

# Lenovo PM1635a Enterprise Mainstream 12Gb SAS SSDs

## Product Guide (withdrawn product)

The Lenovo PM1635a Enterprise Mainstream 12Gb SAS solid-state drives (SSDs) in capacities of up to 3.2 TB capacity are next-generation high-performance SSDs suitable for a wide range of applications of running on both System x and ThinkServer platforms.



Figure 1. Lenovo PM1635a Enterprise Mainstream 12Gb SAS SSD

### Did you know?

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. By combining the enhanced reliability of Samsung NAND flash memory silicon with NAND Flash management technologies, PM1635a 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 table lists the part numbers and feature codes for ThinkSystem servers.

**Withdrawn:** PM1635a drives are now all withdrawn from marketing.

Table 1. Ordering part numbers and feature codes - ThinkSystem

Part number	Feature code	Description
2.5-inch hot-swap drives		
7N47A00117	AUMC	ThinkSystem 2.5" PM1635a 400GB Mainstream SAS 12Gb Hot Swap SSD
7N47A00118	AUMD	ThinkSystem 2.5" PM1635a 800GB Mainstream SAS 12Gb Hot Swap SSD
7N47A00119	AVRG	ThinkSystem 2.5" PM1635a 1.6TB Mainstream SAS 12Gb Hot Swap SSD
7N47A00120	AVRJ	ThinkSystem 2.5" PM1635a 3.2TB Mainstream SAS 12Gb Hot Swap SSD
3.5-inch hot-swap drives		
4XB7A10188	B2XD	ThinkSystem 3.5" PM1635a 800GB Mainstream SAS 12Gb Hot Swap SSD
4XB7A10187	B2XE	ThinkSystem 3.5" PM1635a 1.6TB Mainstream SAS 12Gb Hot Swap SSD
4XB7A10189	B2XL	ThinkSystem 3.5" PM1635a 3.2TB Mainstream 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		
01GV761	AWEY	PM1635a 400GB Enterprise Mainstream 12Gb SAS G3HS 2.5" SSD
01GV766	AWEZ	PM1635a 800GB Enterprise Mainstream 12Gb SAS G3HS 2.5" SSD
01GV771	AWF0	PM1635a 1.6TB Enterprise Mainstream 12Gb SAS G3HS 2.5" SSD

The following table lists the part numbers for ThinkServer systems.

Table 3. Ordering part numbers - ThinkServer

Part number	Description
2.5-inch hot-swap drives	
4XB0K12403	Lenovo ThinkServer 2.5" 400GB PM1635a Enterprise Mainstream SAS 12Gb HS SSD
4XB0K12404	Lenovo ThinkServer 2.5" 800GB PM1635a Enterprise Mainstream SAS 12Gb HS SSD
4XB0K12405	Lenovo ThinkServer 2.5" 1.6TB PM1635a Enterprise Mainstream SAS 12Gb HS SSD
3.5-inch hot-swap drives	
4XB0K12406	Lenovo ThinkServer 3.5" 400GB PM1635a Enterprise Mainstream SAS 12Gb HS SSD
4XB0K12407	Lenovo ThinkServer 3.5" 800GB PM1635a Enterprise Mainstream SAS 12Gb HS SSD
4XB0K12408	Lenovo ThinkServer 3.5" 1.6TB PM1635a Enterprise Mainstream SAS 12Gb HS SSD

The part numbers include the following items:

- One solid-state drive in a hot-swap tray
- Support Flyer for SSDs
- Warranty Flyer

- Important Notices Flyer

## Features

The PM1635a Enterprise Mainstream 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
- 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 Entry SSDs and Enterprise 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). Enterprise Mainstream SSDs have better endurance but lower cost/IOPS ratio compared to Enterprise 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 does not fail upon reaching the specified TBW, but 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 PM1635a 1600 GB drive has an endurance of 8760 TB of total bytes written (TBW). This means that for full operation over five years, write workload must be limited to no more than 4800 GB of writes per day, which is equivalent to 3.0 full drive writes per day (DWPD). For the device to last three years, the drive write workload must be limited to no more than 8000 GB of writes per day, which is equivalent to 5.0 full drive writes per day.

## Technical specifications

The following tables present technical specifications for the PM1635a Enterprise Mainstream SSDs.

Table 4. Technical specifications

Feature	400 GB drive	800 GB drive	1.6 TB drive	3.2 TB drive
Interface	12 Gbps SAS	12 Gbps SAS	12 Gbps SAS	12 Gbps SAS
Capacity	400 GB	800 GB	1.6 TB	3.2 TB
Endurance (drive writes per day for 5 years)	3 DWPD	3 DWPD	3 DWPD	3 DWPD
Endurance (total bytes written)	2,190 TB	4,380 TB	8,760 TB	17,520 TB
Data reliability (UBER)	< 1 in 10 <sup>17</sup> bits read	< 1 in 10 <sup>17</sup> bits read	< 1 in 10 <sup>17</sup> bits read	< 1 in 10 <sup>17</sup> bits read
MTBF	2,000,000 hours	2,000,000 hours	2,000,000 hours	2,000,000 hours
IOPS reads (4 KB blocks)	197,000	197,000	197,000	197,000
IOPS writes (4 KB blocks)	50,000	60,000	60,000	34,000
Sequential read rate (128 KB blocks)	940 MBps	940 MBps	940 MBps	940 MBps
Sequential write rate (128 KB blocks)	620 MBps	800 MBps	830 MBps	780 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	1,500 G (Max) at 0.5 ms
Vibration, non-operating	20 G <sub>RMS</sub> (10-2000 Hz)	20 G <sub>RMS</sub> (10-2000 Hz)	20 G <sub>RMS</sub> (10-2000 Hz)	20 G <sub>RMS</sub> (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 - ThinkSystem

The following table lists the ThinkSystem servers that are compatible.

Table 5. ThinkSystem server support

Part number	Description	1S Rack & Tower				2S Rack & Tower								4S Rack			Dense/ Blade			
		ST50 (7Y48/7Y50)	ST250 (7Y45/7Y46)	SR150 (7Y54)	SR250 (7Y51/7Y52)	ST550 (7X09/7X10)	SR530 (7X07/7X08)	SR550 (7X03/7X04)	SR570 (7Y02/7Y03)	SR590 (7X98/7X99)	SR630 (7X01/7X02)	SR650 (7X05/7X06)	SR670 (7Y36/7Y37/7Y38)	SR850 (7X18/7X19)	SR860 (7X69/7X70)	SR950 (7X11/12/13)	SD530 (7X21)	SD650 (7X58)	SN550 (7X16)	SN850 (7X15)
7N47A00117	ThinkSystem 2.5" PM1635a 400GB Mainstream SAS 12Gb HS SSD	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	Y
7N47A00118	ThinkSystem 2.5" PM1635a 800GB Mainstream SAS 12Gb HS SSD	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	N
7N47A00119	ThinkSystem 2.5" PM1635a 1.6TB Mainstream SAS 12Gb HS SSD	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	Y
7N47A00120	ThinkSystem 2.5" PM1635a 3.2TB Mainstream SAS 12Gb HS SSD	N	N	N	N	N	N	N	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	Y
4XB7A10188	ThinkSystem 3.5" PM1635a 800GB Mainstream SAS 12Gb HS SSD	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N
4XB7A10187	ThinkSystem 3.5" PM1635a 1.6TB Mainstream SAS 12Gb HS SSD	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N
4XB7A10189	ThinkSystem 3.5" PM1635a 3.2TB Mainstream SAS 12Gb HS SSD	N	N	N	N	N	N	N	Y	Y	Y	Y	N	N	N	N	N	N	N	N

## Server support - System x

The following tables list the System x servers that are compatible with the PM1635a Enterprise Mainstream 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, E5-2600 v4)	sd350 (5493)
01GV761	PM1635a 400GB Enterprise Mainstream 12Gb SAS G3HS 2.5" SSD	N	N	Y	Y	Y	Y	N
01GV766	PM1635a 800GB Enterprise Mainstream 12Gb SAS G3HS 2.5" SSD	N	N	Y	Y	Y	Y	N
01GV771	PM1635a 1.6TB Enterprise Mainstream 12Gb SAS G3HS 2.5" SSD	N	N	Y	Y	Y	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)
01GV761	PM1635a 400GB Enterprise Mainstream 12Gb SAS G3HS 2.5" SSD	N	N	N	N	N	Y	N
01GV766	PM1635a 800GB Enterprise Mainstream 12Gb SAS G3HS 2.5" SSD	N	N	N	N	N	Y	N
01GV771	PM1635a 1.6TB Enterprise Mainstream 12Gb SAS G3HS 2.5" SSD	N	N	N	N	N	Y	N

## Support for servers with Intel Xeon v2 processors

Table 8. Support for servers with Intel Xeon v2 processors

Part number	Description	x3300 M4 (7382)	x3500 M4 (7383, E5-2600 v2)	x3550 M4 (7914, E5-2600 v2)	x3630 M4 (7158, E5-2400 v2)	x3650 M4 (7915, E5-2600 v2)	x3650 M4 BD (5466)	x3750 M4 (8753)	x3850 X6/x3950 X6 (6241, E7 v2)
01GV761	PM1635a 400GB Enterprise Mainstream 12Gb SAS G3HS 2.5" SSD	N	N	N	N	N	N	N	Y
01GV766	PM1635a 800GB Enterprise Mainstream 12Gb SAS G3HS 2.5" SSD	N	N	N	N	N	N	N	Y
01GV771	PM1635a 1.6TB Enterprise Mainstream 12Gb SAS G3HS 2.5" SSD	N	N	N	N	N	N	N	Y

## Server support - ThinkServer

The following tables list the ThinkServer systems that are compatible with the PM1635a Enterprise Mainstream SSDs.

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

Table 9. 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)
4XB0K12403	Lenovo ThinkServer 2.5" 400GB PM1635a Enterprise Mainstream SAS 12Gb HS SSD	N	N	N	N	Y	Y	Y	Y	Y
4XB0K12404	Lenovo ThinkServer 2.5" 800GB PM1635a Enterprise Mainstream SAS 12Gb HS SSD	N	N	N	N	Y	Y	Y	Y	Y
4XB0K12405	Lenovo ThinkServer 2.5" 1.6TB PM1635a Enterprise Mainstream SAS 12Gb HS SSD	N	N	N	N	Y	Y	Y	Y	Y
4XB0K12406	Lenovo ThinkServer 3.5" 400GB PM1635a Enterprise Mainstream SAS 12Gb HS SSD	N	N	N	N	Y	Y	Y	Y	Y
4XB0K12407	Lenovo ThinkServer 3.5" 800GB PM1635a Enterprise Mainstream SAS 12Gb HS SSD	N	N	N	N	Y	Y	Y	Y	Y
4XB0K12408	Lenovo ThinkServer 3.5" 1.6TB PM1635a Enterprise Mainstream SAS 12Gb HS SSD	N	N	N	N	Y	Y	Y	Y	Y

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

Table 10. 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)
4XB0K12403	Lenovo ThinkServer 2.5" 400GB PM1635a Enterprise Mainstream SAS 12Gb HS SSD	N	N	N	N	N	N	N	N
4XB0K12404	Lenovo ThinkServer 2.5" 800GB PM1635a Enterprise Mainstream SAS 12Gb HS SSD	N	N	N	N	N	N	N	N
4XB0K12405	Lenovo ThinkServer 2.5" 1.6TB PM1635a Enterprise Mainstream SAS 12Gb HS SSD	N	N	N	N	N	N	N	N
4XB0K12406	Lenovo ThinkServer 3.5" 400GB PM1635a Enterprise Mainstream SAS 12Gb HS SSD	N	N	N	N	N	N	N	N
4XB0K12407	Lenovo ThinkServer 3.5" 800GB PM1635a Enterprise Mainstream SAS 12Gb HS SSD	N	N	N	N	N	N	N	N
4XB0K12408	Lenovo ThinkServer 3.5" 1.6TB PM1635a Enterprise Mainstream SAS 12Gb HS SSD	N	N	N	N	N	N	N	N

### Server support - Flex System

The PM1635a Enterprise Mainstream SSDs are currently not supported by any Flex System compute nodes.



## Storage controller support

The PM1635a Enterprise Mainstream SSDs require a supported SAS disk 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 (7Y02/7Y03)	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 list the System x controllers that support these solid-state drives installed in a supported server.

Table 12. Supported controllers - System x

Part number	Description	v2	Xeon v3				Xeon v4				
		x3850 X6/x3950 X6 (6241, E7 v2)	x3500 M5 (5464)	x3550 M5 (5463)	x3650 M5 (5462)	x3850 X6/x3950 X6 (6241, E7 v3)	nx360 M5 (5465, E5-2600 v3)	x3550 M5 (8869)	x3650 M5 (8871)	x3850 X6/x3950 X6 (6241, E7 v4)	nx360 M5 (5465, E5-2600 v4)
47C8675	N2215 HBA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
46C9114	ServeRAID M1215	N	Y	Y	Y	N	Y	Y	Y	N	Y
46C9110	ServeRAID M5210	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

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

Table 13. Supported controllers - ThinkServer

		TD350	RD350	RD450	RD550	RD650
4XB0F28691	AnyRAID 510i	Y	N	Y	Y	Y
4XB0F28693	AnyRAID 720i	Y	N	Y	Y	Y
4XB0F28694	AnyRAID 720ix	Y	N	Y	Y	Y
4XC0G88834	RAID 500	N	Y	Y	N	N
4XC0G88850	RAID 520i	Y	Y	Y	Y	Y
4XC0G88836	RAID 710	N	Y	Y	N	N
4XC0G88849	RAID 720i	Y	Y	Y	Y	Y

## Operating system support

SAS and SATA 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 product guide for more information:

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

## Warranty

The PM1635a Enterprise Mainstream 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 PM1635a Enterprise Mainstream 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

The PM1635a Enterprise Mainstream 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 PM1635a Enterprise Mainstream 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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