

PHISON



X200Z

U.2

v1.4

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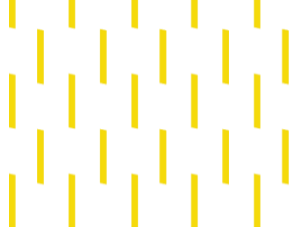
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REVISION HISTORY

Revision	Draft Date	History
v1.0	Dec 13 th , 2024	Preliminary Version, 1 st release
v1.1	Dec 30 th , 2024	Update Performance & power consumption data
v1.2	Fab 13 th , 2025	Update Performance data
v1.3	Mar 13 th , 2025	Update MPN format
v1.4	May 29 th , 2025	Update datasheet format

This specification is based on current mass production firmware version of X200Z-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%.

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PRODUCT OVERVIEW

Capacities

- 800, 1600, 3200GB

Form Factor

- U.2 15mm

PCIe Interface

- PCIe Gen5x4
- 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 9,500MB/s
- Random Read: up to 3,100K IOPS
- Random Write: up to 950K IOPS

Power Consumption¹

- Active Read (Avg. RMS): 20W
- Active Write (Avg. RMS): 19W
- Idle Power: <5W

Endurance / Reliability

- MTBF²: 2.5 million hours
- UBER: < 1 sector per 10¹⁸ bits read
- DWPD: 60
- TBW³:
800GB SSD- 87600 TB
1600GB SSD- 175200 TB
3200GB SSD – 350400 TB

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.

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
- Dual Port
- Reservation
- Metadata Protection
- Thermal throttling
- Power Loss Protection
- Hardware AES-XTS 256-bit Encryption
- Support SMBus

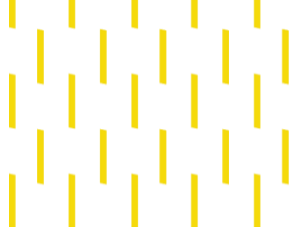
Physical Dimension

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

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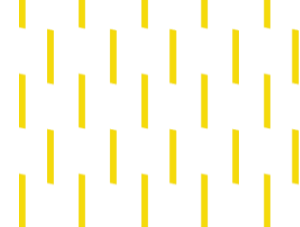
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1. INTRODUCTION

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. X200Z series U.2 offers a wide range of capacities up to 3200GB and its performance can reach up to 14800 MB/s (for sequential read) and 9500 MB/s (for sequential write) based on TLC NAND flash with the DDR4. Moreover, the power consumption of X200Z 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 SSD List

Model Name	Form Factor	Interface	DWPD	User Capacity	Raw Capacity	Security	Part Number
X200Z	U.2	Dual Port	60	3200GB	15360GB	ISE	XX208H023T20Z3116T300
				1600GB	7680 GB	ISE	XX208H021T60Z318T1900
				800GB	3840 GB	ISE	XX208H02800GZ314T0900

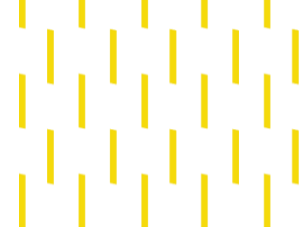
1.3. SSD Security Type

1.3.1. Secure Erase

Secure Erase is a standard ATA command and will write all "0xFF" to fully wipe all the data on hard drives and SSDs. When this command is issued, SSD controller will erase its storage blocks and return to its factory default settings.

Table 1-2 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
ISE	Yes	No	Yes	Yes	No	No



2. PRODUCT SPECIFICATIONS

2.1. Electrical/Physical Interface

- PCI Express® Base Specification Ver. 5.0
- NVM Express™ Base Specification Rev. 2.0
- NVM 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

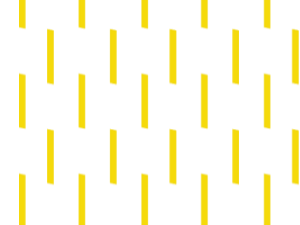
2.2. Device Capacity

Table 2-1 X200Z User Capacity and Addressable Sectors

Model Name	Capacity	User Addressable Sectors	Bytes per Sector
X200Z	800GB	1,532,824,368	512 Byte
	1600GB	3,125,627,568	512 Byte
	3200GB	6,251,233,968	512 Byte

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)
X200Z	800GB	3D TLC	14,800	9500
	1600GB	3D TLC	14,800	9500
	3200GB	3D TLC	14,800	9500

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)
X200Z	800GB	3D TLC	3,100K	950K
	1600GB	3D TLC	3,100K	950K
	3200GB	3D TLC	2,800K	950K

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
 - 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.

2.3.3. 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
X200Z	800GB	3D TLC	95%	95%	95%	90%
	1600GB	3D TLC	95%	95%	95%	90%
	3200 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.

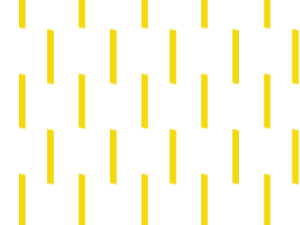
2.3.4. Latency

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)
X200Z	800GB	3D TLC	45	10	50	40
	1600GB	3D TLC	45	10	50	35
	3200 GB	3D TLC	45	10	50	35

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)
X200Z	800GB	3D TLC	45	10	100	100
	1600GB	3D TLC	45	10	100	100
	3200 GB	3D TLC	45	10	100	100

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)
X200Z	800GB	3D TLC	47	13	130	300
	1600GB	3D TLC	47	13	130	300
	3200 GB	3D TLC	47	13	130	300

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
X200Z	800GB	87600	60
	1600GB	175200	60
	3200GB	350400	60

NOTES:

- The JEDEC Enterprise 219A workload.
- Warranty is 5 years.
- DWPD = TBW / (365 x 5 years x User capacity)

2.4.2. UBER

Table 2-9 UBER

Capacity	UBER
800GB	< 1 sector per 10 ¹⁸ bits read
1600GB	
3200GB	

NOTE:

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

2.4.3. MTBF

Table 2-10 MTBF

Capacity	MTBF
800GB	2.5 million hours
1600GB	
3200GB	

NOTE:

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

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	CE Judgement
Stage 1 No TMT	Idle state for entering TMT1 or TMT2 Tflash ~ 76 °C	Full CE
Stage 2 TMT1	When flash temperature reaches TMT1 (77°C ~ 81°C), the drive will speed down to TMT1 with performance (< 7300MB/S)	
Stage 3 TMT2	When flash temperature reaches TMT2 (81°C), the drive will speed down to TMT2 with performance (< 1700MB/S)	
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 ≥ 85°C or controller temperature ≥ 115°C	
Resume TMT2 – TMT1	Tflash ≤ 75°C	Can only exit TT when temperature ≤ 75°C after enter TMT2. Will not change from TMT2 state to TMT 1 state
Resume TMT1 – Normal	Tflash ≤ 75°C	

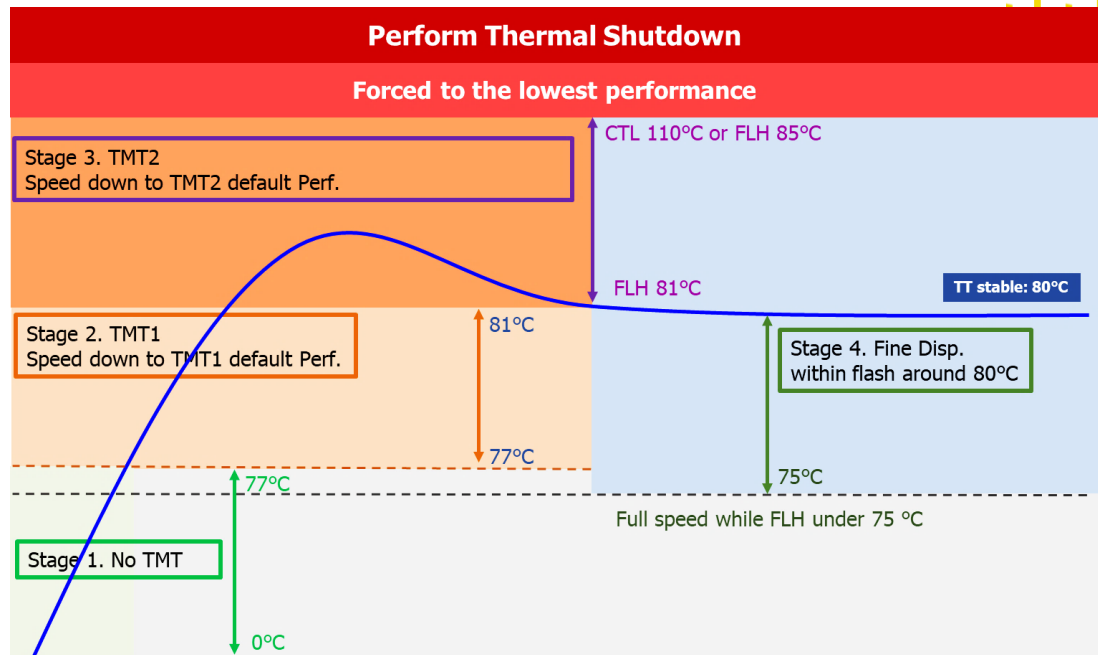


Figure 3-1 Thermal Throttling Mechanism

NOTES:

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

3.3. Airflow Profile

Figure 3-2 depicts the minimum airflow a U.2 15mm (8TB) needs to operate without triggering thermal throttling at ambient temperatures varied from 35°C to 65°C.

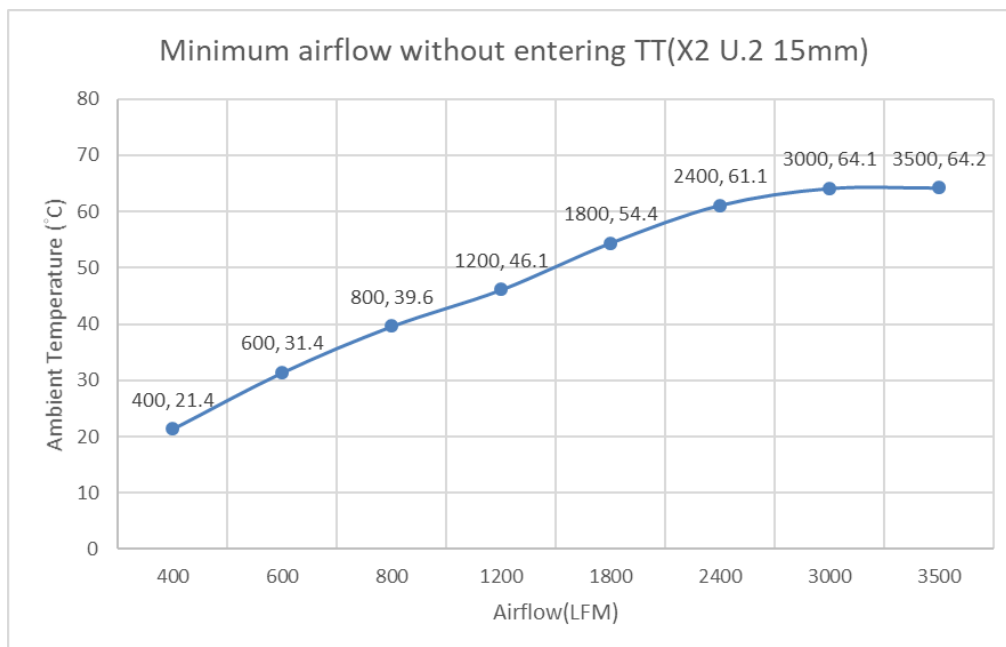


Figure 3-2 U.2 15mm Airflow Curve

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

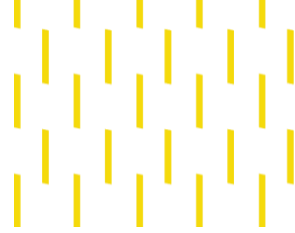
Table 3-3 Mechanical Test Condition

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)

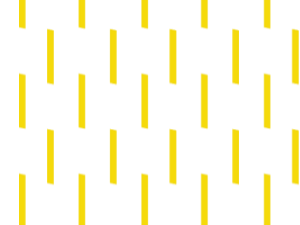
Specification	+/- 4KV
EN55035, CISPR 35 EN 61000-4-2 and IEC 61000-4-2	Device functions are affected, but EUT will be back to its normal or operational state automatically.

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)

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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 ($V_{cc} < 100$ mV) and power re-applied to the drive.

4.2. Power Consumption

Table 4-2 Power Consumption

Model Name	X200Z		
Capacity	800GB	1600GB	3200GB
128K Sequential READ (Average RMS, W)	17	18	19
128K Sequential WRITE (Average RMS, W)	16	17	19
4KB Random READ (Average RMS, W)	18	19	20
4KB Random WRITE (Average RMS, W)	16	16	18
4KB 70/30 Random READ/WRITE (Average RMS, W)	17	19	20
Idle (Average RMS, W)	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 4-3 Inrush Current

Inrush current	800GB	1600GB	3200GB
12V	2.5A		

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5. PHYSICAL DIMENSION

Figure 5-1 shows the case mechanical information of PASCARI X200Z Series SSD in the U.2 15mm form factor.

All dimensions are in millimeters.

Table 5-1 Physical Dimensions and Weight

Parameter	Unit	800GB	1600GB	3200GB
Length	mm	100.10 ± 0.30		
Width	mm	69.85 ± 0.25		
Height	mm	14.70 ± 0.20		
Weight	g	199	201	168

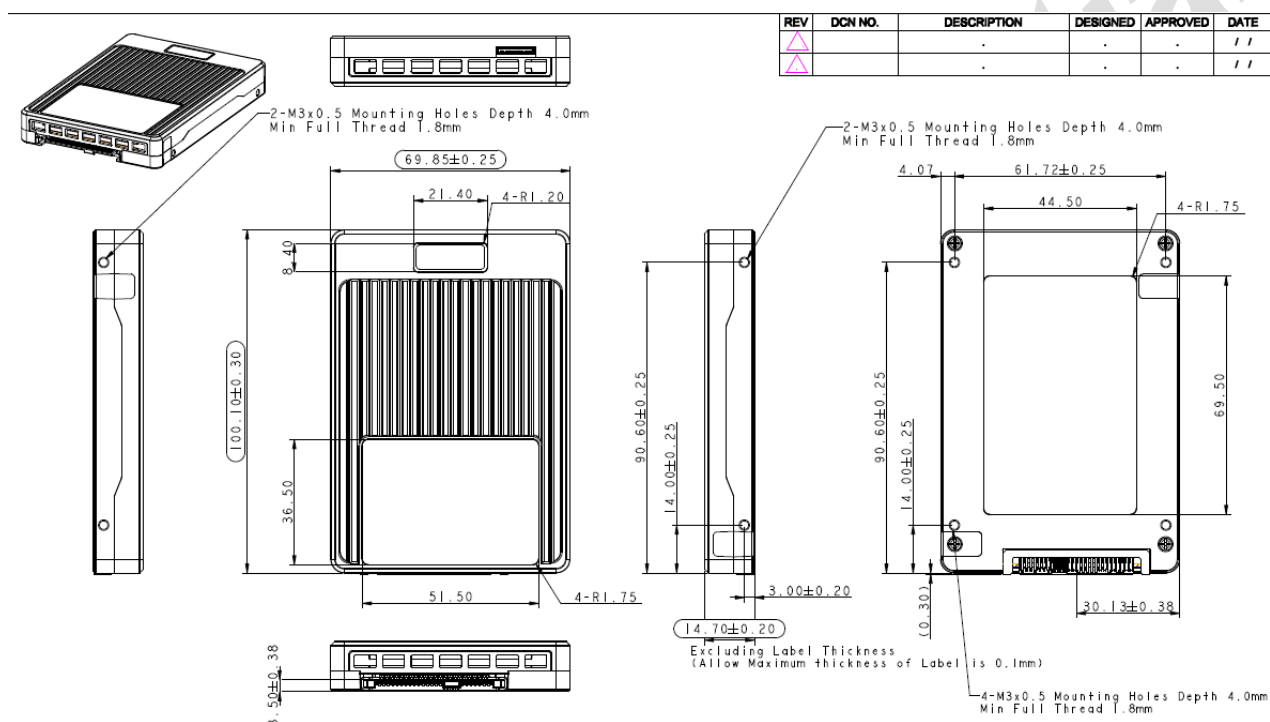


Figure 5-1 U.2 / U.2 2.5-inch 15mm Mechanical information

6. INTERFACE

6.1. PCIe U.2 and U.2 Pin Assignment and Descriptions

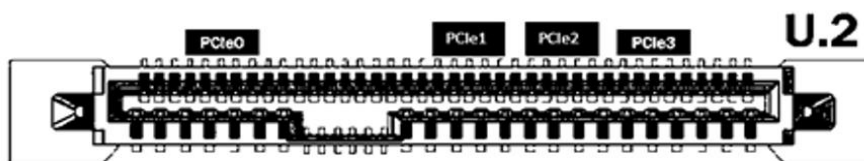


Figure 6-1 X200Z U.2 PCIe SSD Pin Assignment

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
18h	O	Keep Alive
19h	O	Directive Send
1Ah	O	Directive Receive
1Ch	O	Virtualization Management
1Dh	O	NVMe-MI Send
1Eh	O	NVMe-MI Receive
7Ch	O	Doorbell Buffer Config
80h	O	Format NVM
81h	O	Security Send
82h	O	Security Receive
84h	O	Sanitize
86h	O	Get LBA Status

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
00h	-	Reserved
01h	M	Arbitration
02h	M	Power Management
03h	O	LBA Range Type
04h	M	Temperature Threshold
05h	M	Error Recovery
06h	O	Volatile Write Cache
07h	M	Number Of Queues
08h	M	Interrupt Coalescing
09h	M	Interrupt Vector Configuration
0Ah	M	Write Atomicity Normal
0Bh	M	Asynchronous Event Configuration
0Ch	O	Autonomous Power State Transition
0Dh	O	Host Memory Buffer
0Eh	O	Timestamp
0Fh	O	Keep Alive Timer
10h	O	Host Controlled Thermal Management
11h	O	Non-Operational Power State Config
12h	O	Read Recovery Level Config
13h	O	Predictable Latency Mode Config
14h	O	Predictable Latency Mode Window
15h	O	LBA Status Information Attributes
16h	O	Host Behavior Support
17h	O	Sanitize Config
18h	O	Endurance Group Event Configuration
19h - 77h	-	Reserved (NVMe Reserved)
78h – 7Dh	-	Reserved(NVMe MI Reserved)
7Eh	M	Controller Metadata (NVMe MI)
7Fh	M	Namespace Metadata (NVMe MI)
80h	O	Software Progress Marker
81h	O	Host Identifier
82h	O	Reservation Notification Mask
83h	O	Reservation Persistence
84h	O	Namespace Write Protection Config
85h - BFh	-	Command Set Specific (Reserved)
C0h - FFh	O	Vendor Specific

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

Identifier	O/M	Command Description
07h	O	Telemetry Host-Initiated
08h	O	Telemetry Controller-Initiated
09h	O	Endurance Group Information
0Ah	O	Predictable Latency Per NVM Set
0Bh	O	Predictable Latency Event Aggregate
0Ch	O	Asymmetric Namespace Access
0Dh	O	Persistent Event Log
0Eh	O	LBA Status Information
0Fh	O	Endurance Group Event Aggregate
10h	O	Media Unit Status
11h	O	Supported Capacity Configuration List
12h	O	Feature Identifiers Supported and Effects
13h	O	NVMe-MI Commands Supported and Effects
14h	O	Command and Feature Lockdown
15h	O	Boot Partition
16h	O	Rotational Media Information
70h	O	Discovery
80h	O	Reservation Notification
81h	O	Sanitize Status
82h - FFh	-	Reserved

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
0Ah	O	Management Endpoint Buffer Read
0Bh	O	Management Endpoint Buffer Write
0Ch	O	Shutdown
0Ch - BFh	O	Reserved
C0h - FFh	O	Vendor Specific

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
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)	**

Bytes	O/M	Description	Default Value
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)	0x40000003 ISE
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

NVMe Command Set Attributes			
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

I/O Command Set Attributes			
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

I/O Command Set Attributes			
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
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

I/O Command Set Attributes			
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
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

I/O Command Set Attributes			
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
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

I/O Command Set Attributes			
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

Vendor Specific			
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

Bytes	O/M	Description	Default Value
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
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:

- *According to IDEMA SPEC
- ** 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

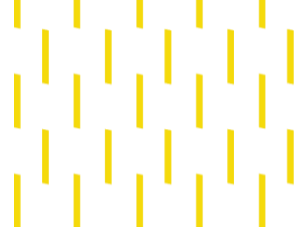
Bytes Index	Bytes	Description
[71:64]	8	Soft ECC Error Count
[79:72]	8	End to End Correction Counts
[80]	1	System Data % Used
[87:81]	7	Refresh Counts
[95:88]	8	User Data Erase Counts
[97:96]	2	Thermal Throttling Status and Count
[103:98]	6	DSSD Specification Version
[111:104]	8	PCIe Correctable Error 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

Table 7-15 SMART Attributes (Log Identifier D2h)

Bytes Index	Bytes	Description
[7:0]	8	Device Capacity
[15:8]	8	User Capacity
[23:16]	8	NAND Read
[31:24]	8	NAND Write
[39:32]	8	NAND Erase Sector
[47:40]	8	SSD Life Remaining Percent D3
[55:48]	8	SSD Life Used Percent D3
[56]	1	WP Water Mark
[58:57]	2	Highest temperature
[62:59]	4	Read Fail Count
[66:63]	4	Data E3D Error
[70:67]	4	PHY Error Count
[74:71]	4	Total Bad Block Count
[78:75]	4	Total Early Bad Blcok Count
[82:79]	4	Total Later Bad Blcok Count
[86:83]	4	Read Fail Count
[90:87]	4	Program Fail Count
[94:91]	4	Erase Failure Count
[102:95]	8	System Table Copy Count
[110:103]	8	ReadMoveTableCnt
[114:111]	4	Data read retry count
[118:115]	4	RAID ECC retry count

Bytes Index	Bytes	Description
[122:119]	4	RAID ECC failed count
[130:123]	8	Total Erase Count
[134:131]	4	D2/D3 Max Erase Cnount
[138:135]	4	D2/D3 Average Erase Count
[142:139]	4	D2/D3 Min Erase Count
[150:143]	8	Background read count
[154:151]	4	Host Write Uncorrectable Sector Count
[158:155]	4	Wear Leveling Count
[160:159]	2	Chip internal temperature
[162:161]	2	Thermal throttling
[164:163]	2	Thermal throttling time
[172:165]	8	FW Code Update Count
[180:173]	8	Flash UNC Error Count
[184:181]	4	HB retry count
[188:185]	4	SB retry count
[190:189]	2	Previous Average Erase Count
[194:191]	4	Power CAP init error count
[198:195]	4	Data RAID ECC Recovery Success
[202:199]	4	Data RAID ECC Recovery Failed
[206:203]	4	Table RAID ECC Recovery Success
[210:207]	4	Table RAID ECC Recovery Failed
[211]	1	SSD Life Used Percent with Previous Average Erase Count
[215:212]	4	ddr decode 1-bit error count
[217:216]	2	error count of thermal sensor 1
[219:218]	2	error count of thermal sensor 2
[221:220]	2	error count of thermal sensor 3
[223:222]	2	error count of thermal sensor 4
[231:224]	8	raw data of thermal sensor (raw data(2Byte)*4sensor= 8Byte)
[235:232]	4	Data Soft RAID Recovery Success
[239:236]	4	Data Soft RAID Recovery Fail
[243:240]	4	ddr corrected error count
[247:244]	4	ddr detected error count
[251:248]	4	cop1 sram corrected error count
[255:252]	4	cop1 sram detected error count
[259:256]	4	nvme sram corrected error count
[263:260]	4	nvme sram detected error count
[267:264]	4	pcie mac0 pl sram corrected error count
[271:268]	4	pcie mac0 pl sram detected error count
[275:272]	4	pcie mac0 tl sram corrected error count
[279:276]	4	pcie mac0 tl sram detected error count
[283:280]	4	pcie mac1 pl sram corrected error count
[287:284]	4	pcie mac1 pl sram detected error count
[291:288]	4	pcie mac1 tl sram corrected error count
[295:292]	4	pcie mac1 tl sram detected error count
[299:296]	4	host sram corrected error count
[303:300]	4	host sram detected error count
[307:304]	4	hdma sram corrected error count
[311:308]	4	hdma sram detected error count
[315:312]	4	ddr0 sram corrected error count
[319:316]	4	ddr0 sram detected error count

Bytes Index	Bytes	Description
[323:320]	4	fip0 sram corrected error count
[327:324]	4	fip0 sram detected error count
[331:328]	4	fip1 sram corrected error count
[335:332]	4	fip1 sram detected error count
[339:336]	4	fip2 sram corrected error count
[343:340]	4	fip2 sram detected error count
[347:344]	4	fip3 sram corrected error count
[351:348]	4	fip3 sram detected error count
[355:352]	4	aepu sram corrected error count
[359:356]	4	aepu sram detected error count
[363:360]	4	sys0 sram corrected error count
[367:364]	4	sys0 sram detected error count
[371:368]	4	smbm sram corrected error count
[375:372]	4	smbm sram detected error count
[379:376]	4	sec sram corrected error count
[383:380]	4	sec sram detected error count
[387:384]	4	dbuf sram corrected error count
[391:388]	4	dbuf sram detected error count
[395:392]	4	dmac sram corrected error count
[399:396]	4	dmac sram detected error count
[403:400]	4	corrected error count
[407:404]	4	detected error count
[415:408]	8	tlc nand read
[423:416]	8	tlc nand write
[431:424]	8	Nand_error_count
[439:432]	8	dqs_timeout_counter0
[447:440]	8	dqs_timeout_counter1
[455:448]	8	fip_dqs_timeout_flg_counter
[511:455]	56	Reserved



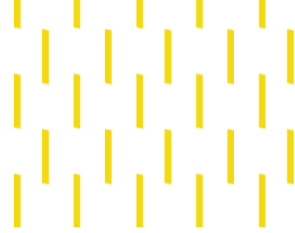
8. VITAL PRODUCT DATA

X200Z 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.

PHISON Confidential



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