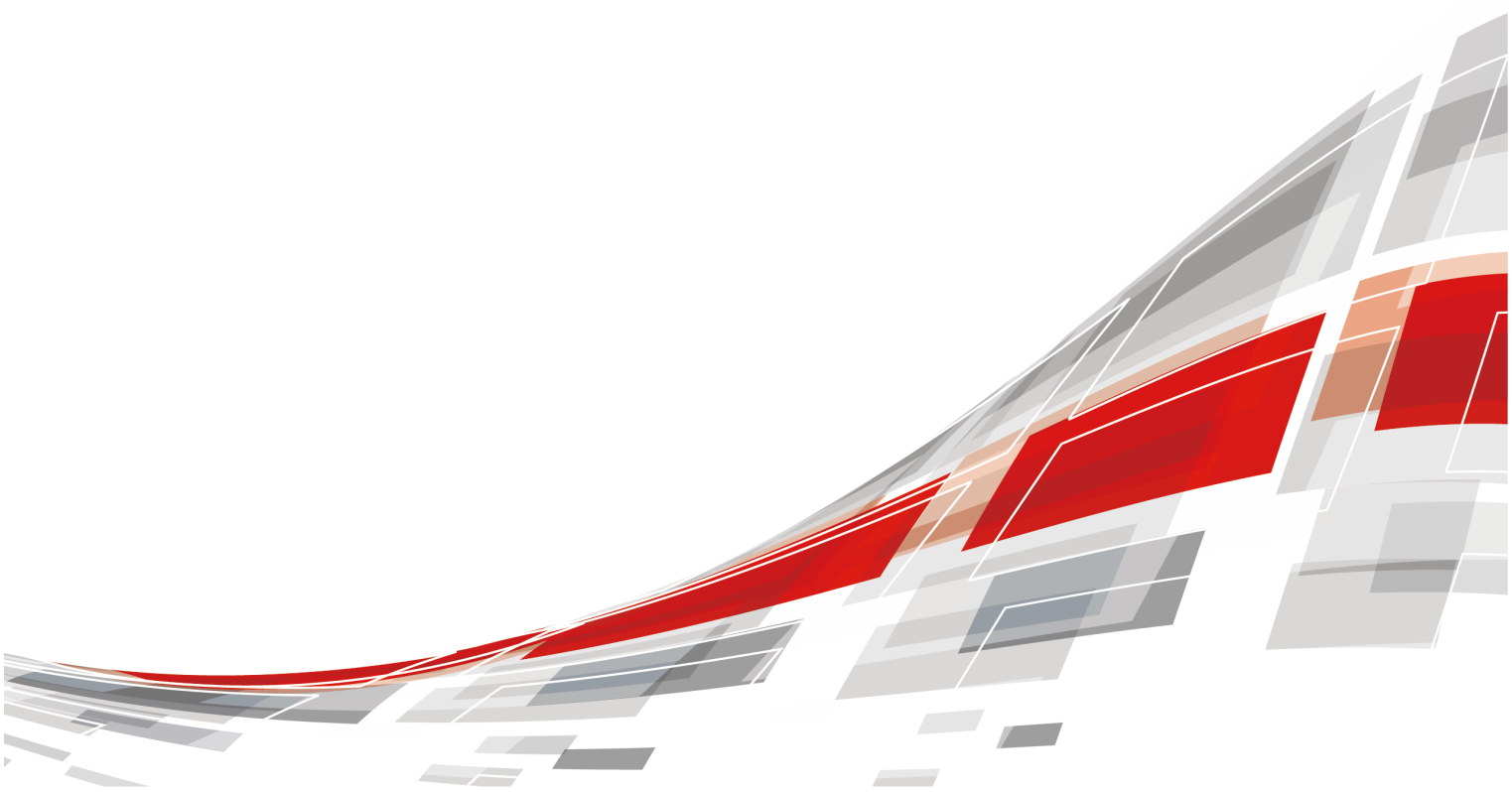
EP500, EP600 NVMe PCIe SSD

Technical White Paper

Issue 02

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About This Document

Purpose

This document describes the system design, features, and specifications of the EP500 and EP600 new-generation NVMe PCIe solid-state drives (SSDs) (EP500 and EP600 for short) so that users can have a thorough understanding of the EP500 and EP600.

Intended Audience

This document (this guide) is intended for:

- Technical support engineers
- Maintenance engineers
- Users

Symbol Conventions

The symbols that may be found in this document are defined as follows:

Symbol	Description
DANGER	Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results. NOTICE is used to address practices not related to personal injury.

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Symbol	Description
NOTE	Supplements the important information in the main text. NOTE is used to address information not related to personal injury, equipment damage, and environment deterioration.

Change History

Issue	Release Date	Description
02	2023-02-08	Update **4.1 Basic Specifications**.
01	2022-06-01	This issue is the first official release.

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1 Introduction

1.1 Overview

1.2 System Design

1.1 Overview

The EP500 series and EP600 series are enterprise-level SSDs with the latest 128-layer 3D eTLC NAND and dedicated enterprise-level controllers. An SSD supports up to 7.68 TB capacity. In an era of digital transformation and data explosion, enterprise users pose higher and higher requirements on performance in various application scenarios. Specifically, they require for high IOPS, low latency, and high consistency to achieve rapid data access. For example, online transaction processing (OLTP) requires real-time processing of original data and seeks to increase the number of transactions per unit time by paralleling queries and minimizing response times. Online analytical processing (OLAP) assists users in making business decisions through complicated analysis on data queries. In addition, more and more applications pose higher requirements on the storage performance of servers, such as high performance computing (HPC), cloud computing, and virtual desktop infrastructure (VDI). The EP500 series and EP600 provide enterprises and data centers with complete solutions with higher performance, lower power consumption, and easier maintenance.

As enterprise-level storage and acceleration components, the EP500 and EP600 feature powerful performance, rapid response, and high reliability, greatly improving the storage I/O performance. Compatible with mainstream operating systems (OSs) and virtual OSs, the EP500 and EP600 enhance performance of various applications, such as databases, virtualization, HPC, and searching, helping customers reduce the total cost of ownership (TCO).

The EP500 and EP600 use PCIe 4.0 x4 data ports. The details are as follows:

- EP500 series: standard 2.5-inch SSDs with SFF-8639 connectors.

  The EP500 series fits into read-intensive application scenarios.
- EP600 series: standard 2.5-inch SSDs with SFF-8639 connectors.

  The EP600 series fits into application scenarios that feature mixed reads and writes.

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The EP500 and EP600 provide products with extensive single-SSD capacities and various specifications for different application scenarios.

- The EP500 series for read-intensive applications provides the following single-SSD capacities: 1920 GB, 3840 GB, and 7680 GB.
- The EP600 series for applications with mixed reads and writes provides the following single-SSD capacities: 1600 GB, 3200 GB, and 6400 GB.

Figure 1-1 and **Figure 1-2** show the appearance of the EP500 and that of the EP600.

Figure 1-1 EP500 appearance



Figure 1-2 EP600 appearance



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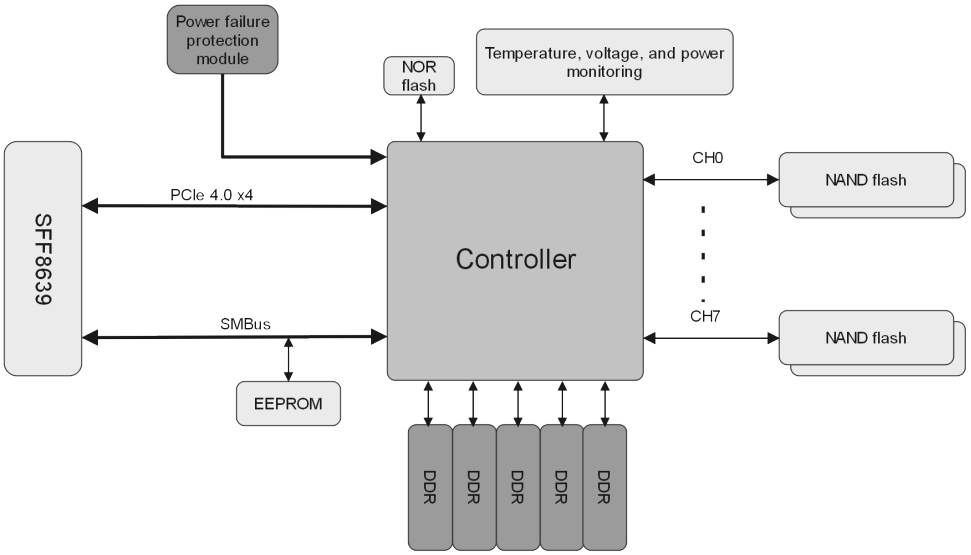
1.2 System Design

The system design of the EP500 and EP600 has the following features:

- Uses enterprise-level SSD controller. The system design fully digs out the potential of the SSD controller and the NAND flash. The controller is an ASIC controller based on the enterprise SSD flash translation layer (FTL) algorithm and low-density parity-check (LDPC) error correcting algorithm, supporting the NVMe 1.4 specification and featuring high performance and low power consumption.
- Enhances device management functions. The standard NVMe interface features eliminate the need for drivers built in OSs and allows the SSD to serve as an OS drive. Comprehensive hot swap functions realize easy maintenance. Out-of-band management functions comply with the NVMe specification and work with servers to enable intelligent monitoring of device health status.

Figure 1-3 shows the system architecture of the EP500 and EP600.

Figure 1-3 EP500 and EP600 system architecture



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2 Product Features

2.1 Performance

2.2 Reliability

2.3 Maintainability

2.1 Performance

- Uses enterprise-level SSD controllers with high performance and low power consumption.
- Supports NVMe 1.3a specification and uses the multi-queue I/O technology to improve the SSD performance and quality of service (QoS).

2.2 Reliability

- End-to-end data protection: allows users to protect data through the DIF domain, and verifies data during data transmission between modules within the SSD.
- Embedded intelligent RAID-like algorithm: restores data after a media data error occurs through computing using RAID-like algorithms based on flash dies.
- Enhanced LDPC error correction algorithm: provides a higher error correction capability than that required by flash memory chips, ensuring data reliability.
- Advanced flash memory access technology: combines the read retry and adaptive read technologies of flash memory chips to ensure data reliability.
- Data inspection technology: periodically inspects data and prevent errors.
- Intelligent wear leveling algorithm: intelligently levels the flash memory wear to prolong SSD service life.
- Multiple backups of metadata: keeps dual backups for and conducts consistency check on key metadata such as that of the booting firmware and NAND flash.
- Power failure protection: ensures that data on the SSD is not lost when a power failure occurs on the server.
- Temperature control: monitors the temperature through multiple temperature sensors and protects data by reducing the read and write speeds based on the temperature of components such as CPUs and the NAND flash memory.

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- Data encryption: provides a mechanism that encrypts data when it is written to the SSD and decrypts data when it is read from the SSD. The controllers support AES-256 hardware encryption.
- Eight-level power consumption management: provides eight performance gears to adapt to different power consumption levels (6 W to 14 W). Users can change the performance gear using simple commands which take effect immediately after execution.
- Online firmware upgrade: completes firmware upgrade within seconds without interrupting services. The upgrade takes effect right upon completion.
- Up to 1600 MT/s NAND interface rate.

2.3 Maintainability

- Supports in-band online upgrade to facilitate routine maintenance.
- Provides extensive management functions based on command-line interface (CLI) to facilitate daily device maintenance. Allows users to manage devices by accessing out-of-band channels and shows device information, including models, capacities, temperature, service life, and health status, on GUI.
- Supports log query, allowing users to monitor the health status of the product.
- Provides a standard NVMe CLI tool that enables users to conveniently obtain relevant logs with thorough failure analysis.

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3 Appearance and Mechanical Structure

3.1 Appearance

3.2 Mechanical Structure

3.1 Appearance

The EP500 and EP600 are standard 2.5-inch SSDs. They can be installed in general-purpose servers such as rack servers.

Figure 3-1 Front view of the EP500 or EP600 in a drive carrier



The EP500 and EP600 show the operating status through indicators on the drive carriers. The amber/blue indicator in **Figure 3-1** is the Fault indicator, and the green indicator is the Activity indicator. The color of the indicator is closely related to the design of the disk enclosure indicators. **Table 3-1** describes the defined indicator status when an EP500 or EP600 is used in a server.

Table 3-1 SSD indicator status definition

Activity Indicator (Green)	Fault Indicator (Amber/Blue)	Status
Off	Off	The NVMe SSD cannot be detected.
On	Off	The NVMe SSD is detected and operating properly.
Blinking at 2 Hz	Off	Data is being read from or written to the NVMe SSD.

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Activity Indicator (Green)	Fault Indicator (Amber/Blue)	Status
Off	Blinking at 2 Hz	The NVMe SSD is being hot inserted.
Off	Blinking at 0.5 Hz	The hot remove process has been completed and the NVMe SSD can be removed.
On/Off	On	The NVMe SSD is faulty.

3.2 Mechanical Structure

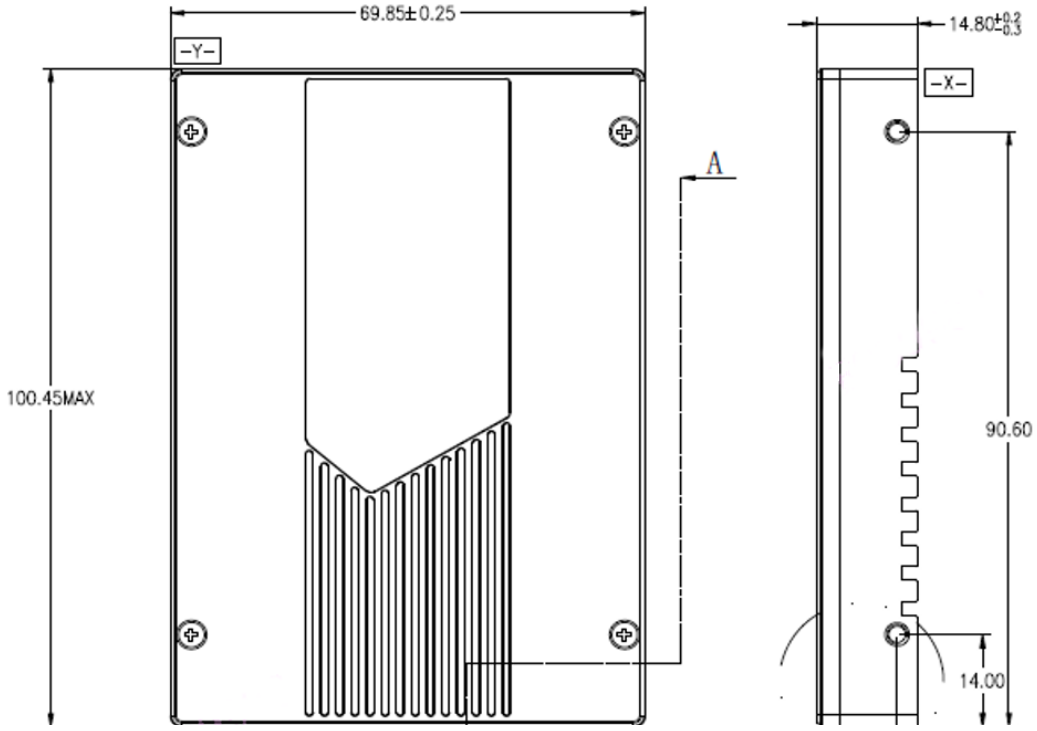
NOTE

All dimensions are in millimeters.

Table 3-2 Dimensions

X – Depth	Y – Width	Z – Height
100.2±0.25	69.85±0.25	14.8 + 0.2 or 14.8 - 0.3

Figure 3-2 SSD dimensions



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4 Specifications

4.1 Basic Specifications
4.2 Capacity
4.3 QoS
4.4 IOPS Consistency
4.5 Hot Swap
4.6 NVMe Feature
4.7 Operating Environment
4.8 Temperature Monitoring and OTP

4.1 Basic Specifications

4.1.1 EP500

Table 4-1 EP500 specifications[a] (LBA[b] format: 512 B)

Item	Specifications		
Model	XFSP4151T90000N	XFSP4153T80000N	XFSP4157T60000N
Capacity	1920 GB[c]	3840 GB	7680 GB
Form	2.5" drive	2.5" drive	2.5" drive
Port	PCIe 4.0	PCIe 4.0	PCIe 4.0
Flash chip type	X2 TLC	X2 TLC	X2 TLC

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Item	Specifications		
Sequential read bandwidth (MB/s)[d]	6500	6700	6300
Random 4 KB read input/ output operations per second (IOPS) (steady)[e]	740,000	1100,000	1000,000
Average read latency@1 QD (µs) [f]	85	85	85
Sequential write bandwidth (MB/s)	2650	4700	4700
Random 4 KB write IOPS (steady/ max.)[g]	100,000	180,000	200,000
Average write latency@1 QD (µs)	15	15	15
Lifetime random PB written (PBW)[h]	3.504 PB	7.008 PB	14.016 PB
Drive writes per day (JESD219)[i]	1	1	1
Power consumption (idle, active)[j]	5 W, 12 W	5 W, 14 W	5 W, 14 W
Weight (g)	< 120		
Power failure protection	Supported		
Chip failure protection	Supported		
Trim	Supported		

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Item	Specifications
Mean Time Between Failures (MTBF)	2 million hours
Annual failure rate (AFR)	≤ 0.44%
Uncorrectable bit error rate (UBER)	10^{-17}
Data retention period (power failure)[k]	3 months at 40°C (104°F)
Data retention period if new SSDs used as spare parts (power failure)[l]	12 months at 40ºC (104°F)

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Item	Specifications
Remarks: a: The performance specifications were tested at the maximum power. b: Logical block addressing (LBA) is a common mechanism for describing data blocks on storage devices. This mechanism is usually used on drives. In such a special simple linear addressing mechanism, an address block is indexed by an integer. For example, LBA 0 indicates the first block, LBA 1 indicates the second block, and the list goes on. c: 1 GB = 1,000,000,000 bytes. d: 1 MB/s = 1,000,000 bytes per second. The sequential read bandwidth was tested by using the FIO tool to sequentially read data with one thread, 512 queue depth (QD), and 128 KB (131,072 bytes) on the CentOS 7.0 system. The sequential write bandwidth was tested by using the similar method. e: The random 4 KB read IOPS (steady) was obtained by using the FIO tool to randomly read data in the steady state with eight threads, 128 QD, and 4 KB. f: µs = Microsecond. The average read latency was obtained by randomly reading data at one thread, one QD, and 4 KB. The average write latency was obtained by using the similar method. g: The result was obtained by randomly reading/writing data at four threads, 64 QD and 4 KB under the steady state using the FIO tool. h: 1 PB = 10^{15} bytes. The PBW was tested with 4 KB I/O size and 4 KB alignment. i: The DWPD was tested according to the JESD219 standard. An SSD can be used for five years if the DWDP stays below the specified value. Otherwise, the SDD service life will be affected. j: The active power consumption was tested with the maximum sequential write bandwidth. k: Data retention period after SSD power failure within the life cycle l: Data retention period after SSD power failure within the first 3% of the life cycle.	

4.1.2 EP600

Table 4-2 EP600 specifications[a] (LBA[b] format: 512 B)

Item	Specifications		
Model	XFSP4161T60000N	XFSP4163T20000N	XFSP4166T40000N
Capacity	1600 GB[c]	3200 GB	6400 GB
Form	2.5" drive	2.5" drive	2.5" drive
Port	PCIe 4.0	PCIe 4.0	PCIe 4.0
Flash chip type	X2 TLC	X2 TLC	X2 TLC

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Item	Specifications		
Sequential read bandwidth (MB/s)[d]	6500	6700	6300
Random 4 KB read input/output operations per second (IOPS) (steady)[e]	740,000	1100,000	1000,000
Average read latency@1 QD (µs) [f]	85	85	85
Sequential write bandwidth (MB/s)	2650	4700	4700
Random 4 KB write IOPS (steady) [g]	210,000	390,000	390,000
Average write latency@1 QD (µs)	14	14	14
Lifetime random PB written (PBW) [h]	8.76 PB	17.52 PB	35.04 PB
Drive writes per day (JESD219)[i]	3	3	3
Average power consumption (idle, active)[j]	5 W, 12 W	5 W, 14 W	5 W, 14 W
Weight (g)	< 120 g		
Power failure protection	Supported		
Chip failure protection	Supported		
Trim	Supported		
Mean Time Between Failures (MTBF)	2 million hours		
Annual failure rate (AFR)	≤ 0.44%		
Uncorrectable bit error rate (UBER)	10^{-17}		
Data retention period (power failure)[k]	3 months at 40ºC (104°F)		

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Item	Specifications
Data retention period if new SSDs used as spare parts (power failure)[I]	12 months at 40ºC (104°F)
For remarks, see those of the EP500.	

4.2 Capacity

Table 4-3 EP500 capacities

EP500	User Addressable Sectors in LBA Mode
1920 GB	3,750,748,848
3840 GB	7,501,476,528
7680 GB	15,002,931,888

Table 4-4 EP600 capacities

EP600	User Addressable Sectors in LBA Mode
1600 GB	3,125,627,568
3200 GB	6,251,233,968
6400 GB	12,502,446,768

NOTE

- The total available capacity of an SSD may be less than the total physical capacity since a small part of the physical capacity is used for NAND media management and maintenance. The JESD218B standard is used. Number of addressable logical blocks = 21168 + (1953504 x SSD capacity in gigabytes).
- 1 GB = 10^9 bytes. 1 sector=512 bytes. The displayed LBA count indicates the total storage capacity. The value remains the same during the SSD service life.

4.3 QoS

Table 4-5 EP500 QoS (LBA format: 512 B)

Specifications	Unit	EP500
		QD = 1

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		1920 GB	3840 GB	7680 GB
QoS (99%)				
Random 4 KB read[a]	µs	95	95	95
Random 4 KB write[a]	µs	32	32	32
Random 4 KB write[b]	ms	0.48	0.48	0.48
Random 4 KB write[b]	ms	8.2	5	5
QoS (99.99%)				
Random 4 KB read[a]	µs	100	100	100
Random 4 KB write[a]	µs	55	60	60
Random 4 KB read[b]	ms	0.7	0.7	0.7
Random 4 KB write[b]	ms	14	9	9
a: The result was tested using the FIO tool at one thread, 1 QD, and 4 KB on a random workload. b: The result was tested using the FIO tool at one thread, 128 QD, and 4 KB on a random workload.				

Table 4-6 EP600 QoS (LBA format: 512 B)

Specifications	Unit	EP600		
		QD = 1		
		1600 GB	3200 GB	6400 GB
QoS (99%)				
Random 4 KB read[a]	µs	95	95	95
Random 4 KB write[a]	µs	14	14	14
Random 4 KB read[b]	ms	0.48	0.48	0.48

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Random 4 KB write[b]	ms	4.4	0.8	0.8
QoS (99.99%)				
Random 4 KB read[a]	µs	100	100	100
Random 4 KB write[a]	µs	26	55	55
Random 4 KB read[b]	ms	0.7	0.7	0.7
Random 4 KB write[b]	ms	9	2	2
For remarks, see those of the EP500.				

4.4 IOPS Consistency

Table 4-7 EP500 IOPS consistency (LBA format: 512 B)

Specifications[a], [b]	Unit	EP500		
		1920 GB	3840 GB	7680 GB
Random 4 KB read (max.)[c]	%	95	95	95
Random 4 KB write (max.)[c]	%	90	90	90

Table 4-8 EP600 IOPS consistency (LBA format: 512 B)

Specifications[a], [b]	Unit	EP600		
		1600 GB	3200 GB	6400 GB
Random 4 KB read (max.)[c]	%	95	95	95
Random 4 KB write (max.)[c]	%	90	90	90

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NOTE

a: The IOPS was sampled per second during the performance test. The sampling data was sorted in descending order. The minimum IOPS in the first 99.9% data was compared with the average IOPS during the test. Measurements were performed on a full Logical Block Address (LBA) span of the drive once the workload reached the steady state.

b: IOPS consistency was tested by using the FIO tool to randomly read and write data at eight threads, 4 KB (4096 bytes_, and 128 QD on Linux CentOS 7.5. Measurements were performed on a full LBA span of the drive once the workload reached the steady state.

c: 4 KB = 4,096 bytes.

4.5 Hot Swap

Hot swap can be implemented in either of the following ways:

- Orderly hot swap: Users can directly insert an SSD when the OS is running, but need to notify the OS before removing an SSD.
- Surprise hot swap: Users can directly insert or remove an SSD.

  The EP500 and EP600 2.5-inch SSDs support both orderly hot swap and surprise hot swap.

NOTICE

Before performing surprise hot swap, ensure that the following conditions are met:

- The server where the SSD is installed supports surprise hot swap.
- The VMD function has been enabled in the BIOS.

4.6 NVMe Feature

The EP500 and EP600 SSDs support the NVMe 1.4 specification. In addition to basic features and mandatory commands, they also support the namespace feature (a maximum of 32 namespaces supported).

4.7 Operating Environment

Table 4-9 Application environment specifications

Item	Description
Product	EP500 and EP600
Temperature	Storage temperature: –40°C to +85°C (–40°F to +185°F) Operating temperature: 0°C to 70°C[a] (32°F to 158°F)

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Item	Description
Altitude	● Operating: –305 m to +4572 m (–1000.66 ft to 15,000 ft) ● Non-operating: –305 m to 12,192 m (–1000.66 ft to 39996.71 ft) **NOTE** The operating temperature decreases by 1°C (1.8°F) with every increase of 220 m (721.78 ft) from 1800 m (5905.47 ft). Working at an altitude above 3048 m (10,000 ft) will affect the reliability of the SSD.
Humidity	● Operating: 5% to 95% ● Non-operating: 5% to 95%
Shock	● Operating: 1000 G (max.) at 0.5 ms ● Non-operating: 1000 G (max.) at 0.5 ms
Vibration	● Operating: 3.1 GRMS (5 Hz to 800 Hz) max. ● Non-operating: 3.1 GRMS (5 Hz to 800 Hz) max.

4.8 Temperature Monitoring and OTP

An EP500 or EP600 SSD has three temperature sensors: the controller temperature sensor, board temperature sensor, and NAND flash temperature sensor.

It adopts a composite temperature monitoring policy, which is part of the NMVe health log (log identifier: 02h at bytes 1 and 2). This policy provides a composite temperature value that considers inputs from the controller temperature sensor, board temperature sensor, and NAND flash temperature sensor.

With the three temperature sensors on key components, the management system monitors temperature of key components in different environments for precise thermal management.

In addition, the 0X6Ah address stored in the SAMRT information allows the server that uses the SSD to read the temperature values from the SSD through the SMBUS for out-of-band management.

The Warning Composite Temperature Threshold (WCTEMP) suggested in the NVMe 1.4 specification is 70ºC(158°F).

The EP500 and EP600 SSDs adopt the throttling mechanism to prevent the temperature from exceeding the specified overtemperature threshold, protecting themselves from faults or excursion.

The EP500 and EP600 firmware uses the following 2-level alarm mechanism for in-band management:

The first alarm threshold is 70ºC(158°F). When the temperature reaches this threshold, the SSD performance will be limited until the temperature drops below 70ºC(158°F).

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The second alarm threshold is 77ºC(170.6°F). When the temperature reaches this threshold, I/Os on the SSD will be stopped to avoid irreversible damage. I/Os will be restored when the temperature drops below 77ºC(170.6°F).

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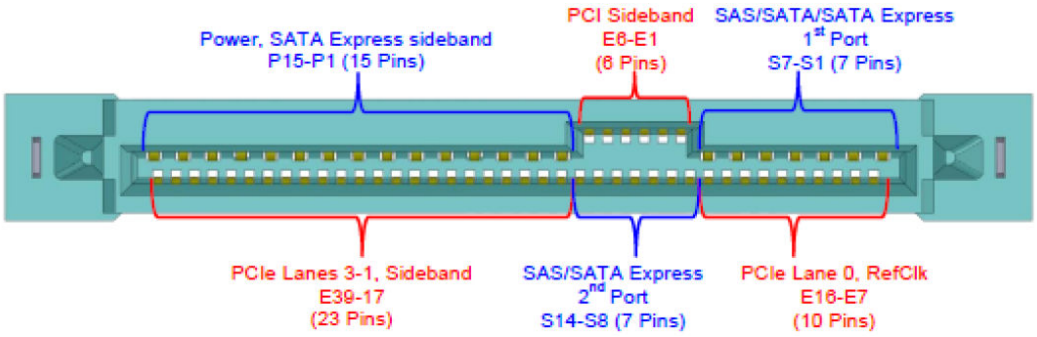
5 Pins and Signals

5.1 2.5-Inch SSD

5.1 2.5-Inch SSD

2.5-inch drives use standard SFF-8639 connectors. The PCIe signal is distributed as follows:

Figure 5-1 PCIe signal distribution



The pins are defined as follows:

Table 5-1 Pin definition

Pin	Name	Description	Pin	Name	Description
S1	GND	Ground	E7	PCIE_REFCLK0_P	PCIe Primary Reference Clock signals
S2	-	NC	E8	PCIE_REFCLK0_N	
S3	-	NC	E9	GND	Ground

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Pin	Name	Description	Pin	Name	Description
S4	GND	Ground	E10	PETp0	ePCIe 0 Transmit+
S5	-	NC	E11	PETn0	ePCIe 0 Transmit-
S6	-	NC	E12	GND	Ground
S7	GND	Ground	E13	PERn0	ePCIe 0 Receive-
E1	REFCLK1+	Reference clock port B (not used)	E14	PERp0	ePCIe 0 Receive+
E2	REFCLK1-	Reference clock port B (not used)	E15	GND	Ground
E3	3.3Vaux+	3.3 V for SM bus	E16	-	NC
E4	-	NC	S8	GND	Ground
E5	-	NC	S9	-	NC
E6	-	NC	S10	-	NC
P1	-	NC	S11	GND	Ground
P2	-	NC	S12	-	NC
P3	-	NC	S13	-	NC
P4	IfDet#	Interface Detect	S14	GND	Ground
P5	GND	Ground	S15	-	NC
P6	GND	Ground	S16	GND	Ground
P7	-	NC	S17	PETp1	ePCIe 1 Transmit+
P8			S18	PETn1	ePCIe 1 Transmit-
P9			S19	GND	Ground
P10	PRSNT#	Presence (Drive type)	S20	PERn1	ePCIe1 Receive-
P11	Activity	Activity (output)/ Spinup	S21	PERp1	ePCIe 1 Receive+

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Pin	Name	Description	Pin	Name	Description
P12	GND	Hot Plug Ground	S22	GND	Ground
P13	12V	Precharge All 12 V Only power for ePCIe SSD	S23	PETp2	ePCIe 2 Transmit+
P14			S24	PETn2	ePCIe 2 Transmit-
P15			S25	GND	Ground
-	-	-	S26	PERn2	ePCIe2 Receive-
-	-	-	S27	PERn2	ePCIe2 Receive+
-	-	-	S28	GND	Ground
-	-	-	E17	PETp3	ePCIe 3 Transmit+
-	-	-	E18	PETn3	ePCIe 3 Transmit-
-	-	-	E19	GND	Ground
-	-	-	E20	PERn3	ePCIe 3 Receive-
-	-	-	E21	PERp3	ePCIe 3 Receive+
-	-	-	E22	GND	Ground
-	-	-	E23	SMClk	SM-Bus Clock
-	-	-	E24	SMDat	SM-Bus Data
-	-	-	E25	TBD	TBD

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6 Management

The EP500 and EP600 provide extensive maintenance and management functions. Management functions include in-band management command sets running in OS and out-of-band management functions provided by BMC.

6.1 In-band Management

6.2 Out-of-band Management

6.1 In-band Management

In-band management functions include:

- Full-drive data clearing: ensures data security when SSDs are sent for repair.
- Online upgrade: facilitates routine maintenance. Firmware can be upgraded without restarting the OS.
- Asset management: shows production dates and serial numbers of assets for easy management.
- SMART: allows users to query health status, service life, and read/write data volumes of devices.
- SNMP agent: enables users to centrally manage NVMe devices.
- Log query: helps maintenance personnel to analyze problems.

6.2 Out-of-band Management

Based on the SMBUS interface, the EP500 and EP600 implement some out-of-band management functions of *NVM Express Basic Management Command* in the *NVM Express Management Interface Revision 1.0*. By means of SMBUS, the BMC can access the VPD information in the EEPROM and read the management data of the NVMe SSD. VPD information of the EP500 and EP600 complies with the requirements specified in the *NVM Express Management Interface Revision 1.0*.

By means of out-of-band management interfaces, the BMC can obtain device information including models, healthy status, service life, and firmware version. The obtained information simplifies device management within nodes.

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Out-of-band management information can be accessed through IIC address 0x6A (R/W bit excluded). VPD's IIC address is 0x53 (R/W bit excluded).

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7 Security

7.1 Security Architecture

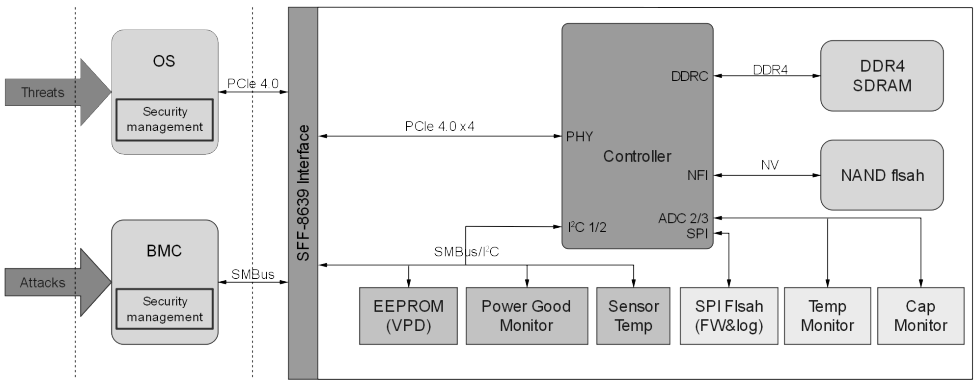
7.2 Security Threats and Attacks

7.3 Security Policies and Solutions

7.1 Security Architecture

The following security architecture is designed based on the logical position of the EP500 and EP600 in applications. As shown in **Figure 7-1**, interfaces of the EP500 and EP600 comply with the NVMe 1.4 specification. OSs read and write data through standard drive I/O interfaces. The BMC uses the SMBUS interface to implement out-of-band management according to *NVM Express Management Interface Revision 1.0*. The standard drive I/O interfaces and out-of-band management rely on the security mechanisms of the OS and BMC. Therefore, the EP500 and EP600 have low security risks.

Figure 7-1 Security architecture

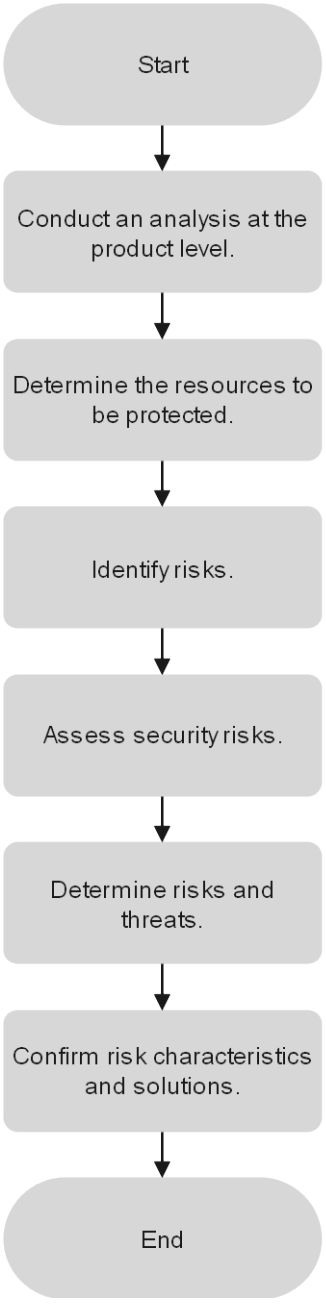


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7.2 Security Threats and Attacks

Identify security threats to the EP500 and EP600 products by referring to **Figure 7-2**.

Figure 7-2 Risk assessment process



The following table lists product components involving security risks and corresponding risk assessment.

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Main Component	Function	Risk	Severity
NVMe Driver	SSD kernel driver, implementing interaction with the block file system and communication in user mode.	Yes	Low
CLI	User mode CLI, allowing users to run commands to obtain SSD information, such as health status and temperature.	Yes	Low
Firmware	Front-end protocol processing module of the NVMe device, processing I/Os between devices and hosts to transfer and parse data.	None	-
BMC interface	Enables users to manage SSDs through the BMC, for example, obtaining the SSD health status and temperature.	Yes	Low

For details about risk solutions, see **7.3 Security Policies and Solutions**.

7.3 Security Policies and Solutions

We are committed to safeguarding the stability and security of customers' networks and services.

As storage devices in a server or storage host, the EP500 and EP600 observe the principle of least privilege and provide the following functions to enhance security:

- Access control: Only users with system administrators' permissions can use device maintenance and management tools of the EP500 and EP600. Ordinary users cannot change settings of the drive.
- Operation log: All the tools that can set the EP500 and EP600 record operation logs. The system logs and key logs are stored separately.
- End-to-end data protection: The EP500 and EP600 conduct end-to-end data checks to ensure user data consistency. They support the T10 DIF standard.
- Firmware upgrade: Firmware can be activated only after the signatures are authenticated by the controllers of the EP500 and EP600.
- Out-of-band management: The EP500 and EP600 support I^2C-based out-of-band management, which supports query.

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8 Certifications

The certifications that the EP500 and EP600 have passed (TBD).

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