ThinkSystem PM1653 Read Intensive SAS 24Gb SSDs
Product Guide

The ThinkSystem PM1653 Read Intensive SAS 24Gb SSDs are next-generation high-performance 24Gb SAS SSDs 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.

Click here to check for updates

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 code	Description
2.5-inch hot-swap drives		
4XB7A80318	BNWC	ThinkSystem 2.5" PM1653 960GB Read Intensive SAS 24Gb HS SSD
4XB7A80319	BNWE	ThinkSystem 2.5" PM1653 1.92TB Read Intensive SAS 24Gb HS SSD
4XB7A80320	BNWF	ThinkSystem 2.5" PM1653 3.84TB Read Intensive SAS 24Gb HS SSD
4XB7A80321	BP3E	ThinkSystem 2.5" PM1653 7.68TB Read Intensive SAS 24Gb HS SSD
4XB7A80322	BP3J	ThinkSystem 2.5" PM1653 15.36TB Read Intensive SAS 24Gb HS SSD
4XB7A80323	BP3D	ThinkSystem 2.5" PM1653 30.72TB Read Intensive SAS 24Gb HS SSD
3.5-inch hot-swap drives		
4XB7A80324	BNWD	ThinkSystem 3.5" PM1653 960GB Read Intensive SAS 24Gb HS SSD
4XB7A80325	BNWG	ThinkSystem 3.5" PM1653 1.92TB Read Intensive SAS 24Gb HS SSD
4XB7A80326	BNWH	ThinkSystem 3.5" PM1653 3.84TB Read Intensive SAS 24Gb HS SSD
4XB7A80327	BP3F	ThinkSystem 3.5" PM1653 7.68TB Read Intensive SAS 24Gb HS SSD
4XB7A80328	BP3H	ThinkSystem 3.5" PM1653 15.36TB Read Intensive SAS 24Gb HS SSD

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 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.

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
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
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
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

Server support

The following tables list the ThinkSystem servers that are compatible.

Table 3. Server support (Part 1 of 2)

Part Number	Description	Edge		1S Intel V2			2S Intel V2				AMD				Dense V2				4S V2		8S
		SE350 (7Z46 / 7D1X)	SE450 (7D8T)	ST50 V2 (7D8K / 7D8J)	ST250 V2 (7D8G / 7D8F)	SR250 V2 (7D7R / 7D7Q)	ST650 V2 (7Z75 / 7Z74)	SR630 V2 (7Z70 / 7Z71)	SR650 V2 (7Z72 / 7Z73)	SR670 V2 (7Z22 / 7Z23)	SR635 (7Y98 / 7Y99)	SR655 (7Y00 / 7Z01)	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)
2.5-inch hot-swap drives																					
4XB7A80318	ThinkSystem 2.5" PM1653 960GB Read Intensive SAS 24Gb HS SSD	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y
4XB7A80319	ThinkSystem 2.5" PM1653 1.92TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y
4XB7A80320	ThinkSystem 2.5" PM1653 3.84TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y
4XB7A80321	ThinkSystem 2.5" PM1653 7.68TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y
4XB7A80322	ThinkSystem 2.5" PM1653 15.36TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y
4XB7A80323	ThinkSystem 2.5" PM1653 30.72TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	Y	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	Y	Y	Y	N	Y	Y	Y	Y	N	N	N	N	N	N	N
4XB7A80325	ThinkSystem 3.5" PM1653 1.92TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	N	Y	Y	Y	N	Y	Y	Y	Y	N	N	N	N	N	N	N
4XB7A80326	ThinkSystem 3.5" PM1653 3.84TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	N	Y	Y	Y	N	Y	Y	Y	Y	N	N	N	N	N	N	N
4XB7A80327	ThinkSystem 3.5" PM1653 7.68TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	N	Y	Y	Y	N	Y	Y	Y	Y	N	N	N	N	N	N	N
4XB7A80328	ThinkSystem 3.5" PM1653 15.36TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	N	Y	Y	Y	N	Y	Y	Y	Y	N	N	N	N	N	N	N

Table 4. Server support (Part 2 of 2)

Part Number	Description	1S Intel V1				2S Intel V1								Dense V1				4S V1		
		ST50 (7Y48 / 7Y50)	ST250 (7Y45 / 7Y46)	SR150 (7Y54)	SR250 (7Y52 / 7Y51)	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)	SR850 (7X18 / 7X19)	SR850P (7D2F / 2D2G)	SR860 (7X69 / 7X70)
2.5-inch hot-swap drives																				
4XB7A80318	ThinkSystem 2.5" PM1653 960GB Read Intensive SAS 24Gb HS SSD	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	Y
4XB7A80319	ThinkSystem 2.5" PM1653 1.92TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	Y
4XB7A80320	ThinkSystem 2.5" PM1653 3.84TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	Y
4XB7A80321	ThinkSystem 2.5" PM1653 7.68TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	Y
4XB7A80322	ThinkSystem 2.5" PM1653 15.36TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
4XB7A80323	ThinkSystem 2.5" PM1653 30.72TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	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	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N
4XB7A80325	ThinkSystem 3.5" PM1653 1.92TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N
4XB7A80326	ThinkSystem 3.5" PM1653 3.84TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N
4XB7A80327	ThinkSystem 3.5" PM1653 7.68TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N
4XB7A80328	ThinkSystem 3.5" PM1653 15.36TB Read Intensive SAS 24Gb HS SSD	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	N	N	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

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

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.

© Copyright Lenovo 2022. All rights reserved.

This document, LP1636, was created or updated on August 23, 2022.

Send us your comments in one of the following ways:

- Use the online Contact us review form found at:
  https://lenovopress.lenovo.com/LP1636
- Send your comments in an e-mail to:
  comments@lenovopress.com

This document is available online at https://lenovopress.lenovo.com/LP1636.

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®
ThinkSystem

The following terms are trademarks of other companies:

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

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