

PHISON



X200

U.2

v1.5

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REVISION HISTORY

Revision	Draft Date	History
0.1	Feb 29 th , 2024	Preliminary Version, 1 st release
0.2	Mar 21 st , 2024	Update performance, power consumption, performance and power sop, physical Dimension, airflow profile
0.3	Apr 26 th , 2024	Fix typo found in chapter 6 and chapter 1.7.2
0.4	May 8 th , 2024	Fix typo found in product overview
0.5	June 4 th , 2024	Update pulse duration, frequency and amplitude for shock and vibration, update chapter 5 interface PIN no. E12 name to "Ground"
0.6	Jun 25 th , 2024	Update performance, power consumption and drive weight
0.7	Jun 27 th , 2024	Correct weight for U.2 3.2TB & 3.84TB
0.8	Jul 4 th , 2024	Updated numbers for performance, latency, QoS, consistency in chapter 2. And update power consumption and inrush current for chapter 4
0.9	Jul 8 th , 2024	Modify number for performance, latency and QoS
0.A	Jul 11 th , 2024	Modify performance and latency number
0.B	Jul 30 th , 2024	1.Modify section 2.2, 32TB performance number 2.Modify section 2.3 latency, 16TB & 32TB number 3.Modify section 2.4 IOPs consistency 4.Modify section 2.5 QoS and remove footnote 5.Fix section 3.2, TBW 32TB flash configuration
0.C	August 8 th , 2024	Update U.2 32TB performance, IOPs consistency. Update X200 power consumption
0.D	August 14 th , 2024	Updated performance
0.E	Sept 6 th , 2024	1.Updated Weight 2.Updated Section 4.2 Power Consumption 3.Updated Section
0.F	Sept 27 th , 2024	1.Remove "estimation" from power consumption measurement. 2.Remove 99.99% QoS from Overview because 99.99% fluctuated a lot with different platforms
1.1	Dec 2 nd , 2024	1.Update power consumption measurement. 2.Update Performance
1.2	Jan 21 st , 2025	Update thermal throttling
1.3	Fab 12 th , 2025	1. Update power consumption 2. Update support command
1.4	Mar 5 th , 2025	Update format
1.5	Jun 18 th , 2025	Update Thermal Throttling Mechanism table

This specification is based on current mass production firmware version of X200-series and is subject to change without notice. Any deviation on following firmware revisions will not be updated unless the deviation is more than 5%.

PRODUCT OVERVIEW

Capacities

- OP=7%: 1920, 3840, 7680, 15360, 30720 GB
- OP=28%: 1600, 3200, 6400, 12800, 25600 GB

Form Factor

- U.2 15mm

PCIe Interface

- PCIe Gen5x4
- Single Port x4 lanes/Dual port 2x2 lanes
- PCIe AER (Advanced Error Reporting)

Compliance

- PCI Express® Base Specification Rev. 5.0
- NVMe Express® Base Specification Rev. 2.0
- NVMe Express® Management Interface Rev 1.2
- PCI Express SFF-8639 Module Specification Revision 5.0, Version 0.7

Performance

- Sequential Read: up to 14,800MB/s
- Sequential Write: up to 8,700MB/s
- Random Read: up to 3,300K IOPS
- Random Write: up to 900K IOPS

Power Consumption¹

- Active Read (Avg. RMS): 23W
- Active Write (Avg. RMS): 25W
- Idle Power: <5W

Endurance / Reliability

- MTBF²: 2.5 million hours
- UBER: < 1 sector per 10¹⁸ bits read
- DWPD: 1 / 3
- TBW³:
1600GB SSD – 8760 TB
1920GB SSD – 3504 TB
3200GB SSD – 17520 TB
3840GB SSD – 7008 TB

6400GB SSD – 35040 TB

7680GB SSD – 14016 TB

12800GB SSD – 70080 TB

15360GB SSD – 28032 TB

25600GB SSD – 140160 TB

30720GB SSD – 56064 TB

Environmental Specification

- Temperature Range
Operating: 0°C - 70°C with specified airflow
Non-operating: -40°C - 85°C
- Shock:
Operating: 500G, 2ms
Non-operating: 1000G, 0.5ms
- Vibration:
Operating: 2.17 Grms (7 - 800 Hz)
Non-operating: 16.3 Grms (10 - 2000 Hz)
- Drop: 80cm, 6 surfaces
- Bending: 50N, 60s

Certifications and Declarations

- CE, FCC, BSMI, VCCI, UKCA, RCM, ICES, KCC, CB, UL

Product Ecological Compliance

- RoHS compliant

Feature Support

- LBAF: 512 / 512+8 / 4K / 4K 8 / 4K+64 Bytes
- 128 Namespaces
- Single Port / Dual Port
- Reservation
- Metadata Protection
- Thermal throttling
- Power Loss Protection
- Hardware AES-XTS 256-bit Encryption
- Support SMBus

Physical Dimension

- U.2 15mm 100(L)x70(W)x15(H) mm

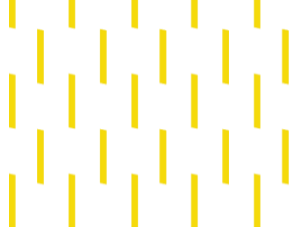
NOTES:

1. Please see “4.2 Power Consumption” for details.
2. MTBF is a prediction simulation based on Telcordia SR-332 model.
3. Please see “2.4.1. TBW (Terabytes Written) and DWPD (Drive Write Per Day)” for details.

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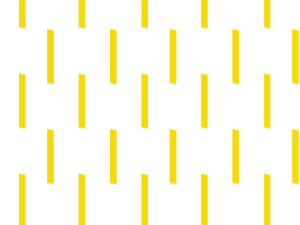


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1. INTRODUCTION

1.1. General Description

Phison's U.2 15mm Solid State Disk (SSD) delivers all the advantages of flash disk technology with PCIe Gen5 x4 interface, including being fully compliant with standard U.2 form factor, providing low power consumption compared to traditional hard drive and hot-swapping when removing/replacing/upgrading flash disks. X200 series U.2 offers a wide range of capacities up to 32TB and its performance can reach up to 14800 MB/s (for sequential read) and 8700 MB/s (for sequential write) based on TLC NAND flash with the DDR4. Moreover, the power consumption of X200 U.2 15mm SSD is much lower than traditional hard drives, making it the best embedded solution for new platforms.

1.2. SSD List

Table 1-1 Single Port SSD List

Model Name	Form Factor	DWPD	Capacity	Security	Part Number
X200E	U.2	3	1600GB	ISE	XP208H031T60E322T0410
				SED	XP208H031T60E222T0410
				Non-SED	XP208H031T60E022T0410
			3200GB	ISE	XP208H033T20E324T0910
				SED	XP208H033T20E224T0910
				Non-SED	XP208H033T20E024T0910
			6400GB	ISE	XP208H036T40E328T1910
				SED	XP208H036T40E228T1910
				Non-SED	XP208H036T40E028T1910
			12800GB	ISE	XP208H0312T8E3116T310
				SED	XP208H0312T8E2116T310
				Non-SED	XP208H0312T8E0116T310
X200P	U.2	1	1920GB	ISE	XP208H031T92P322T0410
				SED	XP208H031T92P222T0410
				Non-SED	XP208H031T92P022T0410
			3840GB	ISE	XP208H033T84P324T0910
				SED	XP208H033T84P224T0910
				Non-SED	XP208H033T84P024T0910
			7680GB	ISE	XP208H037T68P328T1910
				SED	XP208H037T68P228T1910
				Non-SED	XP208H037T68P028T1910
			15360GB	ISE	XP208H0315T3P3116T310
				SED	XP208H0315T3P2116T310
				Non-SED	XP208H0315T3P0116T310
			30720GB	ISE	XP208H0330T7P3132T710
				SED	XP208H0330T7P2132T710
				Non-SED	XP208H0330T7P0132T710

Table 1-2 Dual Port SSD List

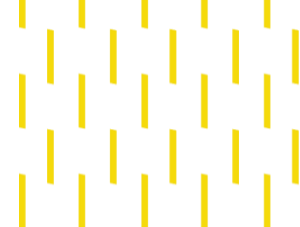
Model Name	Form Factor	DWPD	Capacity	Security	Part Number
X200E	U.2	3	1600GB	ISE	XX208H031T60E322T0410
				SED	XX208H031T60E222T0410
				Non-SED	XX208H031T60E022T0410
			3200GB	ISE	XX208H033T20E324T0910
				SED	XX208H033T20E224T0910
				Non-SED	XX208H033T20E024T0910
			6400GB	ISE	XX208H036T40E328T1910
				SED	XX208H036T40E228T1910
				Non-SED	XX208H036T40E028T1910
			12800GB	ISE	XX208H0312T8E3116T310
				SED	XX208H0312T8E2116T310
				Non-SED	XX208H0312T8E0116T310
X200P	U.2	1	1920GB	ISE	XX208H031T92P322T0410
				SED	XX208H031T92P222T0410
				Non-SED	XX208H031T92P022T0410
			3840GB	ISE	XX208H033T84P324T0910
				SED	XX208H033T84P224T0910
				Non-SED	XX208H033T84P024T0910
			7680GB	ISE	XX208H037T68P328T1910
				SED	XX208H037T68P228T1910
				Non-SED	XX208H037T68P028T1910
			15360GB	ISE	XX208H0315T3P3116T310
				SED	XX208H0315T3P2116T310
				Non-SED	XX208H0315T3P0116T310
			30720GB	ISE	XX208H0330T7P3132T710
				SED	XX208H0330T7P2132T710
				Non-SED	XX208H0330T7P0132T710

1.3. SSD Security Type

IEEE 1667 is supported but needs to be activated by vendor tool when needed, this is to prevent unintended eDrive implementation and the following necessity of Reverting by PSID before being able to re-install Operation System. Table 1-3 illustrates the types of sanitize operation supported.

Table 1-3 Drive Security Type

Drive Security Type	AES-256 Encryption	Sanitize Operation			TCG Commands	IEEE 1667
		Overwrite	Block Erase	Crypto Erase	PSID Revert Process	Windows eDrive
SED (TCG Opal)	Yes	No	Yes	Yes	Yes	Yes
ISE	Yes	No	Yes	Yes	No	No
Non-SED	No	No	No	No	No	No



2. PRODUCT SPECIFICATIONS

2.1. Electrical/Physical Interface

- PCI Express® Base Specification Rev. 5.0
- NVMe Express® Base Specification Rev. 2.0
- NVMe Express® Management Interface Rev 1.2
- PCIe Gen 5 x 4 lanes & backward compatible to PCIe Gen 4, Gen 3, Gen 2 and Gen 1 Device Capacity
- PCIe Express SFF-8639 Module Specification Revision 5.0, Version 0.7
- 256 IO queues supported (1 admin queue and 8 IO queue). Each IO queue support 8K entries

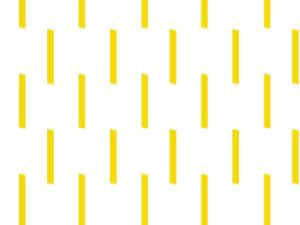
2.2. Device Capacity

Table 2-1 User Capacity and Addressable Sectors

Model Name	Capacity	User Addressable Sectors	Bytes per Sector
X200P	1920GB	3,750,748,848	512 Byte
	3840GB	7,501,476,528	
	7680GB	15,002,931,888	
	15360GB	30,001,856,512	
	30720GB	60,001,615,872	
X200E	1600GB	3,125,627,568	512 Byte
	3200GB	6,251,233,968	
	6400GB	12,502,446,768	
	12800GB	25,000,148,992	
	25600GB	50,000,297,984	

NOTES:

1. 1 Gigabyte (GB) is equal to 1,000,000,000 bytes; 1 sector is equal to 512 bytes.
2. The total actual usable capacity of the SSD may be less than the total physical capacity because internal NAND management, SSD format, SSD partition, operating system and so on.
3. The count of User Addressable Sectors is calculated by the formula of IDEMA.



2.3. Performance

2.3.1. Sequential Read/Write Performance

Table 2-2 Sequential Read/ Write Performance

Model Name	Capacity	Flash Type	Sequential 512KB (QD=32, Job=1)	
			Read (MB/s)	Write (MB/s)
X200P	1920GB	3D TLC	14,800	4,300
	3840GB	3D TLC	14,800	8,600
	7680GB	3D TLC	14,800	8,700
	15360GB	3D TLC	14,800	8,500
	30720 GB	3D TLC	14,000	7,400
X200E	1600GB	3D TLC	14,800	4,300
	3200GB	3D TLC	14,800	8,600
	6400GB	3D TLC	14,800	8,700
	12800GB	3D TLC	14,800	8,500
	25600 GB	3D TLC	14,000	7,400

NOTES:

- Performance is measured with the following conditions
 - FIO on Linux: 512KB sequential read/write for full drive
 - SSD is unformatted drive.
- Performance platform:
 - Mother board: MS03-CE0-000
 - CPU: Intel Xeon Gold 5416S
 - DRAM: DDR5 64G
 - OS version: Ubuntu 20.04.2 LTS
- Performance may differ according to flash configuration and platform.
- The tables are for reference only. Any criteria for accepting goods shall be further discussed based on different flash configurations.

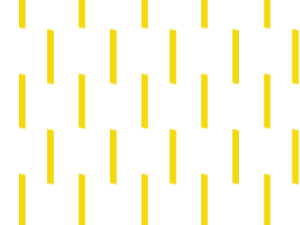
2.3.2. Random Read/ Write Performance

Table 2-3 Random Read/ Write Performance

Model Name	Capacity	Flash Type	Random 4KB (QD=128, Jobs=8)	
			Read (IOPS)	Write (IOPS)
X200P	1920GB	3D TLC	2,400K	140K
	3840GB	3D TLC	3,300K	320K
	7680GB	3D TLC	3,200K	390K
	15360GB	3D TLC	2,800K	420K
	30720 GB	3D TLC	2,300K	265K
X200E	1600GB	3D TLC	2,400K	390K
	3200GB	3D TLC	3,300K	790K
	6400GB	3D TLC	3,200K	880K
	12800GB	3D TLC	2,800K	900K
	25600 GB	3D TLC	2,300K	615K

NOTES:

- Performance is measured with the following conditions
 - FIO on Linux: 4KB random read/write for full drive
 - SSD is unformatted drive.
- Performance platform:
 - Mother board: MS03-CE0-000



- (b) CPU: Intel Xeon Gold 5416S
- (c) DRAM: DDR5 64G
- (d) OS version: Ubuntu 20.04.2 LTS
- 3. Performance may differ according to flash configuration and platform.
- 4. The tables are for reference only. Any criteria for accepting goods shall be further discussed based on different flash configurations.

2.3.3. IOPS Consistency

Table 2-4 IOPS Consistency

Model Name	Capacity	Flash Type	Random 4KB (QD=1, Job =1)		Random 4KB (QD=8, Jobs=4)	
			Read	Write	Read	Write
X200P	1920 GB	3D TLC	95%	95%	95%	95%
	3840 GB	3D TLC	95%	95%	95%	95%
	7680 GB	3D TLC	95%	95%	95%	95%
	15360 GB	3D TLC	95%	95%	95%	95%
	30720 GB	3D TLC	95%	95%	95%	95%
X200E	1600 GB	3D TLC	95%	95%	95%	90%
	3200 GB	3D TLC	95%	95%	95%	90%
	6400 GB	3D TLC	95%	95%	95%	90%
	12800 GB	3D TLC	95%	95%	95%	90%
	25600 GB	3D TLC	95%	95%	95%	90%

NOTES:

- Consistency Definition: (IOPS in the 99.9% 1-second interval) / (average IOPS during the test)
- Performance is measured with the following conditions
 - IOPS consistency on Linux: 4KB random read/write for full drive.
 - SSD is unformatted drive.
- Performance platform:
 - Mother board: MS03-CE0-000
 - CPU: Intel Xeon Gold 5416S
 - DRAM: DDR5 64G
 - OS version: Ubuntu 20.04.2 LTS
- Performance may differ according to flash configuration and platform.
- The tables are for reference only. Any criteria for accepting goods shall be further discussed based on different flash configurations.

2.3.4. Latency

Table 2-5 Latency

Model Name	Capacity	Flash Type	Random 4KB (QD=1, Job=1)		Random 4KB (QD=8, Jobs=4)	
			Read (μs)	Write (μs)	Read (μs)	Write (μs)
X200P	1920 GB	3D TLC	60	9	70	250
	3840 GB	3D TLC	60	9	70	110
	7680 GB	3D TLC	60	9	70	100
	15360 GB	3D TLC	60	9	70	100
	30720 GB	3D TLC	65	10	70	130
X200E	1600 GB	3D TLC	60	9	70	100
	3200 GB	3D TLC	60	9	70	50
	6400 GB	3D TLC	60	9	70	50
	12800 GB	3D TLC	60	9	70	50
	25600 GB	3D TLC	65	9	70	60

NOTES:

- Performance is measured with the following conditions
 - Latency on Linux: 4KB random read/write for full drive.
 - SSD is unformatted drive.
- Performance platform:
 - Mother board: MS03-CE0-000
 - CPU: Intel Xeon Gold 5416S
 - DRAM: DDR5 64G
 - OS version: Ubuntu 20.04.2 LTS
- Performance may differ according to flash configuration and platform.
- The tables are for reference only. Any criteria for accepting goods shall be further discussed based on different flash configurations.

2.3.5. Quality of Service (QoS)

Table 2-6 QoS (99%)

Model Name	Capacity	Flash Type	4KB Random Read/Write Quality of Service (QoS=99%)			
			(QD=1, Job =1)		(QD=8, Jobs =4)	
			Read (μs)	Write (μs)	Read (μs)	Write (μs)
X200P	1920 GB	3D TLC	70	10	140	250
	3840 GB	3D TLC	70	10	130	150
	7680 GB	3D TLC	70	10	120	120
	15360 GB	3D TLC	70	10	120	120
	30720 GB	3D TLC	70	10	120	150
X200E	1600 GB	3D TLC	70	10	140	120
	3200 GB	3D TLC	70	10	130	120
	6400 GB	3D TLC	70	10	120	120
	12800 GB	3D TLC	70	10	120	120
	25600 GB	3D TLC	70	10	120	120

Table 2-7 QoS (99.99%)

Model Name	Capacity	Flash Type	4KB Random Read/Write Quality of Service (QoS=99.99%)			
			(QD=1, Job =1)		(QD=8, Jobs =4)	
			Read (μs)	Write (μs)	Read (μs)	Write (μs)
X200P	1920 GB	3D TLC	75	13	240	500
	3840 GB	3D TLC	75	13	200	500
	7680 GB	3D TLC	75	13	180	500
	15360 GB	3D TLC	75	13	160	500
	30720 GB	3D TLC	75	13	160	500
X200E	1600 GB	3D TLC	75	13	240	500
	3200 GB	3D TLC	75	13	200	500
	6400 GB	3D TLC	75	13	180	500
	12800 GB	3D TLC	75	13	160	500
	25600 GB	3D TLC	75	13	160	500

NOTES:

- QoS is measured with the following conditions
 - QoS on Linux: 4KB random read/write for full drive.
 - SSD is unformatted drive.
- Performance platform:
 - Mother board: MS03-CE0-000
 - CPU: Intel Xeon Gold 5416S
 - DRAM: DDR5 64G
 - OS version: Ubuntu 20.04.2 LTS

- Performance may differ according to flash configuration and platform.
- The tables are for reference only. Any criteria for accepting goods shall be further discussed based on different flash configurations

2.4. Reliability

2.4.1. TBW (TeraBytes Written) and DWPD (Drive Write Per Day)

Table 2-8 TBW & DWPD

Model Name	Capacity	TBW	DWPD
X200P	1920GB	3504	1
	3840GB	7008	1
	7680GB	14016	1
	15360GB	28032	1
	30720GB	56064	1
X200E	1600GB	8760	3
	3200GB	17520	3
	6400GB	35040	3
	12800GB	70080	3
	25600GB	140160	3

NOTES:

- The JEDEC Enterprise 219A workload.
- Warranty is 5 years.
- $DWPD = TBW / (365 \times 5 \text{ years} \times \text{User capacity})$

2.4.2. UBER

Table 2-9 UBER

Capacity	UBER
1600GB	< 1 sector per 10^{18} bits read
1920GB	
3200GB	
3840GB	
6400GB	
7680GB	
15360GB	
12800GB	
25600GB	
30720GB	

NOTE:

- UBER (Uncorrectable Bit Error Rates) means the uncorrectable error per bits read.

2.4.3. MTBF

Table 2-10 MTBF

Capacity	MTBF
1600GB	2.5 million hours
1920GB	
3200GB	
3840GB	
6400GB	

7680GB	
15360GB	
12800GB	
25600GB	
30720GB	

NOTES:

1. MTBF (Mean Time Between Failures) represents the average operational time between failures of the drive

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3. ENVIRONMENTAL SPECIFICATIONS

3.1. Temperature and Humidity

Table 3-1 Temperature and Humidity Specification

Temperature	Operating	0°C to 70°C
	Non-operating	-40°C to 85°C
Relative Humidity	Operating	5% to 95%
	Non-operating	5% to 95%

3.2. Thermal Throttling

Table 3-2 Thermal Throttling Mechanism

Item	Description
Stage 1 No TMT	To monitor temp every 1 sec, until flash temperature over 77°C.
Stage 2 TMT1	While flash temp reach TMT1 (flash 77°C), it would trigger TMT to decrease Performance lightly.
Stage 3 TMT2	While flash temp reach TMT2 (flash 81°C), it would trigger TMT to decrease Performance heavily.
Stage 4 TT Stable	To Keep TT stable within flash temp 77~83°C. Would monitor temperature every second
TMT Protect	While flash temp reach 84°C Force 1 ACTIVE DIE PER CH(~500MB)
TMT Fatal	Perform thermal shutdown process when flash temperature $\geq 85^{\circ}\text{C}$ or controller temperature $\geq 115^{\circ}\text{C}$
Exit TT	While temperature $\leq 75^{\circ}\text{C}$, Device exit TT(Full speed) °

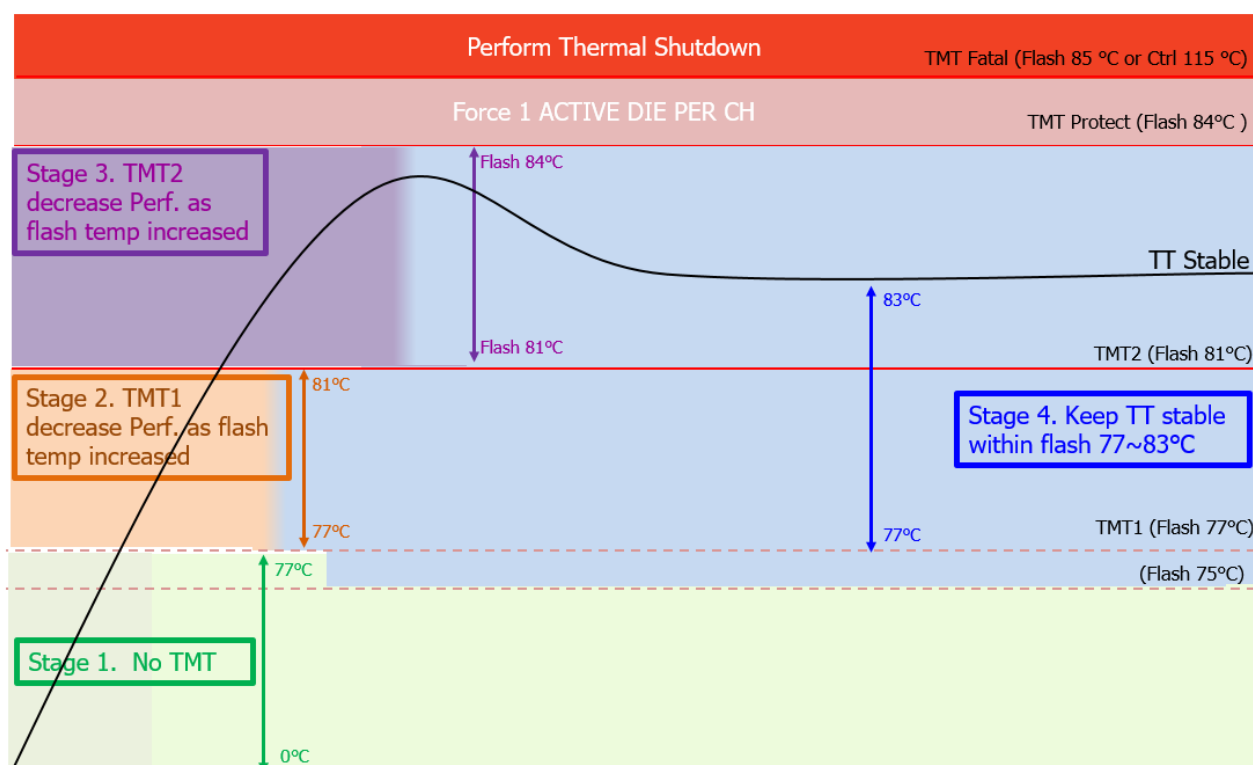


Figure 3-1 Thermal Throttling Mechanism

NOTES:

1. The temperature for TMT is based on T_{case} . (T_{case} : temperate value of on SSD thermal sensor)
2. TMT levels maybe varying by different workloads.

3.3. Airflow Profile

Figure 3-2 depicts the minimum airflow an X200 U.2 15mm (8TB) SSD needs to operate without triggering thermal throttling at different ambient temperatures.

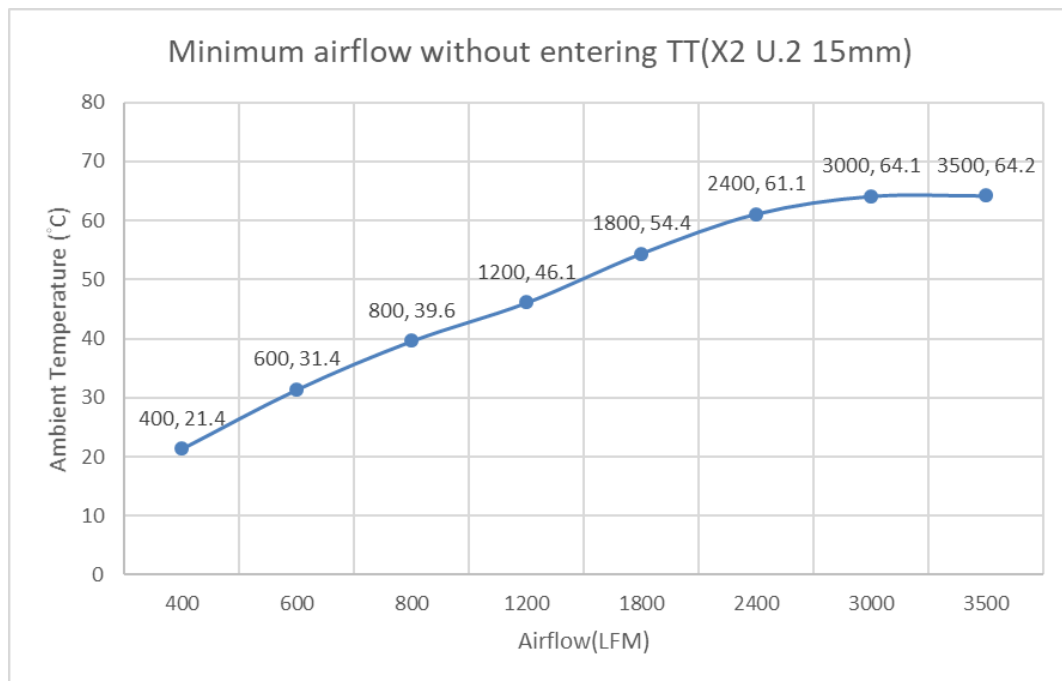
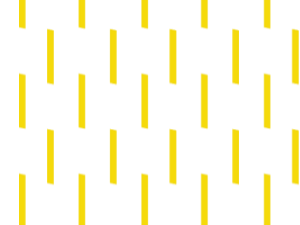


Figure 3-2 X200 U.2 15mm Airflow Curve



3.4. Mechanical (Shock/Vibration/Drop/Bending)

Table 3-3 Mechanical Test Condition

Shock	Operating	500G, 2ms
		1000G, 0.5ms
	Non-operating	500G, 2ms
		1000G, 0.5ms
Vibration	Operating	2.17 Grms (7 - 800 Hz)
	Non-operating	16.3 Grms (10 - 2000 Hz)
		0.4G/3G (2 - 500 Hz)
Drop	Non-operating	80cm, 6 surfaces
Bending	Non-operating	50N, 60s

3.5. Altitude

Table 3-4 Altitude

Altitude	Operating	0 to 18,000 feet
	Non-operating	0 to 40,000 feet

3.6. Electrostatic Discharge (ESD)

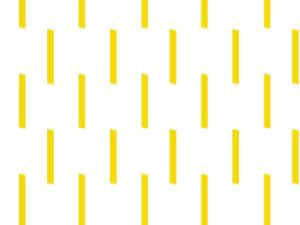
Table 3-5 Electrostatic Discharge (ESD)

Specification	+/- 4KV
EN55035, CISPR 35 EN 61000-4-2 and IEC 61000-4-2	Device functions are affected, but EUT will be back to its normal or operational state automatically.

3.7. EMI Compliance

Table 3-6 EMI Compliance

Specification
EN 55032, CISPR 32(CE) AS/NZS CISPR 32(CE) ANSI C63.4 (FCC) CNS 15936 (BSMI) VCCI-CISPR 32 (VCCI)



4. ELECTRICAL SPECIFICATIONS

4.1. Supply Voltage

Table 4-1 Supply Voltage

12V Operating Voltage	12V, +/- 10%
12V Rise Time (Max/Min)	2ms/ 100ms
12V Fall Time (Max/Min)	0.1ms / 5s
12V Noise Level	240mVp-p, 0-20MHz
Min. Off Time ¹ (under 0.1 V)	500ms
3.3Vaux Operating Voltage	3.3V, +5%/- 10%
3.3Vaux Rise Time (Max/Min)	2ms / 100ms
3.3Vaux Fall Time (Max/Min)	0.1ms / 5s
3.3Vaux Noise Level	66mVp-p, 0-20MHz

NOTE:

1. Minimum time between power removed from SSD (Vcc < 100 mV) and power re-applied to the drive.

4.2. Power Consumption

Table 4-2 X200P Power Consumption

Model Name	X200P				
Capacity	1920GB	3840GB	7680GB	15360GB	30720GB
128K Sequential READ (Average RMS, W)	16	17	17	19	21
128K Sequential WRITE (Average RMS, W)	14	21	21	23	24
4KB Random READ (Average RMS, W)	15	17	20	21	23
4KB Random WRITE (Average RMS, W)	16	22	23	24	25
4KB 70/30 Random READ/WRITE (Average RMS, W)	14	18	21	23	24
Idle (Average RMS, W)	5	5	5	5	5

Table 4-3 X200E Power Consumption

Model Name	X200E				
Capacity	1600GB	3200GB	6400GB	12800GB	25600GB
128K Sequential READ (Average RMS, W)	16	17	17	19	21
128K Sequential WRITE (Average RMS, W)	15	21	21	23	24
4KB Random READ (Average RMS, W)	16	18	20	22	23
4KB Random WRITE (Average RMS, W)	16	22	23	24	25
4KB 70/30 Random READ/WRITE (Average RMS, W)	14	18	20	22	22
Idle (Average RMS, W)	5	5	5	5	5

NOTES:

1. Power consumption is measured in average RMS on full speed mode.
2. Power consumption is measured with the following conditions
 - (a) Power Consumption: 128KB seq. read/write & 4K random read/write for full drive.
 - (b) SSD is unformatted drive.
3. Power consumption platform:
 - (a) Mother board: MS03-CE0-000
 - (b) CPU: Intel Xeon Gold 5416S
 - (c) DRAM: DDR5 64G
 - (d) OS version: Ubuntu 20.04.2 LTS
4. Power consumption may differ according to flash configuration and platform.
5. The tables are for reference only. Any criteria for accepting goods shall be further discussed based on

different flash configurations.

6. Power consumption is measured in average RMS on full speed mode.
7. Data collection procedure – Average RMS (500ms resolution)
 - (a) Run entire test script one time.
 - (b) Run every condition in this script
 - (c) Calculate average value for every condition then choose Average RMS
 - (d) Note value for every condition
 - (e) 3pcs sample for every capacity.

4.3. Inrush Current

Table 4-4 Inrush Current

Inrush current	1600GB /1920GB	3200GB /3840GB	6400GB /7680GB	12800GB /15360GB	25600GB /30720GB
12V	2.5A				3A

5. PHYSICAL DIMENSION

Figure 5-1 shows the case mechanical information of Phison X200 Series SSD in the U.2 15mm form factor. All dimensions are in millimeters.

Table 5-1 Physical Dimensions and Weight

Parameter	Unit	1600GB /1920GB	3200GB /3840GB	6400GB /7680GB	12800GB /15360GB	25600GB /30720GB
Length	mm	100.10 ± 0.30				
Width	mm	69.85 ± 0.25				
Height	mm	14.70 ± 0.20				
Weight	g	188	199	201	168	169

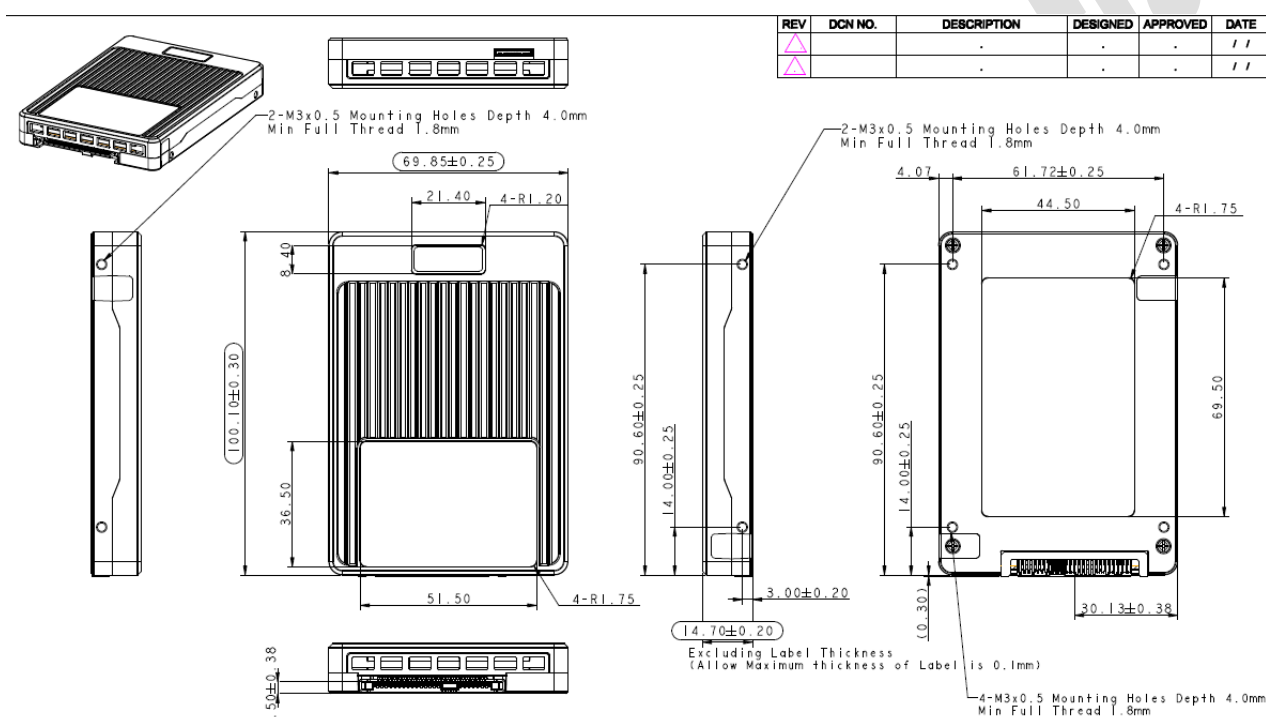


Figure 5-1 U.2 2.5-inch 15mm Mechanical information

6. INTERFACE

6.1. PCIe U.2 Pin Assignment and Descriptions

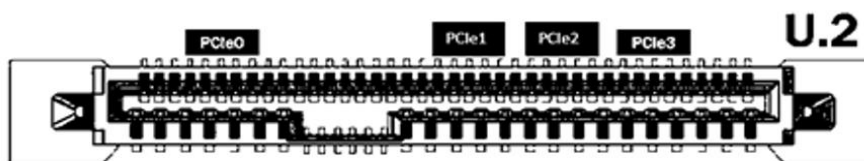
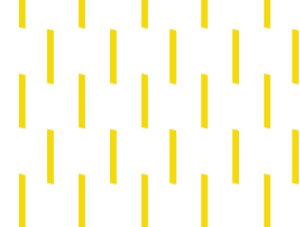


Figure 6-1 X200 U.2 PCIe SSD Pin Assignment

Table 6-1 Pin Assignment and Descriptions

Pin No.	Name	Description
P1	WAKE#	Reserved
P2	Reserved	Reserved
P3	PWRDIS	Power disable
P4	IfDet#	Interface Type Detect
P5	Ground	Ground
P6	Ground	Ground
P7	+5V	NC
P8	+5V	NC
P9	+5V	NC
P10	PRSNT#	Presence detect
P11	Activity#	Activity indicator
P12	Ground	Ground
P13	+12V Precharge	+12V Precharge power
P14	+12V	+12V for SFF-8639 power
P15	+12V	+12V for SFF-8639 power
SG1	Ground	Ground
SG2	Ground	Ground
S1	Ground	Ground
S2	NC	NC
S3	NC	NC
S4	Ground	Ground
S5	NC	NC
S6	NC	NC
S7	Ground	Ground
S8	Ground	Ground
S9	NC	NC
S10	NC	NC
S11	Ground	Ground
S12	NC	NC
S13	NC	NC
S14	Ground	Ground
S15	HPT0	Host port type-0
S16	Ground	Ground
S17	U.2 TX p1	Transmitter differential pair, U.2 Lane 1
S18	U.2 TX n1	Transmitter differential pair, U.2 Lane 1
S19	Ground	Ground

Pin No.	Name	Description
S20	U.2 RX n1	Receiver differential pair, U.2 Lane 1
S21	U.2 RX p1	Receiver differential pair, U.2 Lane 1
S22	Ground	Ground
S23	U.2 TX p2	Transmitter differential pair, or U.2 Lane 2
S24	U.2 TX n2	Transmitter differential pair, or U.2 Lane 2
S25	Ground	Ground
S26	U.2 RX n2	Receiver differential pair, U.2 Lane 2
S27	U.2 RX p2	Receiver differential pair, U.2 Lane 2
S28	Ground	Ground
E1	REFCLKB+	Reference clock (differential pair) for second X2 port
E2	REFCLKB-	Reference clock (differential pair) for second X2 port
E3	+3.3 Vaux	3.3 V auxiliary power
E4	CLKREQ#/PERSTB#	Clock request/Fundamental reset for second x2 port
E5	PERST#	Fundamental reset (if Single Port mode enabled, first x2 port)
E6	IFDet2#	Interface Type Detect
E7	REFCLK+	Reference clock (if dual-port enabled, first X2 port)
E8	REFCLK-	Reference clock (if dual-port enabled, first X2 port)
E9	Ground	Ground
E10	U.2 TX p0	Transmitter differential pair, U.2 Lane 0
E11	U.2 TX n0	Transmitter differential pair, U.2 Lane 0
E12	Ground	Ground
E13	U.2 RX n0	Receiver differential pair, U.2 Lane 0
E14	U.2 RX p0	Receiver differential pair, U.2 Lane 0
E15	Ground	Ground
E16	HPT1	Host port type
E17	U.2 TX p3	Transmitter differential pair, U.2 Lane 3
E18	U.2 TX n3	Transmitter differential pair, U.2 Lane 3
E19	Ground	Ground
E20	U.2 RX n3	Receiver differential pair, U.2 Lane 3
E21	U.2 RX p3	Receiver differential pair, U.2 Lane 3
E22	Ground	Ground
E23	SMCLK	SMBus (System Management Bus) clock
E24	SMDAT	SMBus (System Management Bus) data
E25	DualPortEn#	Dual-port Enable



7. SUPPORTED COMMANDS

7.1. NVMe Command List

Table 7-1 Admin Command List

Identifier	O/M	Command Description
00h	M	Delete I/O Submission Queue
01h	M	Create I/O Submission Queue
02h	M	Get Log Page
04h	M	Delete I/O Completion Queue
05h	M	Create I/O Completion Queue
06h	M	Identify
08h	M	Abort
09h	M	Set Feature
0Ah	M	Get Feature
0Ch	M	Asynchronous Event Request
0Dh	O	Namespace Management
10h	O	Firmware Commit
11h	O	Firmware Image Download
14h	O	Device Self-test
15h	O	Namespace Attachment
1Dh	O	NVMe-MI Send
1Eh	O	NVMe-MI Receive
80h	O	Format NVM
81h	O	Security Send
82h	O	Security Receive
84h	O	Sanitize

Table 7-2 I/O Commands

Identifier	O/M	Command Description
00h	M	Flush
01h	M	Write
02h	M	Read
04h	O	Write Uncorrectable
05h	O	Compare
08h	O	Write Zeroes
09h	O	Dataset Management (Trim only)
0Ch	O	Verify
0Dh	O	Reservation Register
0Eh	O	Reservation Report
11h	O	Reservation Acquire
15h	O	Reservation Release

Table 7-3 Set Feature Commands

Identifier	O/M	Command Description
01h	M	Arbitration
02h	M	Power Management
04h	M	Temperature Threshold
05h	M	Error Recovery
07h	M	Number Of Queues

08h	M	Interrupt Coalescing
09h	M	Interrupt Vector Configuration
0Ah	M	Write Atomicity Normal
0Bh	M	Asynchronous Event Configuration
0Eh	O	Timestamp
10h	O	Host Controlled Thermal Management
17h	O	Sanitize Config
18h	O	Endurance Group Event Configuration
7Eh	M	Controller Metadata (NVMe MI)
7Fh	M	Namespace Metadata (NVMe MI)
81h	O	Host Identifier
82h	O	Reservation Notification Mask
83h	O	Reservation Persistence
C0h	O	Error Injection
C1h	O	Clear FW Update History
C2h	O	EOL/PLP Failure Mode
C3h	O	Clear PCIe Correctable Error Counters
C4h	O	Enable IEEE1667
C5h	O	Latency Monitor
C6h	O	PLP Health Check Interval
C7h	O	DSSD Power State

Table 7-4 Get Log Page Commands

Identifier	O/M	Command Description
00h	O	Supported Log Pages
01h	M	Error Information
02h	M	SMART / Health Information
03h	M	Firmware Slot Information
04h	O	Changed Namespace List
05h	O	Commands Supported and Effects
06h	O	Device Self-test
07h	O	Telemetry Host-Initiated
08h	O	Telemetry Controller-Initiated
09h	O	Endurance Group Information
0Dh	O	Persistent Event Log
0Fh	O	Endurance Group Event Aggregate
12h	O	Feature Identifiers Supported and Effects
13h	O	NVMe-MI Commands Supported and Effects
14h	O	Command and Feature Lockdown
80h	O	Reservation Notification
81h	O	Sanitize Status
C0h	O	SMART/Health Information Extended
C1h	O	Error Recovery
C2h	O	Firmware Activation History
C3h	O	Latency Monitor
C4h	O	Device Capabilities
C5h	O	Unsupported Requirements

Table 7-5 NVMe Management Interface Commands

Identifier	O/M	Command Description
00h	M	Read NVMe-MI Data Structure

01h	M	NVM Subsystem Health Status Poll
02h	M	Controller Health Status Poll
03h	M	Configuration Set
04h	M	Configuration Get
05h	M	VPD Read
06h	M	VPD Write
07h	M	Reset

Table 7-6 SMBus / I2C Elements Supported

SMBus/I2C Element	SMBus/I2C Address(8bit)	
	Hex Format	Binary format
FRU Information Device (for NVMe Storage Device)	A6h	1010_011xb
SMBus/I2C Management Endpoint	3Ah	0011_101xb
Basic Management Command	D4h	1101_010xb

7.2. Identify Device Data

The following table details the sector data returned by the IDENTIFY DEVICE command.

Table 7-7 Identify Controller Data Structure

Bytes	O/M	Description	Default Value
01:00	M	PCI Vendor ID (VID)	0X1987
03:02	M	PCI Subsystem Vendor ID (SSVID)	0X1987
23:04	M	Serial Number (SN)	TBD
63:24	M	Model Number (MN)	TBD
71:64	M	Firmware Revision (FR)	TBD
72	M	Recommended Arbitration Burst (RAB)	0x00
75:73	M	IEEE OUI Identifier (IEEE)	TBD*
76	O	Controller Multi-Path I/O and Namespace Sharing Capabilities (CMIC)	0x00 1 port 0x03 2 ports
77	M	Maximum Data Transfer Size (MDTS)	0x09
79:78	M	Controller ID (CNTLID)	0x0000
83:80	M	Version (VER)	0x00020000
87:84	M	RTD3 Resume Latency (RTD3R)	0x001E8480 (2 Sec)
91:88	M	RTD3 Entry Latency (RTD3E)	0x00989680
95:92	M	Optional Asynchronous Events Supported (OAES)	0x00004300
99:96	M	Controller Attributes (CTRATT)	0x00000290
101:100	O	Read Recovery Levels Supported (RRLS):	0x0000
110:102	-	Reserved	0x00
111	M	Controller Type (CNTRLTYPE)	0x01
127:112	O	FRU Globally Unique Identifier (FGUID):	TBD
129:128	O	Command Retry Delay Time 1 (CRDT1):	0x0000
131:130	O	Command Retry Delay Time 2 (CRDT2):	0x0000
133:132	O	Command Retry Delay Time 3 (CRDT3):	0x0000
239:134		Reserved	
252:240		Reserved for the NVMe Management Interface	
253	M	NVM Subsystem Report (NVMSR)	0x01
254	M	VPD Write Cycle Information (VWCI)	0x00
255	M	Management Endpoint Capabilities (MEC)	0x03
257:256	M	Optional Admin Command Support (OACS)	0x045F

Bytes	O/M	Description	Default Value
258	M	Abort Command Limit (ACL)	0x07
259	M	Asynchronous Event Request Limit (AERL)	0x0F
260	M	Firmware Updates (FRMW)	0x1F
261	M	Log Page Attributes (LPA)	0x3E
262	M	Error Log Page Entries (ELPE)	0xFF
263	M	Number of Power States Support (NPSS)	5
264	M	Admin Vendor Specific Command Configuration (AVSCC)	0x01
265	O	Autonomous Power State Transition Attributes (APSTA)	0x00
267:266	M	Warning Composite Temperature Threshold (WCTEMP)	0x015E
269:268	M	Critical Composite Temperature Threshold (CCTEMP)	0x0166
271:270	O	Maximum Time for Firmware Activation (MTFA)	0x0032
275:272	O	Host Memory Buffer Preferred Size (HMPRE)	0x00000000
279:276	O	Host Memory Buffer Minimum Size (HMMIN)	0x00000000
295:280	O	Total NVM Capacity (TNVMCAP)	**
311:296	O	Unallocated NVM Capacity (UNVMCAP)	**
315:312	O	Replay Protected Memory Block Support (RPMBS)	0x00000000
317:316	O	Extended Device Self-test Time (EDSTT)	0x0002
318	O	Device Self-test Options (DSTO)	0x01
319	O	Firmware Update Granularity (FWUG)	0xFF
321:320	O	Keep Alive Support (KAS)	0x0000
323:322	O	Host Controlled Thermal Management Attributes (HCTMA)	0x0001
325:324	O	Minimum Thermal Management Temperature (MNTMT)	0x0111
327:326	O	Maximum Thermal Management Temperature (MXTMT)	0x01A2
331:328	O	Sanitize Capabilities (SANICAP)	0x40000002 nonSED 0x40000003 SED 0x40000003 ISE 0x40000003 FIPS
335:332	O	Host Memory Buffer Minimum Descriptor Entry Size (HMMINDS):	0x00000000
337:336	O	Host Memory Maximum Descriptors Entries (HMMAXD):	0x0000
339:338	O	NVM Set Identifier Maximum (NSETIDMAX):	0x0000
341:340	O	Endurance Group Identifier Maximum (ENDGIDMAX):	0x0001
342	O	ANA Transition Time (ANATT):	0x00
343	O	Asymmetric Namespace Access Capabilities (ANACAP):	0x00
347:344	O	ANA Group Identifier Maximum (ANAGRPMAX):	0x00000000
351:348	O	Number of ANA Group Identifiers (NANAGRPID):	0x00000000
355:352	O	Persistent Event Log Size (PELS):	0x63
511:356		Reserved	0x0

Table 7-8 NVMe Command Set Attributes

Bytes	O/M	Description	Default Value
512	M	Submission Queue Entry Size (SQES)	0x66
513	M	Completion Queue Entry Size (CQES)	0x44
515:514		Maximum Outstanding Commands (MAXCMD)	0x0400 1 port 0x0200 2 ports
519:516	M	Number of Namespaces (NN)	0x00000080
521:520	M	Optional NVM Command Support (ONCS)	0x00FF
523:522	M	Fused Operation Support (FUSES)	0x0001
524	M	Format NVM Attributes (FNA)	0x04
525	M	Volatile Write Cache (VWC)	0x06

527:526	M	Atomic Write Unit Normal (AWUN)	0x00FF
529:528	M	Atomic Write Unit Power Fail (AWUPF)	0x00FF
530	M	NVM Vendor Specific Command Configuration (NVSCC)	0x01
531	M	Namespace Write Protection Capabilities (NWPC):	0x00
533:532	O	Atomic Compare & Write Unit (ACWU)	0x00FF
535:534	M	Reserved	0x0000
539:536	O	SGL Support (SGLS)	0x000F0001
543:540	O	Maximum Number of Allowed Namespaces (MNAN):	0x00000000
767:544	M	Reserved	0x00
1023:768	M	NVM Subsystem NVMe Qualified Name (SUBNQN):	TBD

Table 7-9 I/O Command Set Attributes

Bytes	O/M	Description	Default Value
2079:2048	M	Power State 0 Descriptor (PSD0)	
Bit[255:184]		Reserved	0x0
Bit[183:182]		Active Power Scale (APS)	0x2
Bit[181:179]		Reserved	0x0
Bit[178:176]		Active Power Workload (APW)	0x0
Bit[175:160]		Active Power (ACTP)	0xBB8
Bit[159:152]		Reserved	0x0
Bit[151:150]		Idle Power Scale (IPS)	0x0
Bit[149:144]		Reserved	0x0
Bit[143:128]		Idle Power (IDL P)	0x0
Bit[127:125]		Reserved	0x0
Bit[124:120]		Relative Write Latency (RWL)	0x0
Bit[119:117]		Reserved	0x0
Bit[116:112]		Relative Write Throughput (RWT)	0x0
Bit[111:109]		Reserved	0x0
Bit[108:104]		Relative Read Latency (RRL)	0x0
Bit[103:101]		Reserved	0x0
Bit[100:96]		Relative Read Throughput (RRT)	0x0
Bit[95:64]		Exit Latency (EXLAT)	0x0
Bit[63:32]		Entry Latency (ENLAT)	0x0
Bit[31:26]		Reserved	0x0
Bit[25]		Non-Operational State (NOPS)	0x0
Bit[24]		Max Power Scale (MPS)	0x0
Bit[23:16]		Reserved	0x0
Bit[15:0]		Maximum Power (MP)	0xBB8
2111:2080	O	Power State 1 Descriptor (PSD1)	
Bit[255:184]		Reserved	0x0
Bit[183:182]		Active Power Scale (APS)	0x2
Bit[181:179]		Reserved	0x0
Bit[178:176]		Active Power Workload (APW)	0x0
Bit[175:160]		Active Power (ACTP)	0x9C4
Bit[159:152]		Reserved	0x0
Bit[151:150]		Idle Power Scale (IPS)	0x0
Bit[149:144]		Reserved	0x0
Bit[143:128]		Idle Power (IDL P)	0x0
Bit[127:125]		Reserved	0x0
Bit[124:120]		Relative Write Latency (RWL)	0x1
Bit[119:117]		Reserved	0x0

Bytes	O/M	Description	Default Value
Bit[116:112]		Relative Write Throughput (RWT)	0x1
Bit[111:109]		Reserved	0x0
Bit[108:104]		Relative Read Latency (RRL)	0x1
Bit[103:101]		Reserved	0x0
Bit[100:96]		Relative Read Throughput (RRT)	0x1
Bit[95:64]		Exit Latency (EXLAT)	0x0
Bit[63:32]		Entry Latency (ENLAT)	0x0
Bit[31:26]		Reserved	0x0
Bit[25]		Non-Operational State (NOPS)	0x0
Bit[24]		Max Power Scale (MPS)	0x0
Bit[23:16]		Reserved	0x0
Bit[15:0]		Maximum Power (MP)	0x9C4
2143:2112	O	Power State 2 Descriptor (PSD2)	
Bit[255:184]		Reserved	0x0
Bit[183:182]		Active Power Scale (APS)	0x2
Bit[181:179]		Reserved	0x0
Bit[178:176]		Active Power Workload (APW)	0x0
Bit[175:160]		Active Power (ACTP)	0x7D0
Bit[159:152]		Reserved	0x0
Bit[151:150]		Idle Power Scale (IPS)	0x0
Bit[149:144]		Reserved	0x0
Bit[143:128]		Idle Power (IDL P)	0x0
Bit[127:125]		Reserved	0x0
Bit[124:120]		Relative Write Latency (RWL)	0x2
Bit[119:117]		Reserved	0x0
Bit[116:112]		Relative Write Throughput (RWT)	0x2
Bit[111:109]		Reserved	0x0
Bit[108:104]		Relative Read Latency (RRL)	0x2
Bit[103:101]		Reserved	0x0
Bit[100:96]		Relative Read Throughput (RRT)	0x2
Bit[95:64]		Exit Latency (EXLAT)	0x0
Bit[63:32]		Entry Latency (ENLAT)	0x0
Bit[31:26]		Reserved	0x0
Bit[25]		Non-Operational State (NOPS)	0x0
Bit[24]		Max Power Scale (MPS)	0x0
Bit[23:16]		Reserved	0x0
Bit[15:0]		Maximum Power (MP)	0x7D0
2175:2144	O	Power State 3 Descriptor (PSD3)	-
Bit[255:184]		Reserved	0x0
Bit[183:182]		Active Power Scale (APS)	0x2
Bit[181:179]		Reserved	0x0
Bit[178:176]		Active Power Workload (APW)	0x0
Bit[175:160]		Active Power (ACTP)	0x708
Bit[159:152]		Reserved	0x0
Bit[151:150]		Idle Power Scale (IPS)	0x0
Bit[149:144]		Reserved	0x0
Bit[143:128]		Idle Power (IDL P)	0x0
Bit[127:125]		Reserved	0x0
Bit[124:120]		Relative Write Latency (RWL)	0x3
Bit[119:117]		Reserved	0x0

Bytes	O/M	Description	Default Value
Bit[116:112]		Relative Write Throughput (RWT)	0x3
Bit[111:109]		Reserved	0x0
Bit[108:104]		Relative Read Latency (RRL)	0x3
Bit[103:101]		Reserved	0x0
Bit[100:96]		Relative Read Throughput (RRT)	0x3
Bit[95:64]		Exit Latency (EXLAT)	0x0
Bit[63:32]		Entry Latency (ENLAT)	0x0
Bit[31:26]		Reserved	0x0
Bit[25]		Non-Operational State (NOPS)	0x0
Bit[24]		Max Power Scale (MPS)	0x0
Bit[23:16]		Reserved	0x0
Bit[15:0]		Maximum Power (MP)	0x708
2207:2176	O	Power State 4 Descriptor (PSD4)	-
Bit[255:184]		Reserved	0x0
Bit[183:182]		Active Power Scale (APS)	0x2
Bit[181:179]		Reserved	0x0
Bit[178:176]		Active Power Workload (APW)	0x0
Bit[175:160]		Active Power (ACTP)	0x5DC
Bit[159:152]		Reserved	0x0
Bit[151:150]		Idle Power Scale (IPS)	0x0
Bit[149:144]		Reserved	0x0
Bit[143:128]		Idle Power (IDL P)	0x0
Bit[127:125]		Reserved	0x0
Bit[124:120]		Relative Write Latency (RWL)	0x4
Bit[119:117]		Reserved	0x0
Bit[116:112]		Relative Write Throughput (RWT)	0x4
Bit[111:109]		Reserved	0x0
Bit[108:104]		Relative Read Latency (RRL)	0x4
Bit[103:101]		Reserved	0x0
Bit[100:96]		Relative Read Throughput (RRT)	0x4
Bit[95:64]		Exit Latency (EXLAT)	0x0
Bit[63:32]		Entry Latency (ENLAT)	0x0
Bit[31:26]		Reserved	0x0
Bit[25]		Non-Operational State (NOPS)	0x0
Bit[24]		Max Power Scale (MPS)	0x0
Bit[23:16]		Reserved	0x0
Bit[15:0]		Maximum Power (MP)	0x5DC
2239:2208	O	Power State 5 Descriptor (PSD5)	-
Bit[255:184]		Reserved	0x0
Bit[183:182]		Active Power Scale (APS)	0x2
Bit[181:179]		Reserved	0x0
Bit[178:176]		Active Power Workload (APW)	0x0
Bit[175:160]		Active Power (ACTP)	0x4B0
Bit[159:152]		Reserved	0x0
Bit[151:150]		Idle Power Scale (IPS)	0x0
Bit[149:144]		Reserved	0x0
Bit[143:128]		Idle Power (IDL P)	0x0
Bit[127:125]		Reserved	0x0
Bit[124:120]		Relative Write Latency (RWL)	0x5
Bit[119:117]		Reserved	0x0

Bytes	O/M	Description	Default Value
Bit[116:112]		Relative Write Throughput (RWT)	0x5
Bit[111:109]		Reserved	0x0
Bit[108:104]		Relative Read Latency (RRL)	0x5
Bit[103:101]		Reserved	0x0
Bit[100:96]		Relative Read Throughput (RRT)	0x5
Bit[95:64]		Exit Latency (EXLAT)	0x0
Bit[63:32]		Entry Latency (ENLAT)	0x0
Bit[31:26]		Reserved	0x0
Bit[25]		Non-Operational State (NOPS)	0x0
Bit[24]		Max Power Scale (MPS)	0x0
Bit[23:16]		Reserved	0x0
Bit[15:0]		Maximum Power (MP)	0x4B0
2271:2240	O	Power State 6 Descriptor (PSD6)	0x00
2303:2272	O	Power State 7 Descriptor (PSD7)	0x00
2335:2304	O	Power State 8 Descriptor (PSD8)	0x00
2367:2336	O	Power State 9 Descriptor (PSD9)	0x00
2399:2368	O	Power State 10 Descriptor (PSD10)	0x00
2431:2400	O	Power State 11 Descriptor (PSD11)	0x00
2463:2432	O	Power State 12 Descriptor (PSD12)	0x00
2495:2464	O	Power State 13 Descriptor (PSD13)	0x00
2527:2496	O	Power State 14 Descriptor (PSD14)	0x00
2559:2528	O	Power State 15 Descriptor (PSD15)	0x00
2591:2560	O	Power State 16 Descriptor (PSD16)	0x00
2623:2592	O	Power State 17 Descriptor (PSD17)	0x00
2655:2624	O	Power State 18 Descriptor (PSD18)	0x00
2687:2656	O	Power State 19 Descriptor (PSD19)	0x00
2719:2688	O	Power State 20 Descriptor (PSD20)	0x00
2751:2720	O	Power State 21 Descriptor (PSD21)	0x00
2783:2752	O	Power State 22 Descriptor (PSD22)	0x00
2815:2784	O	Power State 23 Descriptor (PSD23)	0x00
2847:2816	O	Power State 24 Descriptor (PSD24)	0x00
2879:2848	O	Power State 25 Descriptor (PSD25)	0x00
2911:2880	O	Power State 26 Descriptor (PSD26)	0x00
2943:2912	O	Power State 27 Descriptor (PSD27)	0x00
2975:2944	O	Power State 28 Descriptor (PSD28)	0x00
3007:2976	O	Power State 29 Descriptor (PSD29)	0x00
3039:3008	O	Power State 30 Descriptor (PSD30)	0x00
3071:3040	O	Power State 31 Descriptor (PSD31)	0x00
4095:3072	O	Vendor Specific.	0x00

Table 7-10 I/O Vendor Specific

Bytes	O/M	Description	Default Value
4095:3072	O	Vendor Specific (VS)	Phison Reserved

NOTES:

- * The OUI shall be a valid IEEE/RAC assigned identifier that may be registered at <http://standards.ieee.org/develop/regauth/oui/public.html>.
- ** Depends on the using of capacity

Table 7-11 Identify Namespace Data Structure & NVM Command Set Specific

Bytes	O/M	Description	Default Value
7:0	M	Namespace Size (NSZE)	TBD*
15:8	M	Namespace Capacity (NCAP)	TBD*
23:16	M	Namespace Utilization (NUSE)	TBD*
24	M	Namespace Features (NSFEAT)	0x10
25	M	Number of LBA Formats (NLBAF)	0x04
26	M	Formatted LBA Size (FLBAS)	0x00
27	M	Metadata Capabilities (MC)	0x03
28	M	End-to-end Data Protection Capabilities (DPC)	0x13
29	M	End-to-end Data Protection Type Settings (DPS)	0x00
30	O	Namespace Multi-path I/O and Namespace Sharing Capabilities (NMIC)	0x01 1 port 0x02 2 ports
31	O	Reservation Capabilities (RESCAP)	0x83
32	O	Format Progress Indicator (FPI)	0x80
33	O	Deallocate Logical Block Features (DLFEAT):	0x19
35:34	O	Namespace Atomic Write Unit Normal (NAWUN)	0x0000
37:36	O	Namespace Atomic Write Unit Power Fail (NAWUPF)	0x0000
39:38	O	Namespace Atomic Compare & Write Unit (NACWU)	0x0000
41:40	O	Namespace Atomic Boundary Size Normal (NABSN)	0x0000
43:42	O	Namespace Atomic Boundary Offset (NABO)	0x0000
45:44	O	Namespace Atomic Boundary Size Power Fail (NABSPF)	0x0000
47:46	O	Namespace Optimal I/O Boundary (NOIOB):	0x0000
63:48	O	NVM Capacity (NVMCAP)	TBD*
65:64	O	Namespace Preferred Write Granularity (NPWG):	0x0000 4K LBA size 0x0007 512B LBA size
67:66	O	Namespace Preferred Write Alignment (NPWA):	0x0000 4K LBA size 0x0007 512B LBA size
69:68	O	Namespace Preferred Deallocate Granularity (NPDG):	0x0000 4K LBA size 0x0007 512B LBA size
71:70	O	Namespace Preferred Deallocate Alignment (NPDA):	0x0000 4K LBA size 0x0007 512B LBA size
73:72	O	Namespace Optimal Write Size (NOWS):	0x0000 4K LBA size 0x0007 512B LBA size
91:74	-	Reserved	0x00
95:92	O	ANA Group Identifier (ANAGRPID):	0x00000000
98:96	-	Reserved	
99	O	Namespace Attributes (NSATTR):	0x00
101:100	O	NVM Set Identifier (NVMSETID):	0x0000
103:102	O	Endurance Group Identifier (NEDGID)	0x0001
119:104	O	Namespace Globally Unique Identifier (NGUID)	TBD**
127:120	O	IEEE Extended Unique Identifier (EUI64)	TBD**
131:128	M	LBA Format 0 Support (LBAF0)	0x00090000
135:132	O	LBA Format 1 Support (LBAF1)	0x00090008
139:136	O	LBA Format 2 Support (LBAF2)	0x000C0000
143:140	O	LBA Format 3 Support (LBAF3)	0x000C0008
147:144	O	LBA Format 4 Support (LBAF4)	0x000C0040
151:148	O	LBA Format 5 Support (LBAF5)	0x00000000
155:152	O	LBA Format 6 Support (LBAF6)	0x00000000
159:156	O	LBA Format 7 Support (LBAF7)	0x00000000
163:160	O	LBA Format 8 Support (LBAF8)	0x00000000

Bytes	O/M	Description	Default Value
167:164	O	LBA Format 9 Support (LBAF9)	0x00000000
171:168	O	LBA Format 10 Support (LBAF10)	0x00000000
175:172	O	LBA Format 11 Support (LBAF11)	0x00000000
179:176	O	LBA Format 12 Support (LBAF12)	0x00000000
183:180	O	LBA Format 13 Support (LBAF13)	0x00000000
187:184	O	LBA Format 14 Support (LBAF14)	0x00000000
191:188	O	LBA Format 15 Support (LBAF15)	0x00000000
383:192		Reserved	0x00
4095:384	O	Vendor Specific (VS)	0x00

NOTES:

1. *According to IDEMA SPEC
2. ** According to IEEE EUI-64 SPEC

Table 7-12 List of Identify Namespace Data Structure for Each Capacity (512+0)

Capacity (GB)	Byte [7:0]: Namespace Size (NSZE)(Hex)	Byte [7:0]: Namespace Size (NSZE)(Dec)
30720	DF8600000	60,001,615,872
15360	6FC400000	30,001,856,512
30720	DF8F952B0	60,011,664,048
15360	6FC7CD2B0	30,005,842,608
7680	37E3E92B0	15,002,931,888
3840	1BF1F72B0	7,501,476,528
1920	DF8FE2B0	3,750,748,848

7.3. SMART Attributes

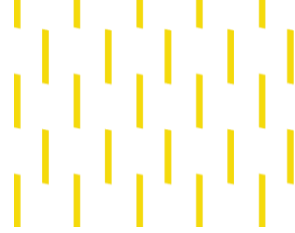
Table 7-13 SMART Attributes (Log Identifier 02h)

Bytes Index	Bytes	Description
[0]	1	Critical Warning
[2:1]	2	Composite Temperature
[3]	1	Available Spare
[4]	1	Available Spare Threshold
[5]	1	Percentage Used
[31:6]	26	Reserved
[47:32]	16	Data Units Read
[63:48]	16	Data Units Written
[79:64]	16	Host Read Commands
[95:80]	16	Host Write Commands
[111:96]	16	Controller Busy Time
[127:112]	16	Power Cycles
[143:128]	16	Power On Hours
[159:144]	16	Unsafe Shutdowns
[175:160]	16	Media and Data Integrity Errors
[191:176]	16	Number of Error Information Log Entries
[195:192]	4	Warning Composite Temperature Time
[199:196]	4	Critical Composite Temperature Time
[201:200]	2	Temperature Sensor 1 (Current Temperature)
[203:202]	2	Temperature Sensor 2 (N/A)
[205:204]	2	Temperature Sensor 3 (N/A)
[207:206]	2	Temperature Sensor 4 (N/A)

[209:208]	2	Temperature Sensor 5 (N/A)
[211:210]	2	Temperature Sensor 6 (N/A)
[213:212]	2	Temperature Sensor 7 (N/A)
[215:214]	2	Temperature Sensor 8 (N/A)
[219:216]	4	Thermal Management Temperature 1 Transition Count
[223:220]	4	Thermal Management Temperature 2 Transition Count
[227:224]	4	Total Time For Thermal Management Temperature 1 (seconds)
[231:228]	4	Total Time For Thermal Management Temperature 2 (seconds)
[511:232]	280	Reserved

Table 7-14 SMART Attributes (Log Identifier C0h)

Bytes Index	Bytes	Description
[15:0]	16	Physical Media Units Written
[31:16]	16	Physical Media Units Read
[39:32]	8	Bad User NAND Blocks
[47:40]	8	Bad System NAND Blocks
[55:48]	8	XOR Recovery Count
[63:56]	8	Uncorrectable Read Error Count
[71:64]	8	Soft ECC Error Count
[79:72]	8	End to End Correction Counts
[80]	1	System Data % Used
[87:81]	7	Refresh Counts
[95:88]	8	User Data Erase Counts
[97:96]	2	Thermal Throttling Status and Count
[103:98]	6	DSSD Specification Version
[111:104]	8	PCIe Correctable Error Count
[115:112]	4	Incomplete Shutdowns
[119:116]	4	Reserved
[120]	1	% Free Blocks
[127:121]	7	Reserved
[129:128]	2	Capacitor Health
[130]	1	NVMe Errata Version
[135:131]	5	Reserved
[143:136]	8	Unaligned I/O
[151:144]	8	Security Version Number
[159:152]	8	Total NUSE
[175:160]	16	PLP Start Count
[191:176]	16	Endurance Estimate
[199:192]	8	PCIe Link Retraining Count
[207:200]	8	Power State Change Count
[493:208]	286	Reserved
[495:494]	2	Log Page Version
[511:496]	16	Log Page GUID



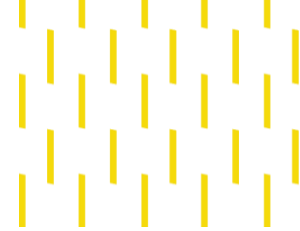
8. VITAL PRODUCT DATA

X200 U.2 devices can support Read and Write to Vital Product Data (VPD). VPD contains:

- Basic inventory information such as type and size of Enterprise PCIe SSD, manufacture, date, revision, and GUID.
- Power management data such as power level and power modes.
- Vendor specific data.

VPD is stored in a SMBus device with a slave address of 0xA6. VPD page can be read via SMBUS through address 0x53. Writes to the VPD page uses 0x53.

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9. PRODUCT COMPLIANCE

Table 9-1 Product Regulatory Compliance and Certifications

Category	Certifications
EMC	CE
	FCC
	BSMI
	VCCI
	UKCA
	RCM
	ICES
	KCC
Safety	CB
	UL

PHISON Confidential

10. PRODUCT WARRANTY POLICY

Complete information regarding Phison's warranties to the Phison brand enterprise SSD product ("Product(s)") is listed below.

This limited warranty covers any defects in material or workmanship in the new Products accompanied by this limited warranty statement. This limited warranty does not apply to any Products on which the original identification information has been altered, obliterated or removed; that has not been handled or packaged correctly; that has been sold as secondhand; or that has been resold contrary to U.S.A. and other applicable export regulations.

Duration of Warranty

For any other Product manufactured and supplied by Phison, Phison hereby certifies that in the event Product does not conform to the specification for (A) a period of five (5) years from the date of Phison's delivery of the Product or (B) the period ending on the date at which use of the Product exceeds Product's total terabytes written as recorded by or derived from Product's S.M.A.R.T. Attribute, including but not limited to, Product's drive life is used up in accordance with the S.M.A.R.T. Attribute, whichever occurs earlier ("Warranty Period"), and such inconformity is confirmed by Phison to be solely attributable to Phison, Phison's sole and maximum obligation shall be to repair or replace the nonconforming Product, free of charge, in Phison's sole discretion.

Exclusion of the Warranty

Notwithstanding the foregoing, the aforementioned warranty shall exclude the inconformity arising from, in relation to or associated with:

- (1) alternation, modification, improper use, misuse or excessive use of Phison Product;
- (2) failure to comply with Phison's instructions;
- (3) Phison's compliance with or use of the instructions, technologies, designs, specifications, devices, materials, components, parts, software and firmware provided, instructed or approved by Buyer (including any of its parents, subsidiaries, affiliates, suppliers, subcontractors or downstream customers);
- (4) combination of Phison Product with other materials, components, parts, goods, hardware, firmware or

software not supplied by Phison;

- (5) any claim brought by a third party who is commonly known as intellectual property right assertion entity or patent troll;
- (6) NAND flash itself or NAND flash which is embedded into Phison Products;
- (7) Phison's compliance with general industry standards;
- (8) other error or failure not solely attributable to Phison's cause (including without limitation, normal wear or tear, manufacturing or assembly wastage, improper operation, virus, unauthorized maintenance or repair).

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11. REFERENCE

The following table is to list out the standards that have been adopted for designing the product.

Table 11-1 List of References

Title	Source
PCI Express® Base Specification Rev. 5.0	https://www.pcisig.com/specifications/pciexpress/base3/
NVM Express® Base Specification Rev. 2.0	http://www.nvmexpress.org/
Solid-State Drive Requirements and Endurance Test Method (JESD219A)	http://www.jedec.org/standards-documents/docs/jesd219a
PCI Express SFF-8639 Module Specification Revision 5.0, Version 0.7	https://pcisig.com/specifications