Lenovo HUSMM32 Enterprise Performance 12G SAS SSDs

Product Guide (withdrawn product)

The New 12 Gb SAS HUSMM32 Enterprise Performance solid-state drives (SSDs) use 3D MLC NAND flash memory technology with a 12 Gb SAS interface to provide a high-performance storage solution in either 2.5-inch or 3.5-inch drive form factor.

The 12 Gb SAS drives with 10 full drives writes per day (DWPD) are an excellent choice for applications demanding high write performance, such as High Performance Computing (HPC), High Definition Imaging and Video (HDIV), high data rate analytics and databases, large-scale virtualization, and video on demand content delivery.

Compared to the previous generation 12 Gb SAS SSDs, these new SSDs offer more than double the random IOPS performance and double the sequential throughput performance.

The 12 Gb SAS Enterprise Performance solid-state drive is shown in the following figure.

Figure 1. 12 Gb SAS Enterprise Performance SSD (hot-swap tray removed)

Did you know?

These drives offer very high random read & write performance (IOPS) and very high throughput (MBps) making them ideal for high-performance dynamic data caching applications. The drives also offer a 12 Gb SAS interface which means they are the best selection for multi-threaded applications.

Rigorous testing of 12Gb SAS Enterprise Performance SSDs by Lenovo through the ServerProven program ensures a high degree of storage subsystem compatibility and reliability. Providing additional peace of mind, these drives are covered under Lenovo warranty.

Part number information

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

Table 1. Ordering information - ThinkSystem

Part number	Feature code	Description
2.5-inch hot-swap drives - ThinkSystem		
7N47A00124	AUMG	ThinkSystem 2.5" HUSMM32 400GB Performance SAS 12Gb Hot Swap SSD
7N47A00125	AUMH	ThinkSystem 2.5" HUSMM32 800GB Performance SAS 12Gb Hot Swap SSD
7N47A00126	AVRB	ThinkSystem 2.5" HUSMM32 1.6TB Performance SAS 12Gb Hot Swap SSD
3.5-inch hot-swap drives - ThinkSystem		
7N47A00997	B16Z	ThinkSystem 3.5" HUSMM32 400GB Performance SAS 12Gb Hot Swap SSD
7N47A00998	B170	ThinkSystem 3.5" HUSMM32 800GB Performance SAS 12Gb Hot Swap SSD
7N47A00999	B171	ThinkSystem 3.5" HUSMM32 1.6TB Performance SAS 12Gb Hot Swap SSD

The following table lists the information for ordering part numbers and feature codes for System x, Flex System and NeXtScale servers.

Table 2. Ordering information - System x, Flex System and NeXtScale

Part number	Feature	Description
2.5-inch hot-swap drives		
01GV711	AVL0	400GB Enterprise Performance 12G SAS G3HS 2.5" SSD
01GV716	AVL1	800GB Enterprise Performance 12G SAS G3HS 2.5" SSD
01GV721	AVL2	1.6TB Enterprise Performance 12G SAS G3HS 2.5" SSD
3.5-inch hot-swap drives		
01GV726	AVL3	400GB Enterprise Performance 12G SAS HS 3.5" SSD
01GV731	AVL4	800GB Enterprise Performance 12G SAS HS 3.5" SSD
01GV736	AVL5	1.6TB Enterprise Performance 12G SAS HS 3.5" SSD
2.5-inch drives for NeXtScale		
01GV741	AVL6	400GB Enterprise Performance 12G SAS 2.5" SSD for NeXtScale
01GV746	AVL7	800GB Enterprise Performance 12G SAS 2.5" SSD for NeXtScale
01GV751	AVL8	1.6TB Enterprise Performance 12G SAS 2.5" SSD for NeXtScale

The following table lists the information for ordering part numbers for ThinkServer systems.

Table 3. Ordering information - ThinkServer

Part number	Description
2.5-inch hot-swap drives	
4XB0K12409	Lenovo ThinkServer Gen 5 2.5" 400GB Enterprise Performance SAS 12Gb HS SSD
4XB0K12410	Lenovo ThinkServer Gen 5 2.5" 800GB Enterprise Performance SAS 12Gb HS SSD
4XB0K12411	Lenovo ThinkServer Gen 5 2.5" 1.6TB Enterprise Performance SAS 12Gb HS SSD
3.5-inch hot-swap drives	
4XB0K12412	Lenovo ThinkServer Gen 5 3.5" 400GB Enterprise Performance SAS 12Gb HS SSD
4XB0K12413	Lenovo ThinkServer Gen 5 3.5" 800GB Enterprise Performance SAS 12Gb HS SSD
4XB0K12414	Lenovo ThinkServer Gen 5 3.5" 1.6TB Enterprise Performance SAS 12Gb HS SSD

The part numbers include the following items:

- One 2.5-inch SSD with either a 2.5-inch or 3.5-inch a hot-swap tray attached
- Support Flyer for SSDs
- Warranty flyer and Important Notices document

Features

The 12Gb SAS Enterprise Performance SSDs have the following features:

- Industry-standard 2.5-inch drive with 2.5-inch or 3.5-inch drive tray attached
- Based on proven HGST Ultrastar SS300 drive technology
- Uses 3D Multi-Level Cell (MLC) NAND flash memory
- Endurance of 10 drive writes per day (DWPD) for 5 years. This equates to a total bytes written (TBW) value of:
    - 400 GB drive: 7 PB
    - 800 GB drive: 15 PB
    - 1.6 TB drive: 29 PB
- SAS 3D MLC solid-state drive with high read performance and consistently low latencies to fulfill client needs in the enterprise space
- High reliability and enhanced ruggedness
- Energy saving, with 9 W typical power consumption per drive
- Absence of moving parts to reduce potential failure points in the server
- S.M.A.R.T. support
- Advanced Encrypting Standard (AES) 256-bit encryption
- Supports Sanitize Cryptographic Erase
- Full end-to-end data path protection
    - Extended error correction code (ECC)
    - Exclusive-OR (XOR) parity to protect against Flash die failure
    - Parity-checked internal data paths without an external write cache
    - Power loss data management without the need for a supercapacitor

The key difference between Enterprise Performance SSDs such as the 12Gb SAS SSDs described here and Enterprise Entry and Enterprise Mainstream SSDs, is their endurance (life expectancy). SSDs have a huge, but finite, number of program/erase (P/E) cycles, which determines how long the drives can perform write operations and thus their life expectancy. Enterprise Performance SSDs have better endurance than the Enterprise Mainstream and Enterprise Entry SSDs, but at a higher cost/IOPS ratio.

SSD write endurance is typically measured by the number of program/erase cycles that the drive can incur over its lifetime, which is listed as TBW in the device specification. The TBW value that is assigned to a solid-state device is the total bytes of written data that a drive can be guaranteed to complete. Reaching this limit does not cause the drive to immediately fail; the TBW 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 800 GB drive has an endurance of 15 PB of total bytes written (TBW). This means that for full operation over five years, write workload must be limited to no more than 8,219 GB of writes per day, which is equivalent to 10.3 full drive writes per day (DWPD). For the device to last three years, the drive write workload must be limited to no more than 13,699 GB of writes per day, which is equivalent to 17.1 full drive writes per day.

Technical specifications

The following table presents technical specifications for the 12Gb SAS Enterprise Performance SSDs.

Table 4. Technical specifications

Feature	**400 GB drive**	**800 GB drive**	**1.6 TB drive**
Interface	12 Gbps SAS	12 Gbps SAS	12 Gbps SAS
Capacity	400 GB	800 GB	1.6 TB
Endurance (drive writes per day over 5 years)	10 DWPD	10 DWPD	10 DWPD
Endurance (total bytes written)	7 PB	15 PB	29 PB
Data reliability	1 in 10^{17} bits read	1 in 10^{17} bits read	1 in 10^{17} bits read
MTBF	2,500,000 hours	2,500,000 hours	2,500,000 hours
IOPS reads (4 KB blocks)	240,000	240,000	240,000
IOPS writes (4 KB blocks)	166,000	130,000	128,000
Sequential read rate (128 KB blocks)	1076 MBps	1076 MBps	1076 MBps
Sequential write rate (128 KB blocks)	1014 MBps	932 MBps	862 MBps
Latency (seq)	85 µs	85 µs	85 µs
Shock, 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, operating	2.17 G_{RMS} (5-700 Hz)	2.17 G_{RMS} (5-700 Hz)	2.17 G_{RMS} (5-700 Hz)
Typical power	9 W	9 W	9 W

Server support - ThinkSystem

The following table lists the ThinkSystem servers that are compatible.

Table 5. ThinkSystem server support

	E	1S Intel				2S Intel								AMD		4S Intel			Dense/ Blade			
Description and part number	**SE350 (7Z46 / 7D1X)**	**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)**	**SR635 (7Y98 / 7Y99)**	**SR655 (7Y00 / 7Z01)**	**SR850 (7X18/7X19)**	**SR860 (7X69/7X70)**	**SR950 (7X11/12/13)**	**SD530 (7X21)**	**SD650 (7X58)**	**SN550 (7X16)**	**SN850 (7X15)**
2.5" HUSMM32 400GB Performance SAS 12Gb Hot Swap SSD, 7N47A00124	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	N	Y	Y
2.5" HUSMM32 800GB Performance SAS 12Gb Hot Swap SSD, 7N47A00125	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
2.5" HUSMM32 1.6TB Performance SAS 12Gb Hot Swap SSD, 7N47A00126	N	N	N	N	N	N	N	N	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y	N	N	N
3.5" HUSMM32 400GB Performance SAS 12Gb Hot Swap SSD, 7N47A00997	N	N	N	N	N	N	N	N	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N	N
3.5" HUSMM32 800GB Performance SAS 12Gb Hot Swap SSD, 7N47A00998	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
3.5" HUSMM32 1.6TB Performance SAS 12Gb Hot Swap SSD, 7N47A00999	N	N	N	N	N	N	N	N	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N	N

Server support - System x

The following tables list the System x servers that are compatible.

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)	nx360 M5 WCT (5467, E5 v4
01GV711	400GB Enterprise Performance 12G SAS G3HS 2.5" SSD	N	N	Y	Y	Y	Y	Y	N
01GV716	800GB Enterprise Performance 12G SAS G3HS 2.5" SSD	N	N	Y	Y	Y	Y	Y	N
01GV721	1.6TB Enterprise Performance 12G SAS G3HS 2.5" SSD	N	N	Y	Y	Y	Y	Y	N
01GV726	400GB Enterprise Performance 12G SAS HS 3.5" SSD	N	N	Y	Y	N	N	N	N
01GV731	800GB Enterprise Performance 12G SAS HS 3.5" SSD	N	N	Y	Y	N	N	N	N
01GV736	1.6TB Enterprise Performance 12G SAS HS 3.5" SSD	N	N	Y	Y	N	N	N	N
01GV741	400GB Enterprise Performance 12G SAS 2.5" SSD for NeXtScale	N	N	N	N	N	Y	N	N
01GV746	800GB Enterprise Performance 12G SAS 2.5" SSD for NeXtScale	N	N	N	N	N	Y	N	N
01GV751	1.6TB Enterprise Performance 12G SAS 2.5" SSD for NeXtScale	N	N	N	N	N	Y	N	N

Support for System x and dense servers with Xeon v3 processors

Table 7. Support for servers with 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)
01GV711	400GB Enterprise Performance 12G SAS G3HS 2.5" SSD	N	N	N	N	N	Y	Y
01GV716	800GB Enterprise Performance 12G SAS G3HS 2.5" SSD	N	N	N	N	N	Y	Y
01GV721	1.6TB Enterprise Performance 12G SAS G3HS 2.5" SSD	N	N	N	N	N	Y	Y
01GV726	400GB Enterprise Performance 12G SAS HS 3.5" SSD	N	N	N	N	N	N	N
01GV731	800GB Enterprise Performance 12G SAS HS 3.5" SSD	N	N	N	N	N	N	N
01GV736	1.6TB Enterprise Performance 12G SAS HS 3.5" SSD	N	N	N	N	N	N	N
01GV741	400GB Enterprise Performance 12G SAS 2.5" SSD for NeXtScale	N	N	N	N	N	N	Y
01GV746	800GB Enterprise Performance 12G SAS 2.5" SSD for NeXtScale	N	N	N	N	N	N	Y
01GV751	1.6TB Enterprise Performance 12G SAS 2.5" SSD for NeXtScale	N	N	N	N	N	N	Y

Server support - Flex System

The following table lists the compatibility information for Flex System servers.

Table 8. Support for Flex System servers

Part number	Description	x240 (8737, E5-2600 v2)	x240 (7162)	x240 M5 (9532, v3)	x240 M5 (9532, v4)	x440 (7167)	x880/x480/x280 X6 (7903)	x280/x480/x880 X6 (7196)	Storage Expansion Node
01GV711	400GB Enterprise Performance 12G SAS G3HS 2.5" SSD	N	N	Y	Y	N	N	N	N
01GV716	800GB Enterprise Performance 12G SAS G3HS 2.5" SSD	N	N	Y	Y	N	N	N	N
01GV721	1.6TB Enterprise Performance 12G SAS G3HS 2.5" SSD	N	N	Y	Y	N	N	N	N
01GV726	400GB Enterprise Performance 12G SAS HS 3.5" SSD	N	N	N	N	N	N	N	N
01GV731	800GB Enterprise Performance 12G SAS HS 3.5" SSD	N	N	N	N	N	N	N	N
01GV736	1.6TB Enterprise Performance 12G SAS HS 3.5" SSD	N	N	N	N	N	N	N	N
01GV741	400GB Enterprise Performance 12G SAS 2.5" SSD for NeXtScale	N	N	N	N	N	N	N	N
01GV746	800GB Enterprise Performance 12G SAS 2.5" SSD for NeXtScale	N	N	N	N	N	N	N	N
01GV751	1.6TB Enterprise Performance 12G SAS 2.5" SSD for NeXtScale	N	N	N	N	N	N	N	N

Storage controller support

The 12Gb SAS Enterprise Performance SSDs require a supported SAS controller. The following table lists the controllers and the servers that support those controllers.

ThinkSystem controllers and servers are listed in the following table.

Table 9. 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

System x, NeXtScale and Flex System controllers and servers are listed in the following table.

Table 10. Controllers for supported servers

		v3		Xeon v4					FS
Part number	Description	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)	sd350 (5493)	x240 M5 (9532)
Onboard	ServeRAID M1200e Controller	N	N	N	N	N	N	N	Y
46C9114	ServeRAID M1215 Controller	N	Y	Y	Y	N	Y	N	N
46C9110	ServeRAID M5210 Controller	Y	Y	Y	Y	Y	Y	N	N
00JX142	ServeRAID M5215 Controller	N	N	N	N	N	N	N	Y
00YD430	H701-L 6Gb HBA Mezz Card	N	N	N	N	N	N	Y	N
47C8675	N2215 SAS/SATA HBA	Y	Y	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 11. 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
4XC0G88834	RAID 500	N	N	Y	Y	N	N
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.

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 12 Gb SAS Enterprise Performance 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 12Gb SAS Enterprise Performance SSDs have the following physical specifications.

Dimensions and weight (approximate, without drive tray):

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

Shipping dimensions and weight - 2.5-inch drives (approximate):

- Height: 63 mm (2.5 in.)
- Width: 174 mm (6.9 in.)
- Depth: 133 mm (5.2 in.)

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

- Height: 95 mm (3.7 in.)
- Width: 257 mm (10.1 in.)
- Depth: 193 mm (7.6 in.)

Operating environment

The 12Gb SAS Enterprise Performance SSDs are supported in the following environment:

- Temperature, operational: 0 to 60° C (32 to 140° F)
- Temperature, shipping: -40 to 80° C (-40 to 176° F)
- Relative humidity: 5 to 95% (noncondensing)
- Maximum altitude: 3,050 m (10,000 ft)

Agency approvals

The 12Gb SAS Enterprise Performance SSDs conform to the following regulations:

- FCC Title 47, Part 15B, Class B
- CA/CSA-CEI/IEC CISPR 22:02
- EN 55024: 1998
- EN 55022: 2006
- EN-60950-1 2nd Edition
- UL/CSA EN-60950-1 2nd Edition
- Low Voltage Directive 2006/95/EC
- C-Tick: AS/NZS3584
- VCCI V-3/2013-04 Class B
- CNS 13438: 2006
- KCC Article 11.1
- RoHS DIRECTIVE 2011/65/EU
- REACH 1907/2006
- WEEE Directive 2002/96/EC

Related publications and links

For more information, see the following documents:

- Lenovo ThinkSystem storage options product page
  https://lenovopress.com/lp0761-storage-options-for-thinksystem-servers
- Lenovo System x storage options product page
  https://www3.lenovo.com/us/en/data-center/servers/server-options/system-x-options/server-storage/c/system-x-storage
- HGST Ultrastar SS300 SAS SSD product page
  https://www.hgst.com/products/solid-state-solutions/ultrastar-ss300
- ServerProven for SSDs
  http://www.lenovo.com/us/en/serverproven/xseries/storage/hssdmatrix.shtml
- ServeRAID Adapter Quick Reference
  http://lenovopress.com/tips0054

Related product families

Product families related to this document are the following:

- Drives

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