ThinkSystem PM1645a Mainstream 12Gb SAS SSDs
Product Guide

The ThinkSystem PM1645a Mainstream SAS 12Gb solid-state drives (SSDs) in capacities of up to 6.4 TB are next-generation high-performance SSDs suitable for a wide range of applications of running on ThinkSystem servers.

The PM1645a SSDs are the follow-on to the PM1645 SSDs and offer improved random write performance.

Figure 1. ThinkSystem PM1645a Mainstream SAS 12Gb SSD

Did you know?

Unlike SATA drives, the 12 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, PM1645a SSDs deliver the extended endurance of up to 3 drive writes per day (DWPD) for 5 years, which is suitable for many enterprise applications.

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		
4XB7A17064	B8JD	ThinkSystem 2.5" PM1645a 3.2TB Mainstream SAS 12Gb Hot Swap SSD

The part numbers include the following items:

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

Features

The PM1645a Mainstream SAS 12Gb SSDs have the following features:

- Mainstream server SSD suitable for mixed read-write-intensive workloads

- Endurance of 3 drive-writes per day (DWPD)

- 2.5-inch or 3.5-inch industry standard form factor with hot-swap tray

- SAS 12 Gbps interface

- 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

Entry SSDs and Mainstream 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). Mainstream SSDs have better endurance but lower cost/IOPS ratio compared to Entry 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.

Comparing PM1643a and PM1645a drives from Lenovo : Samsung has authorized Lenovo to offer both PM1643a and PM1645a SSDs. These two product families use common drive hardware but use custom Lenovo firmware to set the level of endurance – 1 DWPD (drive write per day) for the PM1643a drives and 3 DWPD for the PM1645a drives. The PM1645a drives are part of the Samsung design specification but are only available with Lenovo firmware. PM1645a drives are not available from Samsung with generic firmware.

Technical specifications

The following tables present technical specifications for the PM1645a Mainstream SAS 12Gb SSDs.

Table 2. Technical specifications

Feature	800 GB drive	1.6 TB drive	3.2 TB drive	6.4 TB drive
Interface	12 Gbps SAS	12 Gbps SAS	12 Gbps SAS	12 Gbps SAS
Capacity	800 GB	1.6 TB	3.2 TB	6.4 TB
SED encryption	None	None	None	None
Endurance (drive writes per day for 5 years)	3 DWPD	3 DWPD	3 DWPD	3 DWPD
Endurance (total bytes written)	4,380 TB	8,760 TB	17,520 TB	35,040 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	2,000,000 hours	2,000,000 hours	2,000,000 hours	2,000,000 hours
IOPS reads (4 KB blocks)	230,000	230,000	230,000	230,000
IOPS writes (4 KB blocks)	90,000	130,000	140,000	140,000
Sequential read rate (128 KB blocks)	1000 MBps	1000 MBps	1000 MBps	1000 MBps
Sequential write rate (128 KB blocks)	1000 MBps	1000 MBps	1000 MBps	1000 MBps
Read latency (ran)	120 µs	120 µs	120 µs	130 µs
Write latency (ran)	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
Vibration, non-operating	20 G_{RMS} (10-2000 Hz)	20 G_{RMS} (10-2000 Hz)	20 G_{RMS} (10-2000 Hz)	20 G_{RMS} (10-2000 Hz)
Typical power (R / W)	9 W / 9 W	9 W / 9 W	9 W / 9 W	9 W / 9 W

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)	SR680a V3 (7DHE)	SR685a V3 (7DHC)	ST250 V3 (7DCF / 7DCE)	SR250 V3 (7DCM / 7DCL)
2.5-inch hot-swap drives																				
4XB7A17064	ThinkSystem 2.5" PM1645a 3.2TB Mainstream SAS 12Gb Hot Swap SSD	N	N	N	N	N	N	N	N	N	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																	
4XB7A17064	ThinkSystem 2.5" PM1645a 3.2TB Mainstream SAS 12Gb Hot Swap SSD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

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																				
4XB7A17064	ThinkSystem 2.5" PM1645a 3.2TB Mainstream SAS 12Gb Hot Swap 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 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													
4XB7A17064	ThinkSystem 2.5" PM1645a 3.2TB Mainstream SAS 12Gb Hot Swap SSD	N	N	N	N	N	N	N	Y	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 PM1645a Mainstream SAS 12Gb 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

PM1645a Mainstream SAS 12Gb SSDs have the following physical specifications:

Dimensions and weight (approximate, without the hot-swap tray, if applicable):

- Height: 15 mm (0.6 in.)
- Width: 70 mm (2.8 in.)
- Depth: 100 mm (4.0 in.)
- Weight: 140 g (4.9 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.)

Shipping dimensions and weight for the 3.5-inch drives (approximate):

- Height: 95 mm (3.7 in.)
- Width: 194 mm (7.6 in.)
- Depth: 257 mm (10.0 in.)

Operating environment

PM1645a Mainstream SAS 12Gb 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

PM1645a Mainstream SAS 12Gb 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.

This document, LP1258, was created or updated on June 5, 2023.

Send us your comments in one of the following ways:

- Use the online Contact us review form found at:
  https://lenovopress.lenovo.com/LP1258

- Send your comments in an e-mail to:
  comments@lenovopress.com

This document is available online at https://lenovopress.lenovo.com/LP1258.

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.