

ThinkSystem Kioxia CM5-V Mainstream NVMe PCIe 3.0 x4 Flash Adapters

Product Guide

The ThinkSystem Kioxia CM5-V Mainstream NVMe Flash Storage Adapters in capacities from 1.6 TB to 6.4 TB are advanced data center PCIe add-in cards optimized for mixed read-write performance, endurance, and strong data protection for Lenovo servers. They are engineered for greater performance and endurance in a cost-effective design, and to support a broader set of workloads.

Suggested uses: Data warehousing, Web servers, Media streaming, and Video on Demand (VOD).



Figure 1. ThinkSystem HHL Kioxia CM5-V Mainstream NVMe PCIe 3.0 x4 Flash Adapter

Did you know?

NVMe (Non-Volatile Memory Express) is a technology that overcomes SAS/SATA SSD performance limitations by optimizing hardware and software to take full advantage of flash technology. The use of NVMe Flash Storage Adapters means data is transferred more efficiently from the processor to the storage compared to the legacy Advance Host Controller Interface (AHCI) stack, thereby reducing latency and overhead. These Flash Storage Adapters connect directly to the processor via the PCIe bus, further reducing latency and TCO compared to SAS/SATA SSDs.

Lenovo Enterprise Mainstream Flash Adapters are suitable for mixed read-write and general-purpose data center workloads, however their NVMe PCIe interface means the adapters also offer high performance. Overall, these adapters provide outstanding IOPS/watt and cost/IOPS for enterprise solutions.

Part number information

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

Table 1. Part numbers and feature codes for ThinkSystem

Part number	Feature code	Description
4XB7A38240	BCGL	ThinkSystem HHHH Kioxia CM5-V 6.4TB Mainstream NVMe PCIe3.0 x4 Flash Adapter

The part numbers include the following items:

- One adapter with full-height (3U) PCIe bracket attached
- Separate low-profile (2U) PCIe bracket
- Documentation

Features

Non-Volatile Memory Express (NVMe) is new PCIe 3.0 high performance solid-state storage technology that provides high I/O throughput and low latency. NVMe interfaces remove SAS/SATA bottlenecks and unleash all of the capabilities of contemporary NAND flash memory. Each Flash Storage Adapter has direct PCIe 3.0 x4 connection, which provides at least 2x more bandwidth and 2x less latency than SATA/SAS-based SSD solutions. NVMe Flash Storage Adapters are also optimized for heavy multi-threaded workloads by using internal parallelism and many other improvements, such as enlarged I/O queues.

The ThinkSystem Kioxia CM5-V Mainstream NVMe PCIe 3.0 x4 Flash Adapters have the following features:

- Half-high half-length PCIe adapter with PCIe 3.0 x4 host interface
- Based on the Kioxia KCM51V4C add-in cards
- Third Generation BiCS 3D NAND 64 layer TLC
- 3 drive-write-per-day (DWPD) SSD for mixed read-write workloads
- Full Power-Loss-Protection and End-to-End Data Protection
- Low power consumption (maximum 18 W)

Mainstream Flash Adapters and Performance Flash Adapters have similar read IOPS performance, but the key difference between them is their endurance (or lifetime) (that is, how long they can perform write operations because Flash Adapters (like SSDs) have a finite number of program/erase (P/E) cycles). Mainstream Flash Adapters have a better cost/IOPS ratio but lower endurance compared to Performance Flash Adapters. Write endurance is typically measured by the number of program/erase (P/E) cycles that the adapter incurs over its lifetime, listed as the total bytes of written data (TBW) in the device specification.

The TBW value assigned to a Flash Adapter is the total bytes of written data (based on the number of P/E cycles) that an adapter can be guaranteed to complete (% of remaining P/E cycles = % of remaining TBW). Reaching this limit does not cause the adapter to immediately fail. It simply denotes the maximum number of writes that can be guaranteed. A Flash Adapter will not fail upon reaching the specified TBW. At some point based on manufacturing variance margin, after surpassing the TBW value, the adapter will reach the end-of-life point, at which the adapter will go into a read-only mode.

Because of such behavior by Mainstream Flash Adapters, careful planning must be done to use them only in mixed read-write environments to ensure that the TBW of the adapter will not be exceeded before the required life expectancy.

For example, the 3.2 TB adapter has an endurance of 17,520 TB of total bytes written (TBW). This means that for full operation over five years, write workload must be limited to no more than 9.6 TB of writes per day, which is equivalent to 3.0 full drive writes per day (DWPD). For the device to last three years, the write workload must be limited to no more than 16 TB of writes per day, which is equivalent to 5.0 full drive writes per day.

Technical specifications

The following table presents technical specifications for the ThinkSystem Kioxia CM5-V Mainstream NVMe PCIe 3.0 x4 Flash Adapters.

Table 2. Technical specifications

Feature	1.6 TB adapter	3.2 TB adapter	6.4 TB adapter
Lenovo part number	4XB7A38234	4XB7A38237	4XB7A38240
Kioxia model number	KCM51V4C1T60	KCM51V4C3T20	KCM51V4C6T40
Host interface	PCIe 3.0 x4	PCIe 3.0 x4	PCIe 3.0 x4
Capacity	1.6 TB	3.2 TB	6.4 TB
Endurance (total bytes written)	8,760 TB	17,520 TB	35,040 TB
Endurance (drive writes per day for 5 years)	3.0 DWPD	3.0 DWPD	3.0 DWPD
Data reliability (UBER)	< 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)	657,000	718,000	718,000
IOPS writes (4 KB blocks)	130,000	121,000	117,000
Sequential read rate (128 KB blocks)	3122 MBps	3119 MBps	3120 MBps
Sequential write rate (128 KB blocks)	2489 MBps	3047 MBps	3070 MBps
Latency (random read)	106 µs	106 µs	106 µs
Latency (random write)	10 µs	10 µs	10 µs
Maximum power	13 W	15 W	16 W

Server support

The following tables list the ThinkSystem servers that are compatible.

Table 3. Server support (Part 1 of 2)

Part Number	Description	Edge		1S Intel V2		2S Intel V2				AMD			Dense V2			4S V2	8S				
		SE350 (7Z46 / 7D1X)	SE450 (7D8T)	ST50 V2 (7D8K / 7D8J)	ST250 V2 (7D8G / 7D8F)	SR250 V2 (7D7R / 7D7Q)	ST650 V2 (7Z75 / 7Z74)	SR630 V2 (7Z70 / 7Z71)	SR650 V2 (7Z72 / 7Z73)	SR670 V2 (7Z22 / 7Z23)	SR635 (7Y98 / 7Y99)	SR655 (7Y00 / 7Z01)	SR645 (7D2Y / 7D2X)	SR665 (7D2W / 7D2V)	SD630 V2 (7D1K)	SD650 V2 (7D1M)	SD650-N V2 (7D1N)	SN550 V2 (7Z69)	SR850 V2 (7D31 / 7D32)	SR860 V2 (7Z59 / 7Z60)	SR950 (7X11 / 7X12)
4XB7A38240	ThinkSystem HHHL Kioxia CM5-V 6.4TB Mainstream NVMe PCIe3.0 x4 Flash Adapter	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y

Table 4. Server support (Part 2 of 2)

Part Number	Description	1S Intel V1				2S Intel V1						Dense V1			4S V1					
		ST50 (7Y48 / 7Y50)	ST250 (7Y45 / 7Y46)	SR150 (7Y54)	SR250 (7Y52 / 7Y51)	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)	SR850 (7X18 / 7X19)	SR850P (7D2F / 2D2G)	SR860 (7X69 / 7X70)
4XB7A38240	ThinkSystem HHHL Kioxia CM5-V 6.4TB Mainstream NVMe PCIe3.0 x4 Flash Adapter	N	N	N	N	N	N	N	Y	Y	Y	Y	N	Y	N	N	N	Y	N	Y

Operating system support

The following tables list the supported operating systems for each part number:

- [ThinkSystem HHHL Kioxia CM5-V 6.4TB Mainstream NVMe PCIe3.0 x4 Flash Adapter, 4XB7A38240](#)

Tip: These tables are automatically generated based on data from [Lenovo ServerProven](#).

Table 5. Operating system support for ThinkSystem HHHL Kioxia CM5-V 6.4TB Mainstream NVMe PCIe3.0 x4 Flash Adapter, 4XB7A38240

Operating systems	SR635	SR655	SD530 (Gen 2)	SR570 (Gen 2)	SR590 (Gen 2)	SR630 (Gen 2)	SR650 (Gen 2)	SR850 (Gen 2)	SR860 (Gen 2)	SR950 (Gen 2)	SD530 (Gen 1)	SR570 (Gen 1)	SR590 (Gen 1)	SR630 (Gen 1)	SR650 (Gen 1)	SR850 (Gen 1)	SR860 (Gen 1)	SR950 (Gen 1)
Microsoft Windows 10	N	Y ¹⁵	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Microsoft Windows 11	N	Y ¹⁵	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Microsoft Windows Server 2012 R2	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Microsoft Windows Server 2016	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Microsoft Windows Server 2019	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Microsoft Windows Server 2022	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 6.10	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 6.9	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 7.3	N	N	N	N	N	N	N	N	N	N	Y	N	N	Y	Y	Y	N	Y
Red Hat Enterprise Linux 7.4	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 7.5	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 7.6	Y ¹	Y ¹⁶	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 7.7	Y ²	Y ¹⁷	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 7.8	Y ³	Y ³	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 7.9	Y ⁴	Y ¹⁸	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 8.0	Y ⁵	Y ¹⁹	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 8.1	Y ⁶	Y ²⁰	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 8.2	Y ⁷	Y ²¹	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 8.3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 8.4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 8.5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 8.6	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 9.0	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 11 SP4	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 12 SP2	N	N	N	N	N	N	N	N	N	N	Y	N	N	Y	Y	Y	N	Y
SUSE Linux Enterprise Server 12 SP2 with Xen	N	N	N	N	N	N	N	N	N	N	Y	N	N	Y	N	Y	N	Y
SUSE Linux Enterprise Server 12 SP3	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 12 SP3 with Xen	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 12 SP4	Y ⁸	Y ⁸	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 12 SP4 with Xen	Y ⁹	Y ⁹	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 12 SP5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 12 SP5 with Xen	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 15	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 15 SP1	Y ¹⁰	Y ¹⁰	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 15 SP1 with Xen	Y ¹¹	Y ²²	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Operating systems	SR635	SR655	SD530 (Gen 2)	SR570 (Gen 2)	SR590 (Gen 2)	SR630 (Gen 2)	SR650 (Gen 2)	SR850 (Gen 2)	SR860 (Gen 2)	SR950 (Gen 2)	SD530 (Gen 1)	SR570 (Gen 1)	SR590 (Gen 1)	SR630 (Gen 1)	SR650 (Gen 1)	SR850 (Gen 1)	SR860 (Gen 1)	SR950 (Gen 1)
SUSE Linux Enterprise Server 15 SP2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 15 SP2 with Xen	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 15 SP3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 15 SP3 with Xen	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 15 SP4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 15 SP4 with Xen	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 15 with Xen	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ubuntu 22.04 LTS	Y	Y	N	N	N	Y	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 6.0 U3	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 6.5	N	N	N	N	N	N	N	N	N	N	Y	N	N	Y	Y	Y	N	Y
VMware vSphere Hypervisor (ESXi) 6.5 U1	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 6.5 U2	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 6.5 U3	Y ¹²	Y ²³	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 6.7	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 6.7 U1	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 6.7 U2	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 6.7 U3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 7.0	Y ¹³	Y ²⁴	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 7.0 U1	Y ¹⁴	Y ²⁵	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 7.0 U2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 7.0 U3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 8.0	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

¹ RHEL 7.6 Not support with EPYC 7003 processors.
² RHEL7.7 Not support with EPYC 7003 processors.
³ RHEL7.8 Not support with EPYC 7003 processors
⁴ RHEL7.9 Not support with EPYC 7003 processors.
⁵ RHEL8.0 Not support with EPYC 7003 processors.
⁶ RHEL8.1 Not support with EPYC 7003 processors.
⁷ RHEL8.2 Not support with EPYC 7003 processors.
⁸ SLES12 SP4 Not support with EPYC 7003 processors
⁹ SLES12 SP4 Xen Not support with EPYC 7003 processors
¹⁰ SLES15 SP1 Not support with EPYC 7003 processors
¹¹ SLES15 SP1 Xen Not support with EPYC 7003 processors.
¹² VMware 6.5 U3 Not support with EPYC 7003 processors.

- ¹³ VMware 7.0 Not support with EPYC 7003 processors.
- ¹⁴ VMware 7.0 U1 Not support with EPYC 7003 processors.
- ¹⁵ ISG will not sell/preload this OS, but compatibility and cert only.
- ¹⁶ RHEL 7.6 Not support with EPYC 7003 processors
- ¹⁷ RHEL7.7 Not support with EPYC 7003 processors
- ¹⁸ RHEL7.9 Not support with EPYC 7003 processors
- ¹⁹ RHEL8.0 Not support with EPYC 7003 processors
- ²⁰ RHEL8.1 Not support with EPYC 7003 processors
- ²¹ RHEL8.2 Not support with EPYC 7003 processors
- ²² SLES15 SP1 Xen Not support with EPYC 7003 processors
- ²³ VMware 6.5 U3 Not support with EPYC 7003 processors
- ²⁴ VMware 7.0 Not support with EPYC 7003 processors
- ²⁵ VMware 7.0 U1 Not support with EPYC 7003 processors

Warranty

The adapters carry a one-year, customer-replaceable unit (CRU) limited warranty. When the adapters are installed in a supported server, these drives assume the server'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 adapters have the following physical specifications:

- Height: 69 mm (2.7 in.)
- Length: 168 mm (6.6 in.)
- Depth: 19 mm (0.74 in.)
- Weight: 220 g (7.8 oz)

Operating environment

The adapters are supported in the following environment:

- Temperature:
 - Operating: 0 to 50 °C (32 to 122 °F)
 - Non-operating: -40 to 70 °C (-40 to 158 °F)
 - Transport: -40 to 70 °C (-40 to 158 °F)
- Relative humidity: 5 to 95% (non-condensing)
- Maximum altitude:
 - Operating: 5,486 m (18,000 ft)
 - Non-operating: 12,192 m (40,000 ft)
- Shock: 400 G (Max) at 2 ms
- Vibration: 2.17 G_{RMS} (5-800 Hz)

Agency approvals

The adapters conform to the following regulations:

- Underwriters Laboratories: UL60950-1
- Canada: CAN/CSA-C22.2 No.60950-1
- TUV: EN 60950-1
- BSMI (Taiwan): CNS 13438 (CISPR Pub. 22 Class B): D33003
- MSIP: KN22, KN24 (CISPR Pub. 22 Class B)
- Australia/New Zealand: AS/NZS CISPR32:2015 Class B
- Canada: ICES-003 Issue 6 Class B
- EMC: EN55022 (2010) Class B
- EMC: EN55024 (2010)
- RoHS 2011/65/EU: EN50581 (2012) Category 3

Related publications and links

For more information, see the following documents:

- Lenovo ThinkSystem storage options product web page
<https://lenovopress.com/lp0761-storage-options-for-thinksystem-servers>
- Lenovo ServerProven compatibility
<http://www.lenovo.com/us/en/serverproven/>
- Kioxia CM5-V Add In Card product page:
<https://business.kioxia.com/en-us/ssd/enterprise-ssd/cm5-v-series-aic.html>

Related product families

Product families related to this document are the following:

- [PCIe Flash Adapters](#)

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