ThinkSystem 5210 Entry 6Gb SATA QLC SSDs
Product Guide

The 5210 Entry SATA solid-state drives (SSDs) are low-cost SSDs for ThinkSystem servers. The drives use Micron 64-layer 3D QLC NAND flash memory technology with a SATA 6Gbps interface and provide an affordable solution for large-capacity sequential read-intensive applications such as AI and machine learning data lakes, real-time analytics, big data, and media streaming.

The 5210 Entry SATA SSD is shown in the following figure.

Figure 1. Lenovo ThinkSystem 5210 Entry SATA SSD

Did you know?

QLC (quad-level cell) represents the next generation of NAND flash memory technology. QLC means that 4 bits of data is stored in each memory cell which results in more cost-effective drives and larger drive capacities. The target workloads for QLC-based SSDs are sequential read-intensive workloads. For such workloads, QLC SSDs are an excellent cost-effective candidate for replacing 10K RPM HDDs.

Part number information

The following table lists the ThinkSystem part numbers.

Table 1. ThinkSystem ordering information

Part number	Feature	Description
2.5-inch hot-swap drives		
4XB7A38185	B9AC	ThinkSystem 2.5" 5210 960GB Entry SATA 6Gb Hot Swap QLC SSD
4XB7A38144	B7EW	ThinkSystem 2.5" 5210 1.92TB Entry SATA 6Gb Hot Swap QLC SSD
4XB7A38145	B7EX	ThinkSystem 2.5" 5210 3.84TB Entry SATA 6Gb Hot Swap QLC SSD
4XB7A38146	B7EY	ThinkSystem 2.5" 5210 7.68TB Entry SATA 6Gb Hot Swap QLC SSD

Features

The 5210 Entry SATA SSDs have the following features:

- Industry standard 2.5-inch form factor
- New generation 64-layer 3D QLC NAND flash memory
- Suitable for read-intensive sequential workloads with larger block sizes
- 6 Gbps SATA host interface
- High reliability and enhanced ruggedness
- 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

Endurance

SSDs have a huge but finite number of program/erase (P/E) cycles, which affect how long they can perform write operations and thus their life expectancy. Entry SSDs typically have a better cost per read IOPS ratio but lower endurance and performance compared to Mainstream or Performance SSDs. 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 total bytes written (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. However, 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 1.92TB drive has an endurance of 700 TB of total bytes written (TBW) with 4KB random writes. This means that for full operation over five years, write workload must be limited to no more than 384 GB of 4K random writes per day, which is equivalent to 0.2 full drive writes per day (DWPD). For the device to last three years, the drive write workload must be limited to no more than 639 GB of writes per day, which is equivalent to 0.3 full drive writes per day.

The endurance of the 5210, like other NAND-based solid-state drives, varies depending on the workload. The value of the 5210 SSDs is best achieved when the drives are matched with read-intensive workloads with large-block sequential data access. For example, if all write operations are sequential and in 128KB blocks, the drives can support 0.8 total drive writes per day, which equates to 6,142 GB of data writes per day in the case of the 7.68TB drive option.

The key factors in determining drive endurance are the read/write mix, whether the writes are sequential or random, and the block size. The following tables (Part 1 and Part 2) show the different endurance values of the 5210 drives, based on the workload.

Table 2. Endurance by workload (part 1)

	GB Writes Per Day				Drive Writes Per Day (DWPD)			
Capacity	**960GB**	**1.92TB**	**3.84TB**	**7.68TB**	**960GB**	**1.92TB**	**3.84TB**	**7.68TB**
100% 128KB seq. writes	768 GB	1534 GB	3068 GB	6142 GB	0.8	0.8	0.8	0.8
90% 128KB seq. writes + 10% 4KB random writes	682 GB	1373 GB	2395 GB	4318 GB	0.71	0.72	0.62	0.56
80% 128KB seq. writes + 20% 4KB random writes	624 GB	1258 GB	2137 GB	3019 GB	0.65	0.66	0.56	0.39
70% 128KB seq. writes + 30% 4KB random writes	538 GB	1079 GB	1573 GB	2082 GB	0.56	0.56	0.41	0.27
50% 128 seq. writes + 50% 4KB random writes	413 GB	838 GB	964 GB	1192 GB	0.43	0.44	0.25	0.16
100% 16KB random writes	192 GB	384 GB	748 GB	1498 GB	0.2	0.2	0.2	0.2
100% 8KB random writes	192 GB	384 GB	690 GB	767 GB	0.2	0.2	0.18	0.1
100% 4KB random writes	192 GB	384 GB	345 GB	384 GB	0.2	0.2	0.09	0.05

Table 3. Endurance by workload (Part 2)

	Total Bytes Written (TBW)			
Capacity	**960GB**	**1.92TB**	**3.84TB**	**7.68TB**
100% 128KB seq. writes	1400 TB	2800 TB	5600 TB	11210 TB
90% 128KB seq. writes + 10% 4KB random writes	1240 TB	2505 TB	4370 TB	7880 TB
80% 128KB seq. writes + 20% 4KB random writes	1135 TB	2295 TB	3900 TB	5510 TB
70% 128KB seq. writes + 30% 4KB random writes	980 TB	1970 TB	2870 TB	3800 TB
50% 128 seq. writes + 50% 4KB random writes	750 TB	1530 TB	1760 TB	2175 TB
100% 16KB random writes	350 TB	700 TB	1366 TB	2733 TB
100% 8KB random writes	350 TB	700 TB	1260 TB	1400 TB
100% 4KB random writes	350 TB	700 TB	630 TB	700 TB

Technical specifications

The following table lists the technical specifications for the 5210 Entry SATA SSDs.

Table 4. Technical specifications

Feature	960GB drive	1.92 TB drive	3.84 TB drive	7.68 TB drive
Interface	6 Gbps SATA	6 Gbps SATA	6 Gbps SATA	6 Gbps SATA
Capacity	960 GB	1.92 TB	3.84 TB	7.68 TB
Endurance (drive writes per day)*	0.2 DWPD	0.2 DWPD	0.09 DWPD	0.05 DWPD
Endurance (total bytes written)*	350 TB	700 TB	630 TB	700 TB
Data reliability	< 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)	40,000	70,000	83,000	90,000
IOPS writes (4 KB blocks)	1,200	2,000	2,000	2,000
Sequential read rate (128 KB blocks)	540 MBps	540 MBps	540 MBps	540 MBps
Sequential write rate (128 KB blocks)	70 MBps	165 MBps	265 MBps	355 MBps
Read latency (seq)	310 µs	310 µs	500 µs	540 µs
Write latency (seq)	530 µs	530 µs	530 µs	530 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	3.13 G_{RMS} (5-800 Hz)	3.13 G_{RMS} (5-800 Hz)	3.13 G_{RMS} (5-800 Hz)	3.13 G_{RMS} (5-800 Hz)
Typical power (R / W)	2.8 W / 3.9 W	2.8 W / 3.9 W	2.8 W / 6.3 W	2.8 W / 6.3 W

* Based on 100% 4K random writes; Larger block sizes and sequential writes provide greater endurance, as listed in the table in the Endurance section

Server support

The following tables list the ThinkSystem servers that are compatible.

Table 5. ThinkSystem server support (Part 1)

		Intel 2S								AMD			
Part number	**Description**	**ST550 (7X09/7X10)**	**SR530 (7X07/7X08)**	**SR550 (7X03/7X04)**	**SR570 (7Y02/7Y03)**	**SR590 (7X98/7X99)**	**SR630 (7X01/7X02)**	**SR650 (7X05/7X06)**	**SR670 (7Y36/37/38)**	**SR635 (7Y98/7Y99)**	**SR655 (7Y00/7Z01)**	**SR645 (7D2Y/7D2X)**	**SR665 (7D2W/7D2V)**
4XB7A38185	ThinkSystem 2.5" 5210 960GB Entry SATA 6Gb Hot Swap QLC SSD	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
4XB7A38144	ThinkSystem 2.5" 5210 1.92TB Entry SATA 6Gb Hot Swap QLC SSD	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
4XB7A38145	ThinkSystem 2.5" 5210 3.84TB Entry SATA 6Gb Hot Swap QLC SSD	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
4XB7A38146	ThinkSystem 2.5" 5210 7.68TB Entry SATA 6Gb Hot Swap QLC SSD	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y

Table 6. ThinkSystem server support (Part 2)

		E	1S Intel				4S Intel						Dense/ Blade			
Part number	**Description**	**SE350 (7Z46/7D1X)**	**ST50 (7Y48/7Y50)**	**ST250 (7Y45/7Y46)**	**SR150 (7Y54)**	**SR250 (7Y51/7Y52)**	**SR850 (7X18/7X19)**	**SR850P (7D2F/7D2G)**	**SR860 (7X69/7X70)**	**SR950 (7X11/12/13)**	**SR850 V2 (7D31/32/33)**	**SR860 V2 (7Z59/7Z60)**	**SD530 (7X21)**	**SD650 (7X58)**	**SN550 (7X16)**	**SN850 (7X15)**
4XB7A38185	ThinkSystem 2.5" 5210 960GB Entry SATA 6Gb Hot Swap QLC SSD	N	N	Y	N	Y	Y	Y	Y	Y	N	N	N	N	Y	Y
4XB7A38144	ThinkSystem 2.5" 5210 1.92TB Entry SATA 6Gb Hot Swap QLC SSD	N	N	N	N	N	Y	Y	Y	Y	N	N	Y	N	Y	Y
4XB7A38145	ThinkSystem 2.5" 5210 3.84TB Entry SATA 6Gb Hot Swap QLC SSD	N	N	N	N	N	Y	Y	Y	Y	N	N	Y	N	Y	Y
4XB7A38146	ThinkSystem 2.5" 5210 7.68TB Entry SATA 6Gb Hot Swap QLC SSD	N	N	N	N	N	Y	Y	Y	Y	N	N	Y	N	Y	Y

Operating system support

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 propduct guide for more information:

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

Warranty

The 5210 Entry SATA 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 drives have the following physical specifications (approximate, without the tray):

- Height: 7 mm (0.3 in.)
- Width: 70 mm (2.8 in.)
- Depth: 100 mm (4.0 in.)
- Weight: 70 g (2.5 oz)

Operating environment

The SSDs are supported in the following environment:

- Operating temperature: 0 to 70°C (32 to 158°F)
- Non-operating temperature: -40 to 85°C (-40 to 185°F)
- Relative humidity: 5 to 95% (non-condensing)

Agency approvals

The 5210 Entry SATA SSDs conform to the following regulations:

- Micron Green Standard
- Built with sulfur resistant resistors
- CE (Europe): EN 55032 Class B, RoHS
- FCC: CFR Title 47, Part 15 Class B
- UL: UL-60950-1, 2nd Edition
- BSMI (Taiwan): approval to CNS 13438
- RCM (Australia, New Zealand): AS/NZS CISPR32 Class B
- KCC RRL (Korea): approval to KN 32 Class B, KN 35 Class B
- W.E.E.E.: Compliance with EU WEEE directive 2002/96/EC.
- TUV (Germany): approval to IEC60950/EN60950
- VCCI (Japan): 2015-04 Class B
- IC (Canada): CISPR32 Class B: Canadian ICES-003:2016

Related publications and links

For more information, see the following documents:

- Technical Solution Brief: Accelerate SQL Analytics Workloads by 10X
  https://en.resources.lenovo.com/whitepapers/accelerate-sql-analytics-workloads-by-10x
- Technical Solution Brief: Accelerate NoSQL Databases by up to 9X
  https://en.resources.lenovo.com/whitepapers/accelerate-nosql-databases-by-up-to-9x
- Technical Solution Brief: Accelerate Oracle Database 12c Enterprise by 3.8X
  https://en.resources.lenovo.com/whitepapers/accelerate-oracle-database-12c-enterprise-by-3-8x
- Technical Solution Brief: Rapid Business-Critical, Encrypted Record Storage and Retrieval
  https://en.resources.lenovo.com/whitepapers/rapid-business-critical-encrypted-record-storage-and-retrieval
- Lenovo ThinkSystem storage options product web page
  https://lenovopress.com/lp0761-storage-options-for-thinksystem-servers
- Micron 5210 series product page
  https://www.micron.com/products/solid-state-drives/product-lines/5210
- Micron 5210 Technical Brief
  https://www.micron.com/solutions/technical-briefs/micron-5210-ion-ssd
- ServerProven support
  http://www.lenovo.com/us/en/serverproven
- Lenovo RAID Introduction
  https://lenovopress.com/lp0578-lenovo-raid-introduction
- Lenovo RAID Management Tools and Resources
  https://lenovopress.com/lp0579-lenovo-raid-management-tools-and-resources

Related product families

Product families related to this document are the following:

- Drives

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This document, LP1223, was created or updated on December 8, 2020.

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