

The PM1653 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

PM1653 SSDs have the following physical specifications (without hot-swap tray):

- Height: 15 mm (0.6 in.)
- Width: 70 mm (2.8 in.)
- Depth: 100 mm (4.0 in.)
- Weight: 160 g (5.6 oz)

Operating environment

PM1653 SSDs are supported in the following environment:

- Temperature, operating: 0 - 70 °C (32 - 158 °F)
- Temperature, non-operating: -40 to 85 °C (-40 - 185 °F)
- Relative humidity: 5 - 95% (noncondensing)
- Maximum altitude: -300 - 4,572 m (-1,000 to 15,000 feet)

Agency approvals

PM1653 SSDs conform to the following regulations:

- UL
- TUV
- FCC
- IC
- CB
- CE Mark
- C-Tick Mark
- BSMI (Taiwan)
- KCC (Korea EMI)
- VCCI

Related publications and links

For more information, see the following documents:

- Lenovo Press product guides and papers on RAID adapters and HBAs
  https://lenovopress.com/servers/options/raid
- Lenovo RAID Management Tools and Resources
  https://lenovopress.com/lp0579-lenovo-raid-management-tools-and-resources
- Lenovo RAID Introduction
  https://lenovopress.com/lp0578-lenovo-raid-introduction
- Samsung Enterprise SSDs home page
  https://www.samsung.com/semiconductor/ssd/enterprise-ssd/

Related product families

Product families related to this document are the following:

- Drives

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