Lenovo PM1633a Enterprise Capacity 12Gb SAS SSDs
Product Guide

The Lenovo PM1633a Enterprise Capacity 12Gb SAS solid-state drives (SSDs) in capacities of 3.84 TB, 7.68 TB and 15.36 TB capacities are next-generation high-capacity SSDs suitable for a wide range of applications of running on both System x and ThinkServer platforms.

The PM1633a Enterprise Capacity SSDs are designed for dense storage and with a 12 Gb SAS interface, these drives feature all the capacity and performance that is needed to replace large numbers of 15K rpm and 10K rpm spinning disks, and consolidate storage into tightly packed server configurations.



Figure 1. Lenovo PM1633a Enterprise Capacity 12Gb SAS SSD

Did you know?

Enterprise Capacity SSDs are a category of cost-effective high-capacity SSDs where it makes sense to store all of your data on the SSDs, and not use the SSDs only for caching or indexes.

Unlike SATA drives, the 12 Gb/s SAS interface on these drives supports full duplex data transfer for higher performance, as well as dual port connectivity and enterprise-level error recovery for better availability.

Part number information

The following table lists the part numbers and feature codes for ThinkSystem servers.

Table 1. Ordering part numbers and feature codes - ThinkSystem

Part number	Feature code	Description
2.5-inch hot-swap drives		
7N47A00121	AUMK	ThinkSystem 2.5" PM1633a 3.84TB Capacity SAS 12Gb Hot Swap SSD
7N47A00122	AUML	ThinkSystem 2.5" PM1633a 7.68TB Capacity SAS 12Gb Hot Swap SSD
7N47A00123	B116	ThinkSystem 2.5" PM1633a 15.36TB Capacity SAS 12Gb Hot Swap SSD

The following table lists the part numbers and feature codes for System x servers.

Table 2. Ordering part numbers and feature codes - System x

Part number	Feature code	Description
2.5-inch hot-swap drives with G3HS tray		
01GR786	AVKV	PM1633a 3.84TB Enterprise Capacity 12Gb SAS G3HS 2.5" SSD
01GR771	AUEJ	PM1633a 7.68TB Enterprise Capacity 12Gb SAS G3HS 2.5" SSD
3.5-inch hot-swap drives with hot-swap tray		
01GR791	AVKW	PM1633a 3.84TB Enterprise Capacity 12Gb SAS HS 3.5" SSD
2.5-inch non-hot-swap drives for use in NeXtScale systems		
01GR796	AVKZ	PM1633a 3.84TB Enterprise Capacity 12Gb SAS 2.5" SSD for NeXtScale
01GR776	AUEK	PM1633a 7.68TB Enterprise Capacity 12Gb SAS 2.5" SSD for NeXtScale

Table 3. Ordering part numbers - ThinkServer

Part number	Description
2.5-inch hot-swap drives	
4XB0K12387	Lenovo ThinkServer 2.5" 3.84TB PM1633a Enterprise Capacity SAS 12Gbps HS SSD
4XB0K12402	Lenovo ThinkServer 2.5" 7.68TB PM1633a Enterprise Capacity SAS 12Gb HS SSD
3.5-inch hot-swap drives	
4XB0K12388	Lenovo ThinkServer 3.5" 3.84TB PM1633a Enterprise Capacity SAS 12Gbps HS SSD

The part numbers include the following items:

- One solid-state drive (HS parts include a hot-swap tray)
- Support Flyer for SSDs
- Warranty Flyer
- Important Notices Flyer

Features

The PM1633a Enterprise Capacity SSDs have the following features:

- High capacity server SSD suitable for read-intensive workloads
- Based on Samsung V-NAND technology and TLC flash memory
- Endurance of 1 drive-write per day (DWPD) over 5 years
- 2.5-inch or 3.5-inch industry standard form factor with hot-swap tray
- SAS 12 Gbps interface
- Active-active dual port host 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

Enterprise Capacity SSDs have similar read and write IOPS performance and similar endurance to Enterprise Entry SSDs, however, the key difference is density - the total amount of storage in each 2.5-inch drive. With large configurations, more storage can be installed internal to the server, changing the need for external JBOD connections thereby saving power and rack space.

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.

For example, the PM1633a 7.68 TB drive has an endurance of 14,016 TB of total bytes written (TBW). This means that for full operation over five years, write workload can be up to 7,680 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 can be up to 12,800 GB of writes per day, which is equivalent to 1.7 full drive writes per day.

Users also have the flexibility to use this drive for more write intensive applications because these drives have such a large average daily write capacity. For example, the 3.84 TB has the same average daily write capacity (7,008 TB at 1.0 drive writes per day) as a 400 GB Enterprise Performance drive (7,300 TB at 10 drive writes per day).

Technical specifications

The following tables present technical specifications for the PM1633a Enterprise Capacity SSDs.

Table 4. Technical specifications

Feature	3.84 TB drive	7.68 TB drive	15.36 TB drive
Interface	12 Gbps SAS	12 Gbps SAS	12 Gbps SAS
Capacity	3.84 TB	7.68 TB	15.36 TB
Endurance (drive writes per day for 5 years)	1 DWPD	1 DWPD	1 DWPD
Endurance (total bytes written)	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
MTBF	2,000,000 hours	2,000,000 hours	2,000,000 hours
IOPS reads (4 KB blocks)	180,000	148,000	148,000
IOPS writes (4 KB blocks)	23,000	21,000	21,000
Sequential read rate (128 KB blocks)	940 MBps	640 MBps	640 MBps
Sequential write rate (128 KB blocks)	1000 MBps	450 MBps	450 MBps
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
Vibration, non-operating	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

Server support - ThinkSystem

The following table lists the ThinkSystem servers that are compatible.

Table 5. ThinkSystem server support

Part number	Description	2S Rack & Tower							4S Rack			Dense/ Blade		
		ST550 (7X09/7X10)	SR530 (7X07/7X08)	SR550 (7X03/7X04)	SR570 (7Y03/7Y04)	SR590 (7X98/7X99)	SR630 (7X01/7X02)	SR650 (7X05/7X06)	SR850 (7X18/7X19)	SR860 (7X69/7X70)	SR950 (7X11/12/13)	SD530 (7X21)	SN550 (7X16)	SN850 (7X15)
7N47A00121	ThinkSystem 2.5" PM1633a 3.84TB Capacity SAS 12Gb Hot Swap SSD	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
7N47A00122	ThinkSystem 2.5" PM1633a 7.68TB Capacity SAS 12Gb Hot Swap SSD	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
7N47A00123	ThinkSystem 2.5" PM1633a 15.36TB Capacity SAS 12Gb Hot Swap SSD	Y	N	N	N	N	Y	Y	Y	N	N	Y	Y	Y

Server support - System x

The following tables list the System x servers that are compatible with the PM1633a Enterprise Capacity SSDs.

Support for System x and dense servers with Xeon E5/E7 v4 and E3 v5 processors

Table 6. Support for System x and dense servers with Xeon E5/E7 v4 and E3 v5 processors

Part number	Description	x3250 M6 (3943)	x3250 M6 (3633)	x3550 M5 (8869)	x3650 M5 (8871)	x3850 X6/x3950 X6 (6241, E7 v4)	nx360 M5 (5465, E5 v4)	sd350 (5493)
01GR786	PM1633a 3.84TB Enterprise Capacity 12Gb SAS G3HS 2.5" SSD	N	N	Y	Y	Y	Y	Y
01GR771	PM1633a 7.68TB Enterprise Capacity 12Gb SAS G3HS 2.5" SSD	N	N	Y	Y	Y	N	N
01GR791	PM1633a 3.84TB Enterprise Capacity 12Gb SAS HS 3.5" SSD	N	N	Y	Y	N	N	N
01GR796	PM1633a 3.84TB Enterprise Capacity 12Gb SAS 2.5" SSD NeXtScale	N	N	N	N	N	Y	N
01GR776	PM1633a 7.68TB Enterprise Capacity 12Gb SAS 2.5" SSD NeXtScale	N	N	N	N	N	Y	N

Support for System x and dense servers with Intel E5 v3 and E3 v3 processors

Table 7. Support for servers with Intel Xeon v3 processors

Part number	Description	x3100 M5 (5457)	x3250 M5 (5458)	x3500 M5 (5464)	x3550 M5 (5463)	x3650 M5 (5462)	x3850 X6/x3950 X6 (6241, E7 v3)	nx360 M5 (5465, E5 v3)
01GR786	PM1633a 3.84TB Enterprise Capacity 12Gb SAS G3HS 2.5" SSD	N	N	N	N	N	N	N
01GR771	PM1633a 7.68TB Enterprise Capacity 12Gb SAS G3HS 2.5" SSD	N	N	N	N	N	N	N
01GR791	PM1633a 3.84TB Enterprise Capacity 12Gb SAS HS 3.5" SSD	N	N	N	N	N	N	N
01GR796	PM1633a 3.84TB Enterprise Capacity 12Gb SAS 2.5" SSD for NeXtScale	N	N	N	N	N	N	N
01GR776	PM1633a 7.68TB Enterprise Capacity 12Gb SAS 2.5" SSD for NeXtScale	N	N	N	N	N	N	N

Server support - ThinkServer

The following tables list the ThinkServer systems that are compatible with the PM1633a Enterprise Capacity SSDs.

Support for ThinkServer Generation 5 servers with E5 v4 and E3 v5 processors

Table 8. Support for ThinkServer Generation 5 servers with E5 v4 and E3 v5 processors

Part number	Description	TS150	TS450	TS460	RS160	TD350	RD350 (70Qx)	RD450 (70Qx)	RD550 (70Rx/70Sx)	RD650 (70Rx)
4XB0K12387	Lenovo ThinkServer 2.5" 3.84TB PM1633a Enterprise Capacity SAS 12Gbps HS SSD	N	Y	N	N	Y	Y	Y	Y	Y
4XB0K12402	Lenovo ThinkServer 2.5" 7.68TB PM1633a Enterprise Capacity SAS 12Gb HS SSD	N	N	N	N	Y	Y	Y	Y	Y
4XB0K12388	Lenovo ThinkServer 3.5" 3.84TB PM1633a Enterprise Capacity SAS 12Gbps HS SSD	N	Y	N	N	Y	Y	Y	Y	Y

Support for ThinkServer Generation 5 servers with E5 v3 and E3 v3 processors

Table 9. Support for ThinkServer Generation 5 servers with E5 v3 and E3 v3 processors

Part number	Description	TS140	TS440	RS140	TD350	RD350 (70Dx)	RD450 (70Dx)	RD550 (70Cx)	RD650 (70Dx)
4XB0K12387	Lenovo ThinkServer 2.5" 3.84TB PM1633a Enterprise Capacity SAS 12Gbps HS SSD	N	N	N	N	N	N	N	N
4XB0K12402	Lenovo ThinkServer 2.5" 7.68TB PM1633a Enterprise Capacity SAS 12Gb HS SSD	N	N	N	N	N	N	N	N
4XB0K12388	Lenovo ThinkServer 3.5" 3.84TB PM1633a Enterprise Capacity SAS 12Gbps HS SSD	N	N	N	N	N	N	N	N

Server support - Flex System

The PM1633a Enterprise Capacity SSDs are supported in the following Flex System compute nodes.

Tip: The SN550 and SN850 compute nodes are listed in the ThinkSystem support table.

Table 10. Support for Flex System compute nodes

Part number	Description	x240 (8737, E5-2600 v2)	x240 (7162)	x240 M5 (9532, E5-2600 v3)	x240 M5 (9532, E5-2600 v4)	x440 (7167)	x880/x480/x280 X6 (7903)	x280/x480/x880 X6 (7196)
01GR786	PM1633a 3.84TB Enterprise Capacity 12Gb SAS G3HS 2.5" SSD	N	N	Y	Y	N	N	N
01GR771	PM1633a 7.68TB Enterprise Capacity 12Gb SAS G3HS 2.5" SSD	N	N	Y	Y	N	N	N
01GR791	PM1633a 3.84TB Enterprise Capacity 12Gb SAS HS 3.5" SSD	N	N	N	N	N	N	N
01GR796	PM1633a 3.84TB Enterprise Capacity 12Gb SAS 2.5" SSD for NeXtScale	N	N	N	N	N	N	N
01GR776	PM1633a 7.68TB Enterprise Capacity 12Gb SAS 2.5" SSD for NeXtScale	N	N	N	N	N	N	N

Storage controller support

The PM1633a Enterprise Capacity SSDs require a supported SAS controller.

ThinkSystem controllers and servers are listed in the following table.

Table 11. ThinkSystem server support

Part number	Description	ST550 (7X09/7X10)	SR530 (7X07/7X08)	SR550 (7X03/7X04)	SR570 (7Y03/7Y04)	SR590 (7X98/7X99)	SR630 (7X01/7X02)	SR650 (7X05/7X06)	SR850 (7X18/7X19)	SR860 (7X69/7X70)	SR950 (7X11/12/13)	SD530 (7X21)	SN550 (7X16)	SN850 (7X15)
7Y37A01088	430-8i SAS/SATA 12Gb HBA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
7Y37A01089	430-16i SAS/SATA 12Gb HBA	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
7Y37A01082	RAID 530-8i PCIe 12Gb Adapter	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
7Y37A01083	RAID 730-8i 1GB Cache PCIe 12Gb Adapter	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
7Y37A01084	RAID 930-8i 2GB Flash PCIe 12Gb Adapter	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
7Y37A01085	RAID 930-16i 4GB Flash PCIe 12Gb Adapter	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
Feature AUYK	SD530 HW RAID Kit	N	N	N	N	N	N	N	N	N	N	Y	N	N
7M27A03918	RAID 530-4i 2 Drive Adapter Kit for SN550	N	N	N	N	N	N	N	N	N	N	N	Y	N
7M17A03932	RAID 530-4i 4 Drive Adapter Kit for SN850	N	N	N	N	N	N	N	N	N	N	N	N	Y

The following table lists the controllers and the System x servers that support those controllers.

Table 12. Controllers for supported servers

		Xeon v4					FS
Part number	Description	x3550 M5 (8869)	x3650 M5 (8871)	x3850 X6/x3950 X6 (6241, E7 v4)	nx360 M5 (5465, E5-2600 v4)	sd350 (5493)	x240 M5 (9532)
Onboard	ServeRAID M1200e Controller	N	N	N	N	N	Y
46C9114	ServeRAID M1215 Controller	Y	Y	N	Y	N	N
81Y4481	ServeRAID M5110 Controller	N	N	N	N	N	N
46C9110	ServeRAID M5210 Controller	Y	Y	Y	Y	N	N
00JX142	ServeRAID M5215 Controller	N	N	N	N	N	Y
00YD430	H701-L 6Gb HBA Mezz Card	N	N	N	N	Y	N
46C8988	N2115 SAS/SATA HBA	N	N	N	N	N	N
47C8675	N2215 SAS/SATA HBA	Y	Y	Y	Y	N	N

The following table list the ThinkServer controllers that support these solid-state drives installed in a supported server.

Table 13. Supported controllers - ThinkServer

		TS450	TD350	RD350	RD450	RD550	RD650
4XB0F28691	AnyRAID 510i	N	Y	N	Y	Y	Y
4XB0F28693	AnyRAID 720i	N	Y	N	Y	Y	Y
4XB0F28694	AnyRAID 720ix	N	Y	N	Y	Y	Y
4XC0G88850	RAID 520i	Y	Y	Y	Y	Y	Y
4XC0G88836	RAID 710	N	N	Y	Y	N	N
4XC0G88849	RAID 720i	Y	Y	Y	Y	Y	Y

Operating system support

SSDs operate transparently to users, storage systems, applications, databases, and operating systems. The controllers that support SSDs are supported by the following operating systems:

- Microsoft Windows Server 2008 R2
- Microsoft Windows Server 2012
- Microsoft Windows Server 2012 R2
- Microsoft Windows Server 2016
- Red Hat Enterprise Linux 5 Server Edition
- Red Hat Enterprise Linux 5 Server with Xen x64 Edition
- Red Hat Enterprise Linux 5 Server x64 Edition
- Red Hat Enterprise Linux 6 Server Edition
- Red Hat Enterprise Linux 6 Server x64 Edition
- Red Hat Enterprise Linux 7
- SUSE LINUX Enterprise Server 11 for AMD64/EM64T
- SUSE LINUX Enterprise Server 11 for x86
- SUSE LINUX Enterprise Server 11 with Xen for AMD64/EM64T
- SUSE LINUX Enterprise Server 12
- VMware vSphere 5.1 (ESXi)
- VMware vSphere 5.5 (ESXi)
- VMware vSphere 6.0 (ESXi)
- VMware vSphere 6.5 (ESXi)

Note: The controllers that support the SSDs do not necessarily support all the operating systems listed. Check ServerProven for the latest operating system compatibility for these controllers.
http://www.lenovo.com/us/en/serverproven/

Warranty

The PM1633a Enterprise Capacity SSDs carry a one-year, customer-replaceable unit (CRU) limited warranty. When the SSDs are installed in a supported server, these drives assume the system's base warranty and any warranty upgrades.

Solid State Memory cells have an intrinsic, finite number of program/erase cycles that each cell can incur. As a result, each solid state device has a maximum amount of program/erase cycles to which it can be subjected. The warranty for Lenovo solid state drives (SSDs) is limited to drives that have not reached the maximum guaranteed number of program/erase cycles, as documented in the Official Published Specifications for the SSD product. A drive that reaches this limit may fail to operate according to its Specifications.

Physical specifications

The PM1633a Enterprise Capacity 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: 160 g (5.6 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

The PM1633a Enterprise Capacity 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

The PM1633a Enterprise Capacity 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

Related product families

Product families related to this document are the following:

- Drives

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