ThinkSystem M.2 N3002 Read Intensive NVMe PCIe 4.0 Industrial SSDs

Product Guide (withdrawn product)

The ThinkSystem M.2 N3002 Read Intensive NVMe PCIe 4.0 Industrial SSDs, in capacities up to 3.84TB, are high performance NVMe M.2 drives suitable operating system boot purposes and general data storage functions on ThinkSystem servers in environments up to 85°C.

Figure 1. ThinkSystem M.2 N3002 Read Intensive NVMe PCIe 4.0 Industrial SSDs

Did you know?

The N3002 M.2 SSDs deliver performance for edge applications in environments with temperature from -40°C to 85°C. The NVMe controller and the newest 3D NAND flash technology provides robust, non-volatile storage solution for today's edge computing applications.

Part number information

The following tables list the information for ordering part numbers and feature codes.

Withdrawn: The drives in this product guide are now withdrawn from marketing.

Table 1. Ordering part numbers and feature codes

Part number	Feature	Description	Vendor part number
4XB7B05264	CBSU	ThinkSystem M.2 N3002 480GB Read Intensive NVMe PCIe 4.0 x4 NHS SSD (Industrial)	SFPC480GM2AR2MA-I-7C-62Q-GEN
4XB7B05265	CBSV	ThinkSystem M.2 N3002 960GB Read Intensive NVMe PCIe 4.0 x4 NHS SSD (Industrial)	SFPC960GM2AR4MA-I-8C-62Q-GEN
4XB7B05266	CAAZ	ThinkSystem M.2 N3002 1.92TB Read Intensive NVMe PCIe 4.0 x4 NHS SSD (Industrial)	SFPC1T92M2AR4MA-I-8C-62Q-GEN
4XB7B05267	CAB0	ThinkSystem M.2 N3002 3.84TB Read Intensive NVMe PCIe 4.0 x4 NHS SSD (Industrial)	SFPC3T84M2AR4MA-I-YC-62Q-GEN

The part numbers include the following items:

- One M.2 drive
- Documentation flyer

Features

The ThinkSystem M.2 N3002 Read Intensive NVMe PCIe 4.0 Industrial SSDs have the following features:

- Based on the Swissbit N3002 family of industrial solid state drives
- TLC 3D NAND flash
- End-to-end data protection
- Thermal throttling/sensor
- On-Board Power Fail Protection (Power loss protection, PLP)
- ROHS-compliant
- Command sets: TRIM, S.M.A.R.T, NCQ
- TCG Opal 2.0 compliant self-encrypting drive (SED)

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 N3002 1.92TB drive has an endurance of 1,620 TB of total bytes written (TBW). This

means that for full operation over five years, write workload must be limited to no more than 888 GB of writes per day, which is equivalent to 0.5 full drive writes per day (DWPD). For the device to last three years, the drive write workload must be limited to no more than 1,479 GB of writes per day, which is equivalent to 0.8 full drive writes per day.

The benefits of drive encryption

Self-encrypting drives (SEDs) provide benefits in three main ways:

- By encrypting data on-the-fly at the drive level with no performance impact
- By providing instant secure erasure (cryptographic erasure, thereby making the data no longer readable)
- By enabling auto-locking to secure active data if a drive is misplaced or stolen from a system while in use

The following sections describe the benefits in more details.

Automatic encryption

It is vital that a company keep its data secure. With the threat of data loss due to physical theft or improper inventory practices, it is important that the data be encrypted. However, challenges with performance, scalability, and complexity have led IT departments to push back against security policies that require the use of encryption. In addition, encryption has been viewed as risky by those unfamiliar with key management, a process for ensuring a company can always decrypt its own data. Self-encrypting drives comprehensively resolve these issues, making encryption both easy and affordable.

When the self-encrypting drive is in normal use, its owner need not maintain authentication keys (otherwise known as credentials or passwords) in order to access the data on the drive. The self-encrypting drive will encrypt data being written to the drive and decrypt data being read from it, all without requiring an authentication key from the owner.

Drive retirement and disposal

When hard drives are retired and moved outside the physically protected data center into the hands of others, the data on those drives is put at significant risk. IT departments retire drives for a variety of reasons, including:

- Returning drives for warranty, repair, or expired lease agreements
- Removal and disposal of drives
- Repurposing drives for other storage duties

Nearly all drives eventually leave the data center and their owner's control. Corporate data resides on such drives, and when most leave the data center, the data they contain is still readable. Even data that has been striped across many drives in a RAID array is vulnerable to data theft because just a typical single stripe in today’s high-capacity arrays is large enough to expose for example, hundreds of names and bank account numbers.

In an effort to avoid data breaches and the ensuing customer notifications required by data privacy laws, companies use different methods to erase the data on retired drives before they leave the premises and potentially fall into the wrong hands. Current retirement practices that are designed to make data unreadable rely on significant human involvement in the process, and are thus subject to both technical and human failure.

The drawbacks of today's drive retirement practices include the following:

- Overwriting drive data is expensive, tying up valuable system resources for days. No notification of completion is generated by the drive, and overwriting won't cover reallocated sectors, leaving that data exposed.
- Methods that include degaussing or physically shredding a drive are expensive. It is difficult to ensure the degauss strength is optimized for the drive type, potentially leaving readable data on the drive. Physically shredding the drive is environmentally hazardous, and neither practice allows the drive to be returned for warranty or expired lease.
- Some companies have concluded the only way to securely retire drives is to keep them in their control, storing them indefinitely in warehouses. But this is not truly secure because a large volume of drives coupled with human involvement inevitably leads to some drives being lost or stolen.
- Professional disposal services is an expensive option and includes the cost of reconciling the services as well as internal reports and auditing. Transporting of the drives also has the potential of putting the data at risk.

Self-encrypting drives eliminate the need to overwrite, destroy, or store retired drives. When the drive is to be retired, it can be cryptographically erased, a process that is nearly instantaneous regardless of the capacity of the drive.

Instant secure erase

The self-encrypting drive provides instant data encryption key destruction via cryptographic erasure. When it is time to retire or repurpose the drive, the owner sends a command to the drive to perform a cryptographic erasure. Cryptographic erasure simply replaces the encryption key inside the encrypted drive, making it impossible to ever decrypt the data encrypted with the deleted key.

Self-encrypting drives reduce IT operating expenses by reducing asset control challenges and disposal costs. Data security with self-encrypting drives helps ensure compliance with privacy regulations without hindering IT efficiency. So called "Safe Harbor" clauses in government regulations allow companies to not have to notify customers of occurrences of data theft if that data was encrypted and therefore unreadable.

Furthermore, self-encrypting drives simplify decommissioning and preserve hardware value for returns and repurposing by:

- Eliminating the need to overwrite or destroy the drive
- Securing warranty returns and expired lease returns
- Enabling drives to be repurposed securely

Auto-locking

Insider theft or misplacement is a growing concern for businesses of all sizes; in addition, managers of branch offices and small businesses without strong physical security face greater vulnerability to external theft. Self-encrypting drives include a feature called auto-lock mode to help secure active data against theft.

Using a self-encrypting drive when auto-lock mode is enabled simply requires securing the drive with an authentication key. When secured in this manner, the drive's data encryption key is locked whenever the drive is powered down. In other words, the moment the self-encrypting drive is switched off or unplugged, it automatically locks down the drive's data.

When the self-encrypting drive is then powered back on, it requires authentication before being able to unlock its encryption key and read any data on the drive, thus protecting against misplacement and theft.

While using self-encrypting drives just for the instant secure erase is an extremely efficient and effective means to help securely retire a drive, using self-encrypting drives in auto-lock mode provides even more advantages. From the moment the drive or system is removed from the data center (with or without

authorization), the drive is locked. No advance thought or action is required from the data center administrator to protect the data. This helps prevent a breach should the drive be mishandled and helps secure the data against the threat of insider or outside theft.

Technical specifications

The following tables present technical specifications for the N3002 M.2 SSDs.

Table 2. Technical specifications

Feature	**480 GB drive**	**960 GB drive**	**1.92 TB drive**	**3.84 TB drive**
Interface	PCIe 3.0 x4	PCIe 3.0 x4	PCIe 3.0 x4	PCIe 3.0 x4
Form factor	M.2 2280	M.2 2280	M.2 2280	M.2 2280
Capacity	480 GB	960 GB	1.92 TB	3.84 TB
SED encryption	TCG Opal 2.0	TCG Opal 2.0	TCG Opal 2.0	TCG Opal 2.0
Endurance (drive writes per day for 5 years)	0.36 DWPD	3.0 DWPD	0.46 DWPD	0.52 DWPD
Endurance (total bytes written)	320 TB	5,400 TB	1,620 TB	3,670 TB
Data reliability (UBER)	< 1 in 10^{16} bits read	< 1 in 10^{16} bits read	< 1 in 10^{16} bits read	< 1 in 10^{16} bits read
MTBF	3,000,000 hours	3,000,000 hours	3,000,000 hours	3,000,000 hours
Performance				
IOPS reads (4 KB blocks)	210,200	440,200	440,100	429,200
IOPS writes (4 KB blocks)	301,300	387,100	383,300	505,200
Sequential read rate (128 KB blocks)	3800 MB/s	3790 MB/s	3790 MB/s	3210 MB/s
Sequential write rate (128 KB blocks)	2780 MB/s	3280 MB/s	3280 MB/s	2850 MB/s
Environment				
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	50 G_{RMS} (80-2000 Hz)	50 G_{RMS} (80-2000 Hz)	50 G_{RMS} (80-2000 Hz)	50 G_{RMS} (80-2000 Hz)
Power (R/W, sequential)	3.8 W / 4.0 W	3.8 W / 4.1 W	3.8 W / 4.1 W	4.1 W / 4.1 W
Power (R/W, random)	2.7 W / 3.3 W	3.8 W / 3.3 W	3.8 W / 3.3 W	4.0 W / 3.3 W

Server support

The following tables list the ThinkSystem servers that are compatible.

Table 3. Server support (Part 1 of 5)

Part Number	Description	AMD V3				2S Intel V3/V4						Multi Node V3			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)	SR630 V4 (7DG8 / 7DG9)	SR650 V4 (7DGC / 7DGD)	SR650a V4 (7DGC / 7DGD)	SD535 V3 (7DD8 / 7DD1)	SD530 V3 (7DDA / 7DD3)	SD550 V3 (7DD9 / 7DD2)	ST45 V3 (7DH4 / 7DH5)	ST50 V3 (7DF4 / 7DF3)	ST250 V3 (7DCF / 7DCE)	SR250 V3 (7DCM / 7DCL)
4XB7B05266	ThinkSystem M.2 N3002 1.92TB Read Intensive NVMe PCIe 4.0 x4 NHS SSD (Industrial)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7B05267	ThinkSystem M.2 N3002 3.84TB Read Intensive NVMe PCIe 4.0 x4 NHS SSD (Industrial)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Table 4. Server support (Part 2 of 5)

Part Number	Description	4S 8S Intel V3/V4					GPU Rich							Edge					
		SR850 V3 (7D97 / 7D96)	SR860 V3 (7D94 / 7D93)	SR950 V3 (7DC5 / 7DC4)	SR850 V4 (7DJT / 7DJS)	SR860 V4 (7DJQ / 7DJN)	SR670 V2 (7Z22 / 7Z23)	SR675 V3 (7D9Q / 7D9R)	SR680a V3 (7DHE)	SR680a V3 B200 (7DM9)	SR685a V3 (7DHC)	SR780a V3 (7DJ5)	SR680a V4 (7DMK)	SE100 (7DGR)	SE350 (7Z46 / 7D1X)	SE350 V2 (7DA9)	SE360 V2 (7DAM)	SE450 (7D8T)	SE455 V3 (7DBY)
4XB7B05266	ThinkSystem M.2 N3002 1.92TB Read Intensive NVMe PCIe 4.0 x4 NHS SSD (Industrial)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N
4XB7B05267	ThinkSystem M.2 N3002 3.84TB Read Intensive NVMe PCIe 4.0 x4 NHS SSD (Industrial)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N

Table 5. Server support (Part 3 of 5)

Part Number	Description	Super Computing							1S Intel V2			2S Intel V2			AMD V1			
		SC750 V4 (7DDJ)	SC777 V4 (7DKA)	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)	SR635 (7Y98 / 7Y99)	SR655 (7Y00 / 7Z01)	SR645 (7D2Y / 7D2X)	SR665 (7D2W / 7D2V)
4XB7B05266	ThinkSystem M.2 N3002 1.92TB Read Intensive NVMe PCIe 4.0 x4 NHS SSD (Industrial)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7B05267	ThinkSystem M.2 N3002 3.84TB Read Intensive NVMe PCIe 4.0 x4 NHS SSD (Industrial)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Table 6. Server support (Part 4 of 5)

Part Number	Description	Dense V2				4S V2		8S	4S V1			1S Intel V1			
		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)
4XB7B05266	ThinkSystem M.2 N3002 1.92TB Read Intensive NVMe PCIe 4.0 x4 NHS SSD (Industrial)	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XB7B05267	ThinkSystem M.2 N3002 3.84TB Read Intensive NVMe PCIe 4.0 x4 NHS SSD (Industrial)	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Table 7. Server support (Part 5 of 5)

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)
4XB7B05266	ThinkSystem M.2 N3002 1.92TB Read Intensive NVMe PCIe 4.0 x4 NHS SSD (Industrial)	N	N	N	N	N	N	N	N	N	N	N	N

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)
4XB7B05267	ThinkSystem M.2 N3002 3.84TB Read Intensive NVMe PCIe 4.0 x4 NHS SSD (Industrial)	N	N	N	N	N	N	N	N	N	N	N	N

Storage controller support

NVMe PCIe SSDs require a NVMe drive backplane and some form of PCIe connection to processors. PCIe connections can take the form of either an adapter (PCIe Interposer or PCIe extender) or simply a cable that connects to an onboard NVMe connector.

Consult the relevant server product guide for details about required components for NVMe drive support.

Operating system support

The following tables list the supported operating systems.

Tip: These tables are automatically generated based on data from Lenovo ServerProven.

ThinkSystem M.2 N3002 480GB Read Intensive NVMe PCIe 4.0 x4 NHS SSD (Industrial), 4XB7B05264

The following table lists the OS support for the ThinkSystem M.2 N3002 480GB Read Intensive NVMe PCIe 4.0 x4 NHS SSD (Industrial).

Table 8. Operating system support for ThinkSystem M.2 N3002 480GB Read Intensive NVMe PCIe 4.0 x4 NHS SSD (Industrial), 4XB7B05264

Operating systems	SE360 V2	SE350 V2
Microsoft Windows Server 2019	Y	Y
Microsoft Windows Server 2022	Y	Y
Microsoft Windows Server 2025	Y	Y

ThinkSystem M.2 N3002 3.84TB Read Intensive NVMe PCIe 4.0 x4 NHS SSD (Industrial), 4XB7B05267

The following table lists the OS support for the ThinkSystem M.2 N3002 3.84TB Read Intensive NVMe PCIe 4.0 x4 NHS SSD (Industrial).

Table 9. Operating system support for ThinkSystem M.2 N3002 3.84TB Read Intensive NVMe PCIe 4.0 x4 NHS SSD (Industrial), 4XB7B05267

Operating systems	SE360 V2	SE350 V2
Microsoft Windows Server 2019	Y	Y
Microsoft Windows Server 2022	Y	Y
Microsoft Windows Server 2025	Y	Y

IBM SKLM Key Management support

To effectively manage a large deployment of SEDs in Lenovo servers, IBM Security Key Lifecycle Manager (SKLM) offers a centralized key management solution.

Certain Lenovo servers support Features on Demand (FoD) license upgrades that enable SKLM support. The following table lists the part numbers and feature codes to enable SKLM support in the management processor of the server.

Table 10. FoD upgrades for SKLM support

Part number	Feature code	Description
Security Key Lifecycle Manager - FoD (United States, Canada, Asia Pacific, and Japan)		
00D9998	A5U1	SKLM for System x/ThinkSystem w/SEDs - FoD per Install w/1Yr S&S
00D9999	AS6C	SKLM for System x/ThinkSystem w/SEDs - FoD per Install w/3Yr S&S
Security Key Lifecycle Manager - FoD (Latin America, Europe, Middle East, and Africa)		
00FP648	A5U1	SKLM for System x/ThinkSystem w/SEDs - FoD per Install w/1Yr S&S
00FP649	AS6C	SKLM for System x/ThinkSystem w/SEDs - FoD per Install w/3Yr S&S

The IBM Security Key Lifecycle Manager software is available from Lenovo using the ordering information listed in the following table.

Table 11. IBM Security Key Lifecycle Manager licenses

Part number	Description
7S0A007FWW	IBM Security Key Lifecycle Manager Basic Edition Install License + SW Subscription & Support 12 Months
7S0A007HWW	IBM Security Key Lifecycle Manager For Raw Decimal Terabyte Storage Resource Value Unit License + SW Subscription & Support 12 Months
7S0A007KWW	IBM Security Key Lifecycle Manager For Raw Decimal Petabyte Storage Resource Value Unit License + SW Subscription & Support 12 Months
7S0A007MWW	IBM Security Key Lifecycle Manager For Usable Decimal Terabyte Storage Resource Value Unit License + SW Subscription & Support 12 Months
7S0A007PWW	IBM Security Key Lifecycle Manager For Usable Decimal Petabyte Storage Resource Value Unit License + SW Subscription & Support 12 Months

Warranty

The N3002 M.2 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 N3002 M.2 SSDs have the following physical specifications:

- Length: 80 mm
- Width: 22 mm
- Thickness: 3.8 mm
- Weight: 9g

Operating environment

The N3002 M.2 SSDs are supported in the following environment:

- Temperature, operating: -40 °C to 85 °C (-40 to 185 °F)
- Temperature, non-operating: -40 °C to 85 °C (-40 to 185 °F)
- Relative humidity: 85% (noncondensing)

Agency approvals

The N3002 M.2 SSDs conform to the following regulations:

- CE 2014/30/EU
- FCC 47 CFR Part 15
- UKCA S.I. 2016 No. 1091 and S.I. 2012 No. 3032
- RoHS 2011/65/EU with 2015/863/EU and 2017/2102/EU
- REACH 1907/2006/EU and 207/2011/EU
- WEEE 2012/19/EU

Related publications and links

For more information, see the following documents:

- Lenovo ThinkSystem SSD Portfolio Comparison
  https://lenovopress.com/lp1261-lenovo-thinksystem-ssd-portfolio
- Swissbit product web page
  https://www.swissbit.com/en/products/nand-flash-products/pcie-ssd-modules/

Related product families

Product families related to this document are the following:

- Drives

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