

**Huawei ES3000 V3 NVMe PCIe SSD White Paper  
(ES3500P V3 / ES3600P V3 / ES3600C V3 /  
ES3620P V3 / ES3620C V3)**

# **Huawei ES3000 V3 NVMe PCIe SSD White Paper**

**Issue**      06  
**Date**      2017-05-31

**Copyright © Huawei Technologies Co., Ltd. 2016. All rights reserved.**

No part of this document may be reproduced or transmitted in any form or by any means without prior written consent of Huawei Technologies Co., Ltd.

## **Trademarks and Permissions**



and other Huawei trademarks are trademarks of Huawei Technologies Co., Ltd.

All other trademarks and trade names mentioned in this document are the property of their respective holders.

## **Notice**

The purchased products, services and features are stipulated by the contract made between Huawei and the customer. All or part of the products, services and features described in this document may not be within the purchase scope or the usage scope. Unless otherwise specified in the contract, all statements, information, and recommendations in this document are provided "AS IS" without warranties, guarantees or representations of any kind, either express or implied.

The information in this document is subject to change without notice. Every effort has been made in the preparation of this document to ensure accuracy of the contents, but all statements, information, and recommendations in this document do not constitute a warranty of any kind, express or implied.

## **Huawei Technologies Co., Ltd.**

Address: Huawei Industrial Base  
Bantian, Longgang  
Shenzhen 518129  
People's Republic of China

Website: <http://www.huawei.com>

Email: [support@huawei.com](mailto:support@huawei.com)

---

# Contents

---

<b>1 Introduction.....</b>	<b>1</b>
1.1 Overview .....	1
1.2 System Design .....	4
<b>2 Features .....</b>	<b>5</b>
2.1 Performance Features .....	5
2.2 Reliability Features .....	5
2.3 Maintenance Features .....	5
<b>3 Appearance and Mechanical.....</b>	<b>6</b>
3.1 Appearance .....	6
3.1.1 2.5-inch SSD in the disk tray .....	6
3.1.2 AIC SSD .....	7
3.2 Mechanical.....	7
3.2.1 2.5-inch SSD.....	8
3.2.2 AIC SSD .....	8
<b>4 Technical Specifications .....</b>	<b>10</b>
4.1 Base Specifications .....	10
4.1.1 ES3500P V3.....	10
4.1.2 ES3600P V3.....	12
4.1.3 ES3600C V3 .....	14
4.1.4 ES3620P V3.....	16
4.1.5 ES3620C V3 .....	18
4.2 Capacity .....	19
4.3 Quality of Service (QoS) .....	20
4.4 IOPS Consistency .....	21
4.5 Hot Plug Support .....	22
4.6 NVMe Feature Support.....	22
4.7 Environmental Conditions .....	22
4.8 Thermal Specification.....	23
4.8.1 Boundary Conditions .....	23
4.8.2 Thermal Specification .....	24
4.8.3 Detecting and Self Protection .....	25

<b>5 Pin and Signal Descriptions .....</b>	<b>27</b>
5.1 Pin and Signal for 2.5-inch SSD .....	27
5.2 Pin and Signal for AIC SSD .....	29
<b>6 Management.....</b>	<b>31</b>
6.1 In-band Management .....	31
6.2 Out-of-band Management.....	31
<b>7 Security.....</b>	<b>32</b>
7.1 Security Architecture .....	32
7.2 Security Risks and Threats.....	32
7.3 Security Policies and Solutions.....	33
<b>8 Maintenance .....</b>	<b>34</b>
<b>9 Certifications.....</b>	<b>37</b>
<b>10 DVT and Qualification .....</b>	<b>38</b>
10.1 Signal Integrity .....	38
10.1.1 PCIe .....	38
10.1.2 Input Clock .....	38
10.2 Protocol Compliance .....	39
10.2.1 PCIe .....	39
10.2.2 NVMe .....	39
10.2.3 SNMP .....	39
10.3 Functional and Interoperability.....	40
10.4 Reliability .....	41
<b>11 Contractions .....</b>	<b>42</b>

# 1 Introduction

## 1.1 Overview

Huawei ES3000 V3 NVMe PCIe SSD (ES3000 V3 for short) is an enterprise-level storage acceleration product that features high performance, quick responses, and high reliability, greatly improving storage I/O performance. Compatible with mainstream operating systems and virtualization systems, the ES3000 V3 helps improve service performance of databases, virtualization, high-performance computing (HPC), searching, and other applications, reducing customers' total cost of ownership (TCO).

The ES3000 V3 uses the PCIe 3.0 x4 interface and consists of three series:

- ES3500P series: standard 2.5-inch disk with the SFF-8639 connector  
Designed for scenarios with intensive-read workloads.
- ES3600P series: standard 2.5-inch disk with the SFF-8639 connector  
Designed for scenarios with mixed read/write workloads.
- ES3600C series: standard half-height half-length (HHHL) PCIe card  
Designed for scenarios with mixed read/write workloads.
- ES3620P series: standard 2.5-inch disk with the SFF-8639 connector  
Designed for scenarios with mixed read/write workloads.
- ES3620C series: standard half-height half-length (HHHL) PCIe card  
Designed for scenarios with mixed read/write workloads.

The ES3000 V3 comes in various single-disk capacities and specifications to meet requirements of different applications.

- ES3500P series single-disk capacities: 800 GB, 1200 GB, 2000 GB, 3200 GB, 4000 GB.
- ES3600P series single-disk capacities: 800 GB, 1200 GB, 1600 GB, 2000GB, 3200 GB.
- ES3600C series single-card capacities: 800 GB, 1200 GB, 1600 GB and 3200 GB.
- ES3620P series single-disk capacities: 6400 GB.
- ES3620C series single-card capacities: 6400 GB.

The following figures show the ES3000 V3.

### Figure 1-1 ES3500P V3



**Figure 1-2 ES3600P V3**



**Figure 1-3 ES3600C V3****Figure 1-4 ES3620P V3****Figure 1-5 ES3200C V3**

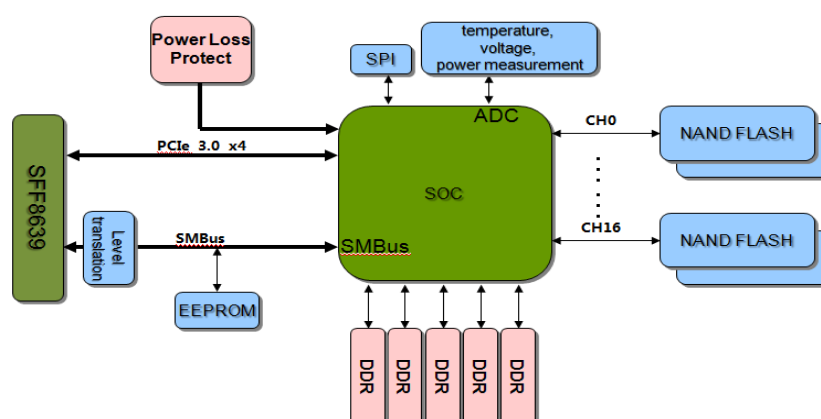
## 1.2 System Design

The ES3000 V3 system design has the following features:

- Uses Huawei's Hi1812 SSD controller. The SSD architecture design fully realizes the potential of the SSD controller. Hi1812 is an ASIC controller based on Huawei's SSD flash translation layer (FTL) algorithm and low-density parity-check (LDPC) error correcting algorithm, supporting the NVMe 1.2 specification and featuring high performance and low power consumption.
- Provides innovative NVMControl technical sets based on Hi1812 to enable high performance and reliability of the SSD.
- Provides enhanced device management functions. The standard NVMe interface eliminates the need for drivers built in OSs and allows the SSD to serve as an OS disk. Comprehensive hot swap functions realize easy maintenance. Out-of-band management functions comply with the NVMe specification and work with Huawei servers to enable intelligent monitoring of device health status.

Figure 1-6 shows the ES3000 V3 system architecture.

**Figure 1-6** ES3000 V3 system architecture





# 2 Features

## 2.1 Performance Features

- Uses Huawei's Hi1812 ASIC SSD controller.
- Supports the NVMe specification and uses multi-queue I/O technology to improve the SSD performance and quality of service (QoS).
- Adopts the innovative NVMControl technology to ensure high performance and reliability.

## 2.2 Reliability Features

- Uses the enhanced LDPC algorithm to provide higher error correction capability than that required by flash memory chips, ensuring device reliability.
- Recovers data after an error occurs in a channel by using the embedded RAID-like algorithm for correcting errors based on channels.
- Adopts the patented flexible RAID algorithm to provide RAID protection for recovered data after channels fail.
- Uses the intelligent wear leveling algorithm to intelligently level the flash memory wear and improve endurance.
- Supports the advanced flash memory access technology to apply the read retry and adaptive read technologies of flash memory chips and ensure data validity.
- Adopts the data inspection technology to periodically inspect data and prevent errors.
- Supports power-off protection to ensure that data on the SSD is not lost when a power failure occurs on the server.

## 2.3 Maintenance Features

- Supports in-band online upgrades to facilitate routine maintenance.
- Provides device information in a centralized manner, including the model, capacities, temperature, remaining service life, and health status.
- Provides abundant CLI (command-line interface) tools to facilitate device daily maintenance.
- Provides the manufacture dates and serial numbers to facilitate asset management.

# 3 Appearance and Mechanical

## 3.1 Appearance

ES3000 V3 product offers two physical packages: 2.5-inch form factor, and Add-In card. It can be installed in universal servers and storage array.

### 3.1.1 2.5-inch SSD in the disk tray

**Figure 3-1** ES3500P V3 / ES3600P V3 / ES3620P V3 front view



The ES3000 V3 supports operating status indicators provided by hard disk enclosures. The Indicator which is Amber/Blue in the Table 3-1 is the Fault Indicator, the Green is the Active Indicator. The color of the indicator is closely related to the design of the hard disk enclosures. When the ES3000 V3 is used in Huawei servers, the status indicators are defined as follows.

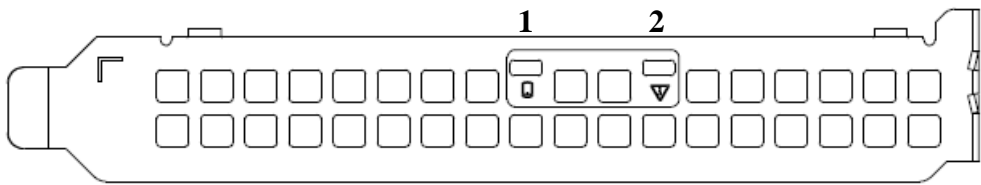
**Table 3-1** Status indicators definition

Active Indicator (Green)	Fault Indicator (Amber/Blue)	Status
Off	Off	• The SSD is powered off.
On	Off	• The SSD is operating properly.
Blinking (2Hz)	Off	• Data is being read or written.
Off	Blinking (2Hz)	• The SSD is located or the OS is ejecting the SSD for hot swap.
Off	Blinking (0.5Hz)	• The SSD is ejected by the OS and can be hot removed.

Active Indicator (Green)	Fault Indicator (Amber/Blue)	Status
Off / On	On	<ul style="list-style-type: none"><li>The SSD is faulty.</li></ul>

3.1.2 AIC SSD

Figure 3-2 ES3600C V3 / ES3620C V3 front view



1	Active Indicator
2	Fault Indicator

Table 3-2 Status indicators definition

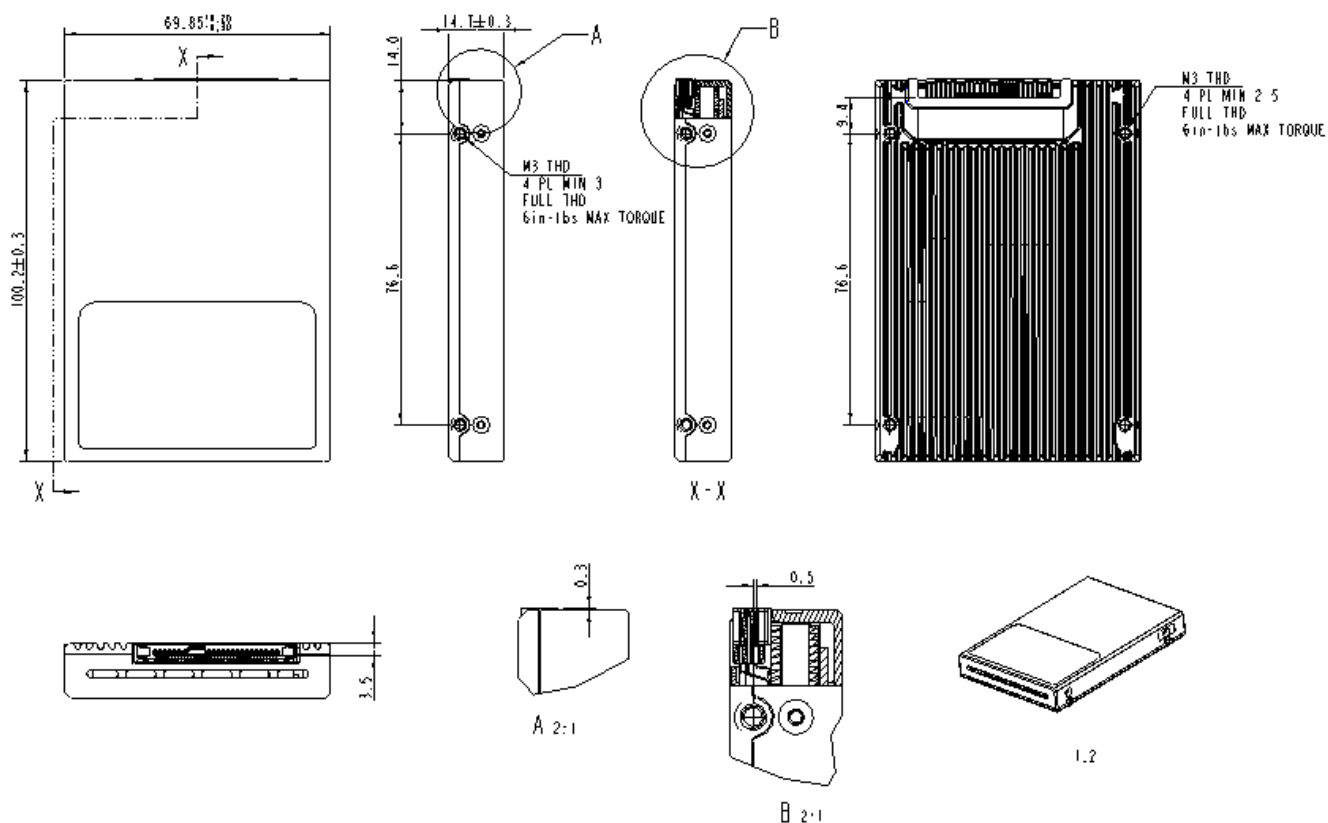
Active Indicator (Green)	Fault Indicator (Yellow)	Status
Off	Off	<ul style="list-style-type: none"><li>The SSD is powered off.</li></ul>
Off	On	<ul style="list-style-type: none"><li>The SSD failed to loading firmware.</li></ul>
Off	Blinking (0.5Hz)	<ul style="list-style-type: none"><li>The SSD is initializing.</li></ul>
On	Off	<ul style="list-style-type: none"><li>The SSD is in the slot and powered on.</li></ul>
Blinking (2Hz)	Off	<ul style="list-style-type: none"><li>Data is being read or written.</li></ul>
On	On	<ul style="list-style-type: none"><li>The SSD is faulty.</li></ul>

3.2 Mechanical

Note:

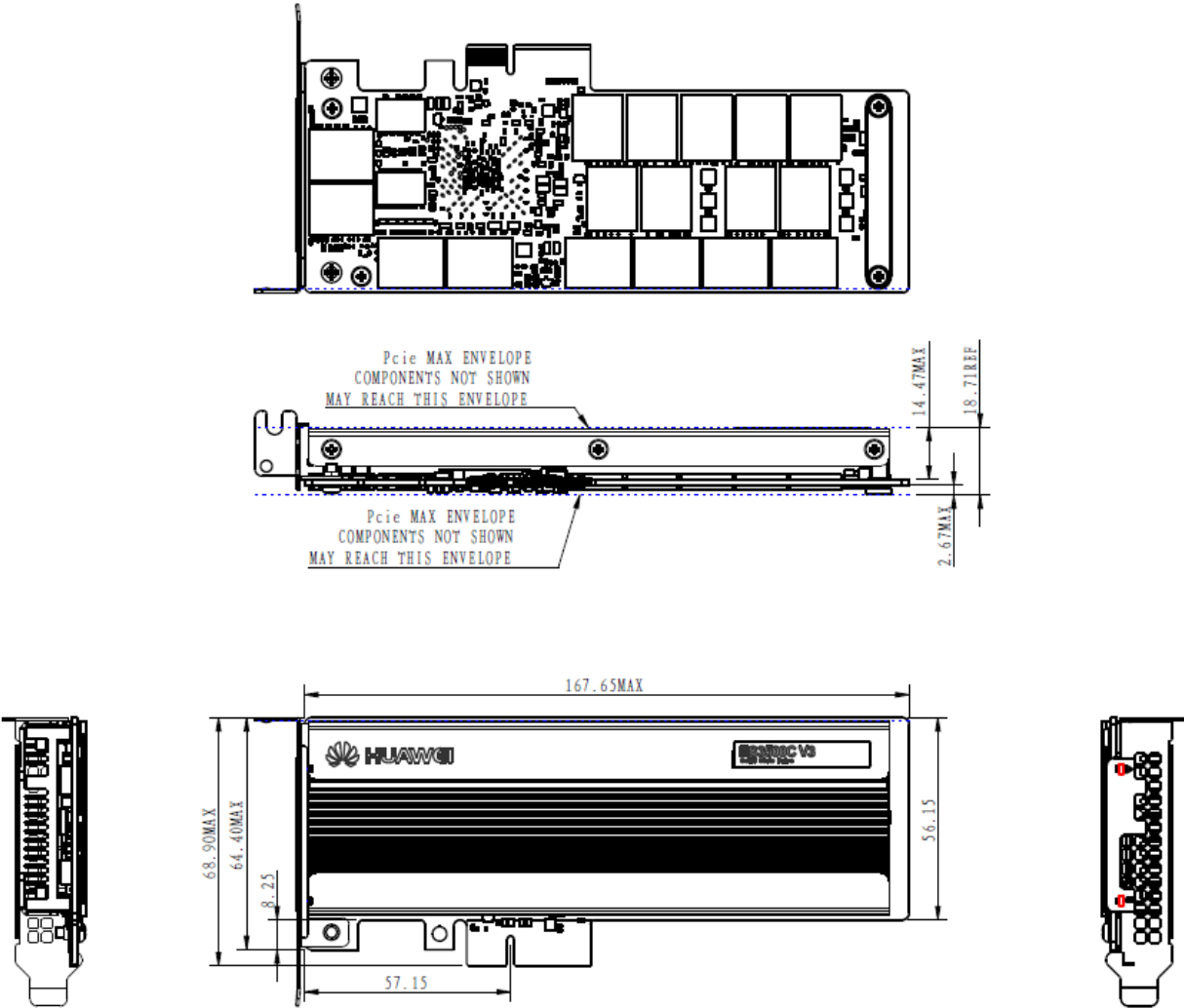
All dimensions are in millimeters.

### 3.2.1 2.5-inch SSD



X – Length	Y – Width	Z – Height
100.2+/-0.3	69.85+0.2/-0.3	14.7+/-0.3

### 3.2.2 AIC SSD



# 4 Technical Specifications

## 4.1 Base Specifications

ES3000 V3 can be set to a variety of LBA format based on business needs, such as 512B, 4096B, etc. On different LBA modes, ES3000 V3 shows different I/O performance. There is optimum performance when on 4096B. To emphasize an important point, ES3620P V3 6.4T 2.5-inch SSD and ES3620C V3 6.4T AIC SSD only support 4096B LBA format.

LBA (Logical Block Addressing) is a common scheme used for specifying the location of blocks of data stored on storage devices, such as hard disk drives. LBA is a particularly simple linear addressing scheme; blocks are located by an integer index, with the first block being LBA 0, the second LBA 1, and so on.

The size of the logical block can be varied, such as 512B, 4096B, and so on. The LBA format here used to represent that which LBA size was used to format the NVMe SSD logical block device.

### 4.1.1 ES3500P V3

**Table 4-1** ES3500P V3 specifications (LBA format: 512B)

Feature	Specifications				
Model	HWE32P43008 L000N	HWE32P43012 L000N	HWE32P43020 L000N	HWE32P43032 L000N	HWE32P43040 L000N
Product Name	ES3500P V3-800	ES3500P V3-1200	ES3500P V3-2000	ES3500P V3-3200	ES3500P V3-4000
Form	2.5-inch disk (PCIe 3.0)	2.5-inch disk (PCIe 3.0)	2.5-inch disk (PCIe 3.0)	2.5-inch disk (PCIe 3.0)	2.5-inch disk (PCIe 3.0)
Capacity	800GB <sup>1</sup>	1200GB	2000GB	3200GB	4000GB
Flash chip type	MLC	MLC	MLC	MLC	MLC
Sequential read bandwidth (GB/s) <sup>2</sup>	2.4	2.9	3.0	2.9	3.1
4KB random read IOPS (Steady) <sup>3</sup>	600,000	710,000	760,000	715,000	760,000

Feature	Specifications				
Average read latency@1QD ( $\mu$ s) <sup>4</sup>	88	88	88	88	88
Sequential write bandwidth (GB/s)	1.0	1.7	1.9	1.8	1.9
4KB random write IOPS (Steady / Max.)	55,000 / 250,000	85,000 / 405,000	50,000 / 452,000	78,000 / 428,000	38,000/464,000
Average write latency@1QD ( $\mu$ s)	18	18	20	18	20
Hybrid (R/W: 7/3) random 4KB IOPS (Steady)	150,000	220,000	150,000	225,000	115,000
PBW (Lifetime Random PB Written) <sup>5</sup>	1.46PB	2.19PB	2.92PB	5.84PB	4.08PB
DWPD (Disk Writes Per Day) <sup>6</sup>	1	1	0.8	1	0.56
Average Power consumption (Idle, Activity) <sup>7</sup>	7W, 13.5W	7W, 17W	7W, 18.5W	7W, 21W	7W, 22W
Weight (g)	145				
Power-off protection	Supported				
Chip failure protection	Supported				
Trim	Supported				
Mean time between failures (MTBF)	2 million hours				
Annual failure rate (AFR)	$\leq 0.44\%$				
Uncorrectable bit error rate (UBER)	$10^{-17}$				
Data Retention (Power off)	40°C 3 months				

Notes:

1, GB = 1, 000, 000, 000 Byte.

2, GB/s = 1, 000, 000, 000 Byte per second. Performance measured using FIO on CentOS 7.0 with 1MB (1,048,510 bytes) transfer size 512 Queue Depth on a sequential workload and number of thread equal to 1. Sequential write bandwidth is likeness.

3, Measured using FIO on CentOS 7.0 with 4KB (4,096 bytes) transfer size 64 Queue Depth 8 threads on a random workload.

4,  $\mu$ s = Microsecond. Average read latency measured using 1 thread 1 QD 4KB transfer size on a random workload. Average write latency is likeness.

5, 1PB =  $10^{15}$  Bytes. PBW measured using 4KB transfer size with 4KB aligned LBA on a random workload.

6, DWPD: Disk Writes Per Day, continuous 5 years.

7, Activity power consumption measured using sequential writes.

**Table 4-2** ES3500P V3 specifications (LBA format: 4096B)

Feature	Specifications				
Model	HWE32P43008 L000N	HWE32P43012 L000N	HWE32P43020 L000N	HWE32P43032 L000N	HWE32P43040 L000N
Sequential read bandwidth (GB/s)	2.4	2.9	3.1	2.9	3.1
4KB random read IOPS (Steady)	600,000	710,000	800,000	715,000	760,000
Average read latency@1QD ( $\mu$ s)	88	88	88	88	88
Sequential write bandwidth (GB/s)	1.0	1.7	1.9	1.8	1.9
4KB random write IOPS (Steady / Max.)	55,000 / 250,000	85,000 / 405,000	50,000 / 452,000	78,000 / 428,000	38,000/464,000
Average write latency@1QD ( $\mu$ s)	18	18	20	18	20
Hybrid (R/W: 7/3) random 4KB IOPS (Steady)	150,000	220,000	150,000	225,000	115,000

## 4.1.2 ES3600P V3

**Table 4-3** ES3600P V3 specifications (LBA format: 512B)

Feature	Specifications				
Model	HWE32P43008	HWE32P43012	HWE32P43016	HWE32P43020	HWE32P43032



Feature	Specifications				
	M000N	M000N	M000N	M000N	M000N
Product Name	ES3600P V3-800	ES3600P V3-1200	ES3600P V3-1600	ES3600P V3-2000	ES3600P V3-3200
Form	2.5-inch disk (PCIe 3.0)	2.5-inch disk (PCIe 3.0)	2.5-inch disk (PCIe 3.0)	2.5-inch disk (PCIe 3.0)	2.5-inch disk (PCIe 3.0)
Capacity	800GB	1200GB	1600GB	2000GB	3200GB
Flash chip type	MLC	MLC	MLC	MLC	MLC
Sequential read bandwidth (GB/s)	2.7	3.0	3.1	2.75	3.1
4KB random read IOPS (Steady)	680,000	760,000	760,000	650,000	760,000
Average read latency@1QD (μs)	88	88	88	88	88
Sequential write bandwidth (GB/s)	1.1	1.8	1.95	1.55	1.95
4KB random write IOPS (Steady / Max.)	100,000 / 275,000	160,000 / 428,000	175,000 / 464,000	110,000 / 380,000	170,000 / 464,000
Average write latency@1QD (μs)	18	18	18	18	18
Hybrid (R/W: 7/3) random 4KB IOPS (Steady)	230,000	385,000	388,000	285,000	388,000
PBW (Lifetime Random PB Written)	4.38PB	6.57PB	8.76PB	10.95PB	17.52PB
DWPD (Disk Writes Per Day)	3	3	3	3	3
Average Power consumption (Idle, Activity)	7W, 14W	7W, 17.5W	7W, 18.5W	7W, 18W	7W, 22W
Weight (g)	145				
Power-off protection	Supported				
Chip failure protection	Supported				
Trim	Supported				

Feature	Specifications
Mean time between failures (MTBF)	2 million hours
Annual failure rate (AFR)	$\leq 0.44\%$
Uncorrectable bit error rate (UBER)	$10^{-17}$
Data Retention (Power off)	40°C 3 months

Notes:

Detailed refers to ES3500P V3's specification notes.

**Table 4-4** ES3600P V3 specifications (LBA format: 4096B)

Feature	Specifications				
Model	HWE32P43008 M000N	HWE32P43012 M000N	HWE32P43016 M000N	HWE32P43020 M000N	HWE32P43032 M000N
Sequential read bandwidth (GB/s)	2.7	3.1	3.2	2.75	3.1
4KB random read IOPS (Steady)	680,000	800,000	800,000	650,000	800,000
Average read latency@1QD ( $\mu$ s)	88	88	88	88	88
Sequential write bandwidth (GB/s)	1.1	1.8	1.95	1.55	1.95
4KB random write IOPS (Steady / Max.)	100,000 / 275,000	160,000 / 428,000	175,000 / 464,000	110,000 / 380,000	170,000 / 464,000
Average write latency@1QD ( $\mu$ s)	18	18	18	18	18
Hybrid (R/W: 7/3) random 4KB IOPS (Steady)	230,000	387,000	390,000	285,000	390,000

### 4.1.3 ES3600C V3

**Table 4-5** ES3600C V3 specifications (LBA format: 512B)

Feature	Specifications			
Model	HWE36P43008M000N	HWE36P43012M000N	HWE36P43016M000N	HWE36P43032M000N

Feature	Specifications			
Product Name	ES3600C V3-800	ES3600C V3-1200	ES3600C V3-1600	ES3600C V3-3200
Form	HHHL AIC (PCIe 3.0)	HHHL AIC (PCIe 3.0)	HHHL AIC (PCIe 3.0)	HHHL AIC (PCIe 3.0)
Capacity	800GB	1200GB	1600GB	3200GB
Flash chip type	MLC	MLC	MLC	MLC
Sequential read bandwidth (GB/s)	2.7	3.0	3.1	3.1
4KB random read IOPS (Steady)	680,000	760,000	760,000	760,000
Average read latency@1QD (μs)	88	88	88	88
Sequential write bandwidth (GB/s)	1.1	1.8	1.95	1.95
4KB random write IOPS (Steady / Max.)	100,000 / 275,000	160,000 / 428,000	175,000 / 464,000	170,000 / 464,000
Average write latency@1QD (μs)	18	18	18	18
Hybrid (R/W: 7/3) random 4KB IOPS (Steady)	230,000	385,000	388,000	388,000
PBW (Lifetime Random PB Written)	4.38PB	6.57PB	8.76PB	17.52PB
DWPD (Disk Writes Per Day)	3	3	3	3
Average Power consumption (Idle, Activity)	7W, 14W	7W, 17.5W	7W, 18.5W	7W, 22W
Weight (g)	233			
Power-off protection	Supported			
Chip failure protection	Supported			
Trim	Supported			
Mean time between failures (MTBF)	2 million hours			

Feature	Specifications
Annual failure rate (AFR)	$\leq 0.44\%$
Uncorrectable bit error rate (UBER)	$10^{-17}$
Data Retention (Power off)	40°C 3 months

Notes:

Detailed refers to ES3500P V3's specification notes.

**Table 4-6** ES3600C V3 specifications (LBA format: 4096B)

Feature	Specifications			
Model	HWE36P43008M000N	HWE36P43012M000N	HWE36P43016M000N	HWE36P43032M000N
Sequential read bandwidth (GB/s)	2.7	3.0	3.2	3.1
4KB random read IOPS (Steady)	680,000	760,000	800,000	800,000
Average read latency@1QD ( $\mu$ s)	88	88	88	88
Sequential write bandwidth (GB/s)	1.1	1.8	1.95	1.95
4KB random write IOPS (Steady / Max.)	100,000 / 275,000	160,000 / 428,000	175,000 / 464,000	170,000 / 464,000
Average write latency@1QD ( $\mu$ s)	18	18	18	18
Hybrid (R/W: 7/3) random 4KB IOPS (Steady)	230,000	385,000	390,000	390,000

## 4.1.4 ES3620P V3

**Table 4-7** ES3620P V3 specifications (LBA format: 4096B<sup>3</sup>)

Feature	Specifications
Model	HWE32P43064M001N
Product Name	ES3620P V3-6400
Form	2.5-inch disk (PCIe 3.0)

Feature	Specifications
Capacity	6400GB
Flash chip type	3D MLC
Sequential read bandwidth (GB/s)	3.0
4KB random read IOPS (Steady)	750,000
Average read latency@1QD (μs)	110
Sequential write bandwidth (GB/s)	1.8
4KB random write IOPS (Steady / Max.)	40,000 / 200,000
8KB random write IOPS (Steady / Max.)	80,000 / 220,000
Average write latency@1QD (μs)	20
Hybrid (R/W: 7/3) random 4KB IOPS (Steady)	120,000
PBW (Lifetime Random PB Written)	19.86PB <sup>1</sup> / 35PB <sup>2</sup>
DWPD (Disk Writes Per Day)	1.7 <sup>1</sup> / 3 <sup>2</sup>
Average Power consumption (Idle, Activity)	7W, 25W
Weight (g)	145
Power-off 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 <sup>-17</sup>
Data Retention (Power off)	40°C 3 months
Power on/off cycles <sup>4</sup>	2000

Notes:

- 1, PBW measured using 4KB transfer size with 4KB aligned LBA on a random workload.
- 2, Using 8KB transfer size with 8KB aligned LBA on a random workload.
- 3, The ES3620P V3 6.4T SSD only supports 4096B LBA format.
- 4, Power on/off cycles is defined as power being removed from the SSD, and then restored.
- 5, Detailed refers to ES3500P V3's specification notes.

## 4.1.5 ES3620C V3

**Table 4-8** ES3620C V3 specifications (LBA format: 4096B)

Feature	Specifications
Model	HWE36P43064M001N
Product Name	ES3620C V3-6400
Form	HHHL AIC (PCIe 3.0)
Capacity	6400GB
Flash chip type	3D MLC
Sequential read bandwidth (GB/s)	3.0
4KB random read IOPS (Steady)	750,000
Average read latency@1QD (μs)	110
Sequential write bandwidth (GB/s)	1.8
4KB random write IOPS (Steady / Max.)	40,000 / 200,000
8KB random write IOPS (Steady / Max.)	80,000 / 220,000
Average write latency@1QD (μs)	20
Hybrid (R/W: 7/3) random 4KB IOPS (Steady)	120,000
PBW (Lifetime Random PB Written)	19.86PB <sup>1</sup> / 35PB <sup>2</sup>
DWPD (Disk Writes Per Day)	1.7 <sup>1</sup> / 3 <sup>2</sup>
Average Power consumption (Idle, Activity)	7W, 25W
Weight (g)	233
Power-off 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 <sup>-17</sup>
Data Retention (Power off)	40°C 3 months

Notes:

1, PBW measured using 4KB transfer size with 4KB aligned LBA on a random workload.

- 2, Using 8KB transfer size with 8KB aligned LBA on a random workload.
- 3, The ES3620C V3 6.4T SSD only supports 4096B LBA format.
- 4, Detailed refers to ES3500P V3's specification notes.

## 4.2 Capacity

ES3500P V3	User Addressable Sectors in LBA Mode
800GB	1,562,824,368
1200GB	2,344,225,968
2000GB	3,907,029,168
3200GB	6,251,233,968
4000GB	7,814,037,168

**Note:** 1GB = 1,000,000,000 bytes; 1 sector = 512 bytes or 512 + 8 bytes. The total usable capacity of the SSD may be less than the total physical capacity because a small portion of the capacity is used for management and maintenance.

ES3600P V3	User Addressable Sectors in LBA Mode
800GB	1,562,824,368
1200GB	2,344,225,968
1600GB	3,125,627,568
2000GB	3,907,029,168
3200GB	6,251,233,968

**Note:** 1GB = 1,000,000,000 bytes; 1 sector = 512 bytes or 512 + 8 bytes.

ES3600C V3	User Addressable Sectors in LBA Mode
800GB	1,562,824,368
1200GB	2,344,225,968
1600GB	3,125,627,568
3200GB	6,251,233,968

**Note:** 1GB = 1,000,000,000 bytes; 1 sector = 512 bytes or 512 + 8 bytes.

ES3620P V3	User Addressable Sectors in LBA Mode
------------	--------------------------------------

6400GB	1,562,824,368
--------	---------------

**Note:**

1GB = 1,000,000,000 bytes.

**1 sector = 4096 bytes.**

<b>ES3620C V3</b>	<b>User Addressable Sectors in LBA Mode</b>
6400GB	1,562,824,368

**Note:**

1GB = 1,000,000,000 bytes.

**1 sector = 4096 bytes.**

## 4.3 Quality of Service (QoS)

**Table 4-9** ES3500P V3 QoS (LBA format: 512B)

Specification <sup>1,2</sup>	unit	ES3500P V3					
		QD = 1			QD = 128		
		2000G	800G / 1200G / 3200G	4000G	800G / 2000G	1200G / 3200G	4000G
Reads (99%)	ms	0.11	0.11	0.11	0.62	0.62	0.62
Writes (99%)	ms	0.16	0.018	0.32	6.5	5.5	7.5
Reads (99.99%)	ms	3	3	3	4	4	4
Writes (99.99%)	ms	5.5	4.5	6	18	18	18

**Table 4-10** ES3600P V3 / ES3600C V3 QoS (LBA format: 512B)

Specification	unit	ES3600P V3 / ES3600C V3		
		QD = 1		QD = 128
		800G / 1200G / 1600G / 2000G / 3200G		2000G      800G / 1200G / 1600G / 3200G
Reads (99%)	ms	0.11		0.6      0.6
Writes (99%)	ms	0.018		6      3.5
Reads (99.99%)	ms	3		4      4
Writes (99.99%)	ms	2		18      18



**Table 4-11** ES3620P V3 / ES3620C V3 QoS (LBA format: **4096B**)

Specification	unit	ES3620P V3 / ES3620C V3	
		QD = 1	QD = 128
		6400G	6400G
Reads (99%)	ms	0.16	0.8
Writes (99%)	ms	0.1	5.5
Reads (99.99%)	ms	3	4
Writes (99.99%)	ms	4.5	18

## NOTES:

1. Device measured using FIO. Quality of Service measured using 4KB (4,096 bytes) transfer size on a random workload on a full Logical Block Address (LBA) span of the drive once the workload has reached steady state.

2. Based on Random 4KB QD=1, 128 workloads, measured as the time taken for 99.0 (or 99.99) percentile of commands to finish the round-trip from host to drive and back to host.

## 4.4 IOPS Consistency

**Table 4-12** ES3500P V3 IOPS consistency (LBA format: 512B)

Specification (queue depth of 256) <sup>1</sup>	unit	ES3500P V3				
		800G	1200GB	2000GB	3200GB	4000GB
Random 4KB Read (up to) <sup>2</sup>	%	90	90	90	90	90
Random 4KB Write (up to)	%	90	90	90	90	90

**Table 4-13** ES3600P V3 / ES3600C V3 IOPS consistency (LBA format: 512B)

Specification (queue depth of 256)	unit	ES3600P V3 / ES3600C V3				
		800G	1200GB	1600GB	2000G	3200GB
Random 4KB Read (up to)	%	90	90	90	90	90
Random 4KB Write (up to)	%	90	90	90	90	90

**Table 4-14** ES3620P V3 / ES3620C V3 IOPS consistency (LBA format: **4096B**)

Specification (queue depth of 256)	unit	ES3620P V3 / ES3620C V3
		6400G
Random 4KB Read (up to)	%	90
Random 4KB Write (up to)	%	90

## NOTES:

1. Performance consistency measured using FIO based on Random 4KB with total queue depth of 256, measured as (IOPS in the 99.9th percentile slowest 1-second interval)/(average IOPS during the test). Measurements are performed on a full Logical Block Address (LBA) span of the drive once the workload has reached steady state.
2. 4KB = 4,096 bytes

## 4.5 Hot Plug Support

Hot plug includes the following two ways:

- Orderly hot plug: Users can directly insert a PCIe SSD when the OS is running, but needs to notify the OS before removing a PCIe SSD.
- Surprise hot plug: Users can directly insert or remove a PCIe SSD.

ES3500P V3, ES3600P V3 and ES3620P V3 which are 2.5-inch form factor NVMe SSD supports orderly hot plug. ES3600C V3 and ES3620C V3 which are AIC form factor PCIe card do not support orderly or surprise hot plug.

## 4.6 NVMe Feature Support

Huawei ES3000 V3 SSD supports the NVMe 1.2 specification. Besides the basic feature and the mandatory commands, it also supports other optional feature:

- Multi Name Space: supports maximum 64 Name Spaces.

## 4.7 Environmental Conditions

**Table 4-15** 2.5-inch SSD Environmental specifications

Item	Description
Product	ES3500P V3, ES3600P V3, ES3620P V3
Temperature	Storage temperature: -40 ℃ to +70 ℃ (-40 ℉ to +158 ℉) Operating temperature(Case): 0 ℃ to +70 ℃ (32 ℉ to +158 ℉) <sup>1</sup>
Altitude	<ul style="list-style-type: none"> <li>• Operating: -305 m to 3,048 m (-1,000 ft to 10,000 ft)</li> <li>• Non-operating: -305 m to 12,192 m (-1,000 ft to 40,000 ft)</li> </ul> <p>The operating temperature decreases by 1 ℃ (1.8 ℉) with every increase of 220 m (721.78 ft).</p>
Humidity	<ul style="list-style-type: none"> <li>• Operating: 5% to 95%</li> <li>• Non-operating: 5% to 95%</li> </ul>
Shock	<ul style="list-style-type: none"> <li>• Operating: 1000 G (Max) at 0.5ms</li> </ul>

Item	Description
	<ul style="list-style-type: none"> <li>Non-operating: 1000 G (Max) at 0.5ms</li> </ul>
Vibration	<ul style="list-style-type: none"> <li>Operating: 2.17 GRMS (5-700 Hz) Max</li> <li>Non-operating: 3.13 GRMS (5-800 Hz) Max</li> </ul>

**Table 4-16** AIC SSD Environmental specifications

Item	Description
Product	ES3600C V3, ES3620C V3
Temperature	Storage temperature: -40°C to +70°C Operating temperature (Ambient): 0°C to 55°C <sup>2</sup>
Altitude	<ul style="list-style-type: none"> <li>Operating: -305m to 3048m (-1,000 ft to 10,000 ft)</li> <li>Non-operating: -305m to 12192m(-1,000 ft to 40,000 ft)</li> </ul> <p>The operating temperature decreases by 1 °C (1.8 °F) with every increase of 220 m (721.78 ft).</p>
Humidity	<ul style="list-style-type: none"> <li>Operating: 5% to 95%</li> <li>Non-operating: 5% to 95%</li> </ul>
Shock <sup>3</sup>	<ul style="list-style-type: none"> <li>Operating: 31G at 2ms, 1 time / face orientation of use only</li> <li>Non-operating: 70G at 2ms, 1 time / face orientation of use only</li> </ul>
Vibration <sup>4</sup>	<ul style="list-style-type: none"> <li>Operating: 0.27 GRMS (5-500 Hz), 3 axes, 10 min/axis</li> <li>Non-operating: 1.49 GRMS (10-500 Hz), 3 axes, 15 min/axis</li> </ul>

**NOTES:**

- Operating temperature implies ambient air temperature under defined airflow in Tables 4-17.
- 0-55°C is for airflow from the server towards the card , not for airflow into the server.
- Stimulus may be applied in the X, Y or Z axis. Shock specification is measured using Root Mean Squared (RMS) value.
- Stimulus may be applied in the X, Y or Z axis. Vibration specification is measured using Root Mean Squared (RMS) value.

## 4.8 Thermal Specification

### 4.8.1 Boundary Conditions

The ES3000 V3 2.5-inch SSD is designed to work in an environment where air is provided at 35°C with specified air flow. The specified air flow is defined in Table 4-17.

The airflow direction is to be consistent with a typical server rack where air is "pulled-in" from the front face of the server. (Shown in Figure 4-1). ES3000 V3 2.5-inch SSD is not designed to work with other air flow direction.

**Figure 4-1** Design airflow direction

## 4.8.2 Thermal Specification

**Table 4-17** 2.5-inch SSD thermal specification

Name	TDP	Airflow	Operation condition
ES3600P V3-800	15W	350LFM 500LFM	Ambient temperature: 0~25℃ Ambient temperature: 0~35℃
ES3600P V3-1200	19W	450LFM 650LFM	Ambient temperature: 0~25℃ Ambient temperature: 0~35℃
ES3600P V3-1600	20W	450LFM 650LFM	Ambient temperature: 0~25℃ Ambient temperature: 0~35℃
ES3600P V3-2000	20W	450LFM 650LFM	Ambient temperature: 0~25℃ Ambient temperature: 0~35℃
ES3600P V3-3200	22W	450LFM 650LFM	Ambient temperature: 0~25℃ Ambient temperature: 0~35℃
ES3500P V3-800	15W	350LFM 500LFM	Ambient temperature: 0~25℃ Ambient temperature: 0~35℃
ES3500P V3-1200	18W	450LFM 650LFM	Ambient temperature: 0~25℃ Ambient temperature: 0~35℃
ES3500P V3-2000	20W	450LFM 650LFM	Ambient temperature: 0~25℃

Name	TDP	Airflow	Operation condition
			Ambient temperature: 0~35℃
ES3500P V3-3200	21W	450LFM 650LFM	Ambient temperature: 0~25℃ Ambient temperature: 0~35℃
ES3500P V3-4000	22W	450LFM 650LFM	Ambient temperature: 0~25℃ Ambient temperature: 0~35℃
ES3620P V3-6400	25W	450LFM 650LFM	Ambient temperature: 0~25℃ Ambient temperature: 0~35℃

**Table 4-18** AIC SSD thermal specification

Part	TDP	Airflow	Operation condition
ES3600C V3-800	14W	300LFM	Ambient temperature: 0~55℃
ES3600C V3-1200	18W	300LFM	Ambient temperature: 0~55℃
ES3600C V3-1600	19W	300LFM	Ambient temperature: 0~55℃
ES3600C V3-3200	21W	300LFM	Ambient temperature: 0~55℃
ES3620C V3-6400	25W	450LFM	Ambient temperature: 0~55℃

### 4.8.3 Detecting and Self Protection

ES3000V3 will detect the SSD controller's junction temperature and flash ambient temperature; SMART information will record the maximum temperature SSD has reached and the number and time of over temperature.

### Figure 4-2 Temperature monitoring parameters in SMART

```
linux-uqb2:~ # hioadm temperature -d nvme1
highest temperature:          320 degree K (47 degree C)
exceed temperature threshold count: 0
exceed temperature threshold time: 0 min
controller highest temperature: 324 degree K (51 degree C)
controller exceed threshold count: 0
controller exceed threshold time: 0 min

sensors temperature information (degree K / degree C):
```

	current	over threshold	under threshold
composite	319(46)	351(78)	273(0)
controller1	323(50)	373(100)	273(0)

The maximum junction temperature of NAND flash used by ES3000 V3 can be 85℃. According to the test result of Huawei Media Laboratory: below 78℃, the temperature threshold of NAND Flash, SSD can work reliably in the whole lifecycle; over 78℃, NAND flash can access and store the data correctly, but running for a long time in this environment,

the lifecycle of the SSD will be affected; over 85°C, the NAND flash cannot work properly. Therefore, Huawei designed the following temperature control strategy:

A, In-band, firmware implements the alarms function and performance limit function by detecting the inner composite temperature;

B, Out-of-band, by detecting the highest temperature of NAND flash in the SSD device, BMC adjust the wind speed to avoid triggering the temperature control mechanism.

In-band, firmware uses the 2 level alarm mechanism:

1, the first warning threshold is 78°C, when the temperature reaches this threshold, the device will send alarm information to remind the user that the equipment overheating.

2.1, the second alarm threshold is 85°C, when the temperature reaches the second threshold, the firmware will limit the performance of the device.

2.2, when the temperature reaches the second threshold and the over temperature duration is more than 6 minutes, in order to ensure data reliability, ES3000 V3 will further restrict read and write performance, lower power consumption and to avoid exceeding the specifications of the products. When the temperature is reduced below the RT level, the performance limit will be lifted.

**Table 4-19** Temperature self protect design

Grade	Threshold	Action
OT Level 1	composite: 78°C	Warning.
RT Level 1	composite: 75°C	The warning will be lifted.
OT Level 2	composite: 85°C	Warning, limit the performance.
RT Level 2	composite: 78°C	The performance limit will be lifted, the warning remains active.

OT : Over Temperature

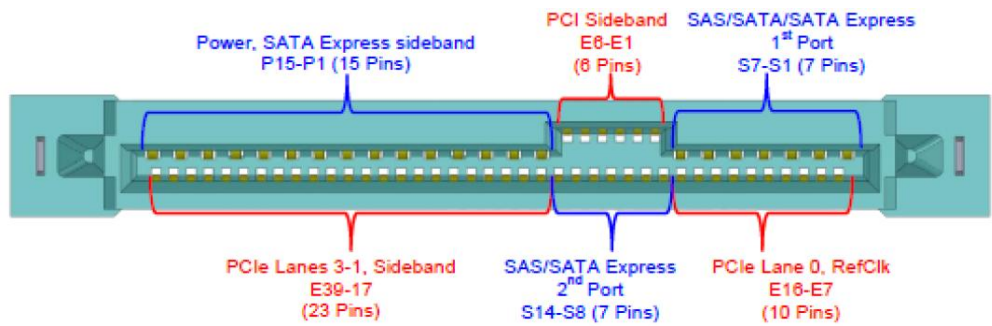
RT : Recovery temperature

# 5 Pin and Signal Descriptions

## 5.1 Pin and Signal for 2.5-inch SSD

The connector of 2.5-inch SSD is SFF-8639. The PCIe signal assignments are as follow:

Figure 5-1 Signal Assignments



The pin definitions are as follow:

Table 5-1 Pin definition ( Compatible with SFF-8639 )

Pin	Name	Description	Pin	Name	Description
S1	GND	Ground	E7	RefClk0+	ePCIe Primary RefClk +
S2		NC	E8	RefClk0-	ePCIe Primary RefClk-
S3		NC	E9	GND	Ground
S4	GND	Groud	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	3.3V for SM bus	E16	RSVD	Reserved
E4	ePERst1#	ePCIe Rest(port B)(not used)	S8	GND	Ground
E5	ePERst0#	ePCIe Rest(port A)	S9		NC
E6	RSVD(Vendor)	Reserved(vendor)	S10		NC
P1		NC	S11	GND	Ground
P2		NC	S12		NC
P3		NC	S13		NC
P4	IfDet#	Interface Detect (Was GND-percharge)	S14	GND	Ground
P5	GND	Ground	S15	RSVD	Reserved
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	ePCIe1 Receive+
P12	GND	Hot Plug Ground	S22	GND	Ground
P13	12V	Precharge	S23	PETp2	ePCIe 2 Transmit+
P14		All -12V	S24	PETn2	ePCIe 2 Transmit-
P15		Only power for ePCIe SSD	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	DualPortEn#	ePCIe 2x2 Select

## 5.2 Pin and Signal for AIC SSD

Side B			Side A	
Pin	Name	Description	Name	Description
1	+12V	12V power	PRSNT1#	Hot-Plug presence detect
2	+12V	12V power	+12V	12V power
3	+12V	12V power	+12V	12V power
4	GND	Ground	GND	Ground
5	SMCLK	SMBus clock	JTAG2	TCK (Test Clock), clock input for JTAG interface
6	SMDAT	SMbus data	JTAG3	TDI (Test Data Input)
7	GND	Gound / UART_HOST	JTAG4	TDO (Test Data Output)
8	+3.3V	3.3V power	JTAG5	TMS (Test Mode Select)
9	JTAG1	TRST# (Test Reset) resets the JTAG interface	+3.3V	3.3V power

10	3.3Vaux	3.3V auxiliary power	+3.3V	3.3V power
11	WAKE#	Signal for Link reactivation	PERST#	Fundamental reset
Mechanical Key				
12	RSVD	Reserved	GND	Ground
13	GND	Ground	REFCLK+	Reference clock (differential pair)
14	PETp0	Transmitter differential pair, Lane 0	REFCLK-	Reference clock (differential pair)
15	PETn0	Transmitter differential pair, Lane 0	GND	Ground
16	GND	Ground	PERp0	Receiver differential pair, Lane 0
17	PRSNT2#	Hot-Plug presence detect	PERn0	Receiver differential pair, Lane 0
18	GND	Ground	GND	Ground
End of the x1 Connector				
19	PETp1	Transmitter differential pair, Lane 1	RSVD	
20	PETn1	Transmitter differential pair, Lane 1	GND	Ground
21	GND	Ground	PERp1	Receiver differential pair, Lane 1
22	GND	Ground	PERn1	Receiver differential pair, Lane 1
23	PETp2	Transmitter differential pair, Lane 2	GND	Ground
24	PETn2	Transmitter differential pair, Lane 2	GND	Ground
25	GND	Ground	PERp2	Receiver differential pair, Lane 2
26	GND	Ground	PERn2	Receiver differential pair, Lane 2
27	PETp3	Transmitter differential pair, Lane 3	GND	Ground
28	PETn3	Transmitter differential pair, Lane 3	GND	Ground
29	GND	Ground	PERp3	Receiver differential pair, Lane 3
30	RSVD	Reserved	PERn3	Receiver differential pair, Lane 3
31	PRSNT2	Hot-Plug presence detect	GND	Ground
32	GND	Ground	RSVD	Reserved
End of the x4 Connector				

# 6 Management

ES3000 V3 provides maintenance and management functions with comprehensive functions and high performance. That includes the in-band management tools and the out-of-band management interfaces.

## 6.1 In-band Management

As follow:

- Provide whole-disk wiping to ensure data confidentiality when the SSD is sent for repair.
- Supports in-band online upgrades to facilitate routine maintenance.
- Provides device information in a centralized manner, including the model, capacities, temperature, remaining service life, and health status
- Supports log query for analyzing device health status.
- Provides the manufacture dates and serial numbers to facilitate asset management.
- Provides statistics functions to allow maintenance engineers to query the wear status, the ratio of bad blocks.

Besides, ES3000 V3 provides the GUI management tools in Windows platform, which facilitates the user's daily operation.

## 6.2 Out-of-band Management

ES3000 V3 provides SMBUS interface, supports the out-of-band management in the server. By means of SMBUS, BMC can access the VPD information in the EEPROM and read the management data of the NVMe SSD. The VPD meets specification for Enterprise SSD Form Factor Version 1.0a, the out-of-band management meets specification for NVMe Basic Management Command Revision 1.0.

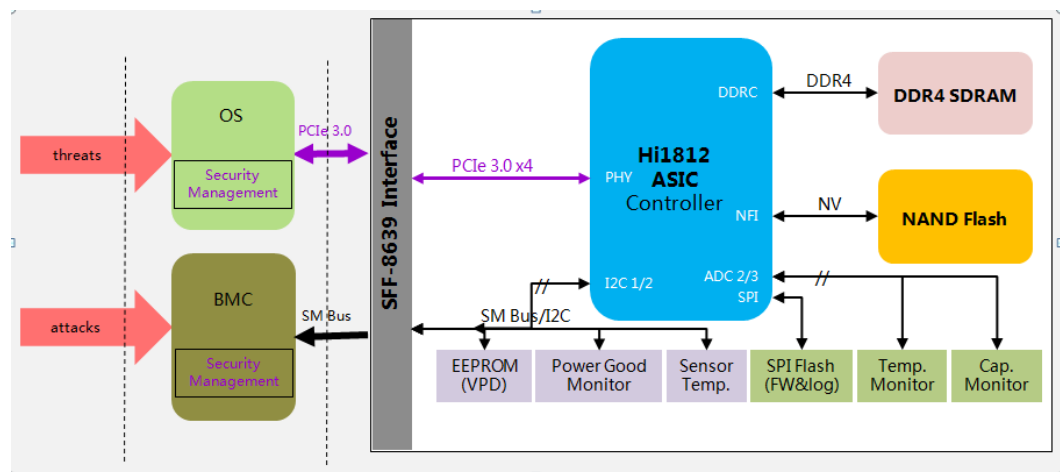
By means of out-of-band management interface, BMC can obtain the information including model number, healthy status, remaining life, firmware version, and so on.

Out-of-band management information can be accessed through address 0x6A (not include R/W bit). VPD's IIC address is 0x53 (not include R/W bit).

# 7 Security

## 7.1 Security Architecture

The following figure shows the security architecture based on the logical position of the ES3000 V3 in real applications. As shown in the figure, the ES3000 V3 relies on the security mechanisms of the OS and BMC, which solve most security risks. Therefore, The ES3000 V3 has low security risks.



## 7.2 Security Risks and Threats

The following risk assessment process is used to identify security threats to the ES3000 V3.



The following table describes the security risk assessment for the related product components.

Main Compone	Description	Risks Involved	Severity
--------------	-------------	----------------	----------

nt			
NVMe driver	SSD kernel driver for interaction with the block file system and communication with the user space.	Yes	Low
CLI	Enables users to run commands to obtain SSD information, such as health status and temperature.	Yes	Low
SNMP agent	Enables users to manage SSDs over the network in a centralized manner, for example, obtaining the SSD health status and temperature.	Yes	Low
Firmware	As the front-end protocol processing module of the NVMe device, the firmware processes I/O between the device and the host by transmitting and parsing 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 the next section.

## 7.3 Security Policies and Solutions

Huawei is committed to safeguarding the stability and security of customers' networks and services.

As a storage device in a server or storage host, the ES3000 V3 follows the lowest permission security policies and provides the following functions to enhance security:

- Access control: Administrator permissions are required to use any device maintenance and management tools of the ES3000 V3.
- Operation log: All non-query operations performed on the ES3000 V3 are logged.
- Security assurance: A complete data clearance tool is provided to destroy data at the NAND flash memory chip level, preventing data leakage.
- Firmware upgrade: Firmware upgrade through in-band management channels ensures upgrade reliability and network security. The upgrade tool performs an upgrade only after the upgrade file passes the integrity and validity checks. Firmware can be loaded only after it is authenticated by the Hi1812 controller, which ensures firmware validity and data security.
- Device management: The ES3000 V3 uses out-of-band management based on I2C channels and in-band management based on SNMP. Both management functions support only query, preventing malicious and illegal write operations.

# 8 Maintenance

According to the *Huawei Warranty Policy for Servers & Storage (Warranty Policy for short)*, Huawei provides a three-year warranty for the ES3000 V3 and a three-month warranty for software media. Warranty Policy is a warranty agreement for upgrade and maintenance before and after the warranty expires, with a well-defined scope of services, including service hours, response time, terms of service, and service agreement terms and conditions.

The *Warranty Policy* is country-specific. The service types, service levels, response time, and terms and conditions may vary with the country where the product is used. Not all services described in the *Warranty Policy* are provided to users in all countries. For more information about warranty services in your country, contact Huawei technical support or your local representative office.

Table 8-1 provides the warranty service response time.

**Table 8-1** Response time

Service Content	Response Time		Description	Remarks
Help Desk	24×7		Available 24 hours a day, 7 days a week (00:00 to 24:00, Monday to Sunday)	None
Remote troubleshooting			Available 24 hours a day, 7 days a week (00:00 to 24:00, Monday to Sunday)	Response time starts from the moment when the technical support accepts a customer's service request to the time when technical support contacts the customer to provide remote troubleshooting service.

Service Content	Response Time		Description	Remarks
Online technical support			You can obtain online support at Huawei's website. This service is available 24 hours a day (00:00 to 24:00), 7 days a week (Monday to Sunday).	None
Licensing of software updates			You can obtain online support at Huawei's website. This service is available 24 hours a day (00:00 to 24:00), 7 days a week (Monday to Sunday).	None
Return for repair	Outside China	45 calendar days shipment (CDS), 9 hours a day, 5 days a week	Available 9 hours a day, 5 days a week, excluding official holidays (09:00 to 18:00, Monday to Friday).	The repaired or new parts will be shipped within 45 calendar days after Huawei receives the defective parts.
	In China	9 x 5 x next business day (NBD)	Available 9 hours a day, 5 days a week, excluding official holidays (09:00 to 18:00, Monday to Friday).	Service requests submitted after 15:30 will be handled the next workday.

Table 8-2 describes warranty services provided by Huawei.

**Table 8-2** Warranty services

Service Content	Description
Help Desk	Huawei provides 24-hour after-sales technical support (such as handling requests for troubleshooting and hardware repair),

Service Content	Description
	receives and handles customer inquiries, complaints, and suggestions through a dedicated hotline.
Remote troubleshooting	After receiving a service request for rectifying a network or system fault, Huawei technical support engineers first analyze and handle the fault remotely and then resolve the issue as soon as possible. There are two remote troubleshooting methods: telephone support and remote access.
Online technical support	The Huawei support website provides product technical materials, such as product manuals, configuration guides, networking cases, and maintenance records. Authorized users can access the website, download documents, get up-to-date maintenance skills, and learn about the latest products.
Licensing of software updates	Huawei provides patches whenever necessary to ensure stable and reliable equipment operation.
Return for repair	<p>Huawei repairs or replaces faulty parts for you within a specified period. You can return faulty parts to the designated Huawei customer service center after submitting a service request.</p> <p>Huawei provides a three-year warranty for parts replacement and onsite repair for the ES3000 V3 used in China. Huawei provides a 9-hour-a-day, 5-day-a-week NBD support program.</p> <p>For the ES3000 V3 used outside China, Huawei provides a three-year warranty for parts replacement and repair, as well as a 9-hour-a-day, 5-day-a-week NBD support program. Huawei delivers the repaired or new parts within 45 calendar days after receiving the faulty parts.</p>



# 9 Certifications

9 Certifications lists the certifications that the ES3000 V3 has passed.

**Table 9-1** Certifications and standards

No.	Country/Region	Certification	Standard
1	China	RoHS	SJ/T-11363-2006 SJ/T-11364-2006
2	Europe	WEEE	2002/96/EC
3	Europe	RoHS	2002/95/EC
4	Europe	REACH	EC 1907/2006
5	Europe	CE	EN 60950-1:2006 2nd Ed EN 55022:2006 + A1:2007 (Class A) EN 55024:1998 + A1:2001 + A2:2003 EN 61000-3-2:2006 EN 61000-3-3:1995 +A1:2001 +A2:2005
6	America	FCC	
7	Japan	VCCI	
8	America	NRTL-UL	

# 10 DVT and Qualification

## 10.1 Signal Integrity

### 10.1.1 PCIe

**Table 10-1** High speed PCIe link test

Item	Description	Result
TX Conformance	With SigTest tools, in accordance with the requirements of the PCIe specification, test PCIe TX signal including Jitter, Eye and other indicators. Test controller chip samples cover Fast, Slow, and Typical chips.	Pass
RX Tolerance	With BertScope tools, in accordance with the requirements of the PCIe specification, test PCIe RX tolerance. Test controller chip samples cover Fast, Slow, and Typical chips.	Pass
Pull off	Measuring the quality of PCIe signals for the longest and shortest link. Test controller chip samples cover Fast, Slow, and Typical chips.	Pass
Build chain	Repeatedly to build chain. Test covers the longest and shortest link. Test chip samples cover Fast, Slow, and Typical chips.	Pass
PVT (Process, Voltage, Temperature)	Operating temperature(Case)for 2.5-inch: 0 ~ 70℃. Operating temperature(Ambient)for AIC: 0 ~ 55℃. voltage deviation: +/-5%. Controller Corner ship: FF, SS, TT.	Pass

### 10.1.2 Input Clock

In accordance with the PCIe specification, inject jitter and frequency offset with the clock generator, test the input clock tolerance.

Test samples cover PVT scene.

## 10.2 Protocol Compliance

### 10.2.1 PCIe

Item	Result
Microsoft HCK certification	Pass
PCI-SIG Compliance Test (with Lecroy Z3)	Pass

### 10.2.2 NVMe

The ES3000 V3 supports NVMe1.2, and has passed through the NVMe Plufest #5 test during the week of February 29, 2016 at UNH-IOL (The University of New Hampshire InterOperability Laboratory). As a result of the testing performed during the Plugfest, the ES3500P SFF and ES3600P SFF qualifies to be added to the NVMe Integrator's List.

The test suite referenced in the report is available at the UNH-IOL website:

<https://www.iol.unh.edu/services/testing/NVMe/testsuites>

Enclosed are the results from the NVMe Conformance Test Suite version 1.2.1:

#### Results Summary

Group Number and Name	Result
GROUP 1: ADMIN COMMAND SET	PASS
GROUP 2: NVM COMMAND SET	PASS
GROUP 3: NVM FEATURES	PASS
GROUP 4: CONTROLLER REGISTERS	PASS
GROUP 5: SYSTEM MEMORY STRUCTURE	PASS
GROUP 6: CONTROLLER ARCHITECTURE	PASS

Enclosed are the results from the NVMe Interoperability Test:

#### Results Summary

Test Number and Name	Result
Test 1.1 – Storage Device Identified	PASS
Test 1.2 – Format Storage Device	PASS
Test 1.3 – Write Read Compare	PASS
Test 1.4 – Multiple Devices on Bus	PASS
Test 1.5 – Boot from NVMe Device	PASS
Test 1.6 – Hotplug NVMe Device (Optional)	PASS

### 10.2.3 SNMP

Net-SNMP is open source code software that supports SNMP v1, SNMP v2c, SNMP v3. SNMP v3 is recommended due to its high security. Net-SNMP includes the source codes of the agent and multiple management tools and supports multiple extension modes.

The SNMP service utility of Windows provides SNMP query and trap functions, but supports only SNMP v1 and v2c. SNMP v3 is not supported. Therefore, exercise caution when using the utility.

The ES3000 V3 provides the SNMP extension agent to support the SNMP function. The extension defines the device MIB (Management Information Base). SNMP clients can query device status through the SNMP extension agent.

## 10.3 Functional and Interoperability

**Table 10-2** Functional and interoperability test list

No.	Item	Description	Result
1	Installation	OS: Linux/Windows/VMware. Each release version has more than 20+ times test for each compatible OS.	Pass
2	Firmware Update	4 pcs for each specification. Upgrade / rollback. Each release version has more than 20+ times for each test device.	Pass
3	Bootable	4 pcs for each specification. Data conformance testing. Reboot and power on/off test.	Pass
4	Performance	4 pcs for each specification. Bandwidth, IOPS, latency, stability, QoS.	Pass
5	Power Cycle	4 pcs for each specification. 2000+ times for each test device.	Pass
6	Reboot	4 pcs for each specification. 2000+ times for each test device.	Pass
7	Power loss	4 pcs for each specification. 2000+ times for each test device.	Pass
8	Hot plug	4pcs for each specification. 300+ times for each test device in capable platforms and OSs.	Pass
9	Fault Injection	Injection Coverage: Drive, Flash, PCIe.	Pass

## 10.4 Reliability

**Table 10-3** Reliability list

Item	Description	Result
RDT	Endurance test base on JESD218/219 Standard. 762 pcs for RDT verification.	Pass
HALT	To accelerate the ageing of the equipment by the following conditions change, and observe the function and performance of the equipment during the test. RH1288H V3 Server inlet temperature: -20 ~ 60℃. Voltage deviation: +/-5%. ES3000 Corner chip: FF, SS, TT.	Pass
HASS	To accelerate the exposure of potential defects of the equipment by the following conditions change, and observe the function and performance of the equipment during the test. Operating temperature(Case) for 2.5-inch: 0 ~ 65℃. Operating temperature(Ambient) for 2.5-inch: 0 ~ 55℃. Tests: Performance and power on/off test.	Pass
Long Term Stability	Samples: 60 pcs. Time: 3 months per sample. Tests: Data conformance testing.	Pass

# 11 Contractions

---

› <b>Numerics</b>	›
›	›
› <b>D</b>	›
› <b>DMA</b>	› Direct Memory Access
› <b>DWPD</b>	› Drive Writes Per Day
› <b>DVT</b>	› Design Verification Test
›	›
› <b>E</b>	›
› <b>ECC</b>	› Error Checking and Correcting
›	›
› <b>H</b>	›
› <b>HALT</b>	› Highly Accelerated Life Test
› <b>HASS</b>	› Highly Accelerated Stress Screens
› <b>HCK</b>	› Hardware Certification Kit
›	›
› <b>I</b>	›
› <b>IOPS</b>	› I/O Per Second
›	›
› <b>L</b>	›
› <b>LBA</b>	› Logical Block Addressing
› <b>LDPC</b>	› Low Density Parity Check Code
›	›
› <b>M</b>	›
› <b>MLC</b>	› Multi Level Cell

•		•
•	<b>N</b>	•
•	<b>NVMe</b>	• Non-Volatile Memory Express
•		•
•	<b>R</b>	•
•	<b>RAID</b>	• Redundant Array of Independent Disks
•	<b>RDT</b>	• Reliability Demonstration Test
•		•
•	<b>S</b>	•
•	<b>SSD</b>	• Solid State Disk
•	<b>SMBUS</b>	• System Management Bus
•	<b>SMART</b>	• Self-Monitoring Analysis and Reporting Technology
•	<b>SNMP</b>	• Simple Network Management Protocol
•		•
•	<b>U</b>	•
•	<b>UBER</b>	• Uncorrectable Bit Error Rate
•		•
•	<b>V</b>	•
•	<b>VPD</b>	• Vital Product Data