PD4 Series

Enterprise-grade PCIe SSD

Specifications

Capacity
- U.3:
  Mixed-use: 6.4TB / 12.8TB / 25.6TB (Max Series)
  Read- centric: 7.68TB / 15.36TB / 30.72TB (Pro Series)

Components
- Controller: Microchip
- Flash: 1.2GHz 3D TLC
- DRAM: DDR4

Compliance
- PCIe Gen4x4
- Surprise insertion / surprise removal (SISR) and hot-plug capable

Performance (up to)[1]
- Sequential read (128K): 7.1 GB/s
- Sequential write (128K): 7.0 GB/s
- Sustained read (128K): 7.1 GB/s
- Sustained write (128K): 7.0 GB/s
- Random 4K read: 1,600,000 IOPS
- Random 4K write: 680,000 IOPS
- Random 8K read: 850,000 IOPS
- Random 8K write: 400,000 IOPS

Power management
- Auto idle
- PCIe link power management
- Temperature monitoring and throttling

Security
- NVM Format

Reliability
- Advanced LDPC error correction
- Global static and dynamic wear leveling
- Hardware Power Loss Protection (PLP)
- UBER: <1 sector per 10^{17} bits read

- MTBF: 2.0 million hours

Endurance[2]
- Up to 1.5 DWPD @5 Years (PD4 Pro Series)
- Up to 3.3 DWPD @5 Years (PD4 Max Series)

Data retention
- JESD219-compliant

Compatibility
- Windows 11/10
- Windows Server 2016/2012 R2/2012
- CentOS, Fedora, FreeBSD, openSUSE, Red Hat, Ubuntu, VMware ESXi, Citrix, KVM

Mechanical form factor
- U.3: 100.5 mm x 69.85 mm x 14.8 mm

Power consumption (TYP)
- Active: <24 W
- Idle: <8 W

Environment
- Operating temperature: 0–70 °C
- Storage temperature: -40–85 °C

Shock & vibration
- Operating: 50 G
  (11 ms duration, half sine wave)
- Non-operating: 1000 G
  (0.5 ms duration, half sine wave)
- Vibration: 3.10 G
  (peak,2–500 Hz)

Warranty
- 5-year limited warranty[3]

Specification notes:

1. Performance claims
   a. Actual performance may vary based on the hardware, software, and overall system configuration.
   b. Sequential performance is measured with 128 KB transfer size, QD 32 and 4 KB alignment with Iometer.
   c. Random performance is sustained performance measured with 4K/8K transfer size, QD 32 and 4 KB alignment with Iometer.
   d. Performance test platform: CPU: Intel Core i7 4770K; motherboard: ASUS Z87-DELUXE; chipset: Intel Z87 Express; OS: Windows 8.1 Pro x64.
2. Endurance claims
   a. DWPD stands for Drive Writes Per Day. TBW = DWPD * capacity * warranty * 365 / 1000.
   b. Access patterns used for random workload during endurance testing is compliant with the JESD219 standard.
3. Limited warranty details: please refer to limited warranty policy and warranty terms.

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Product datasheet

1. Order information

The following table lists the standard part numbers for Exascend PD4 Series SSD. For customization and design service inquiries, including – but not limited to – custom operating temperature, capacity, over-provisioning, endurance, performance, and power, please contact your Exascend account manager or send us an email at sales@exascend.com.

Table 1: PD4 Series SSD product list

PART NUMBER	CAPACITY*	FLASH TYPE	FORM FACTOR
EXPD4U7680GB	7680GB *	3D TLC	U.3
EXPD4U15360GB	15360GB *	3D TLC	U.3
EXPD4U30720GB	30720GB *	3D TLC	U.3
EXPD4U6400GB	6400GB *	3D TLC	U.3
EXPD4U12800GB	12800GB *	3D TLC	U.3
EXPD4U25600GB	25600GB *	3D TLC	U.3

2. Part number decoder

1	2	3	4	5
EX	PD4	U	12800GB	-X

1. Exascend

2. Product series: PD4, PCIe Gen 4 x 4

3. Form factor: U=U.2/U.3; E=E1.S

4. Capacity

5. Customer code

3. Product overview
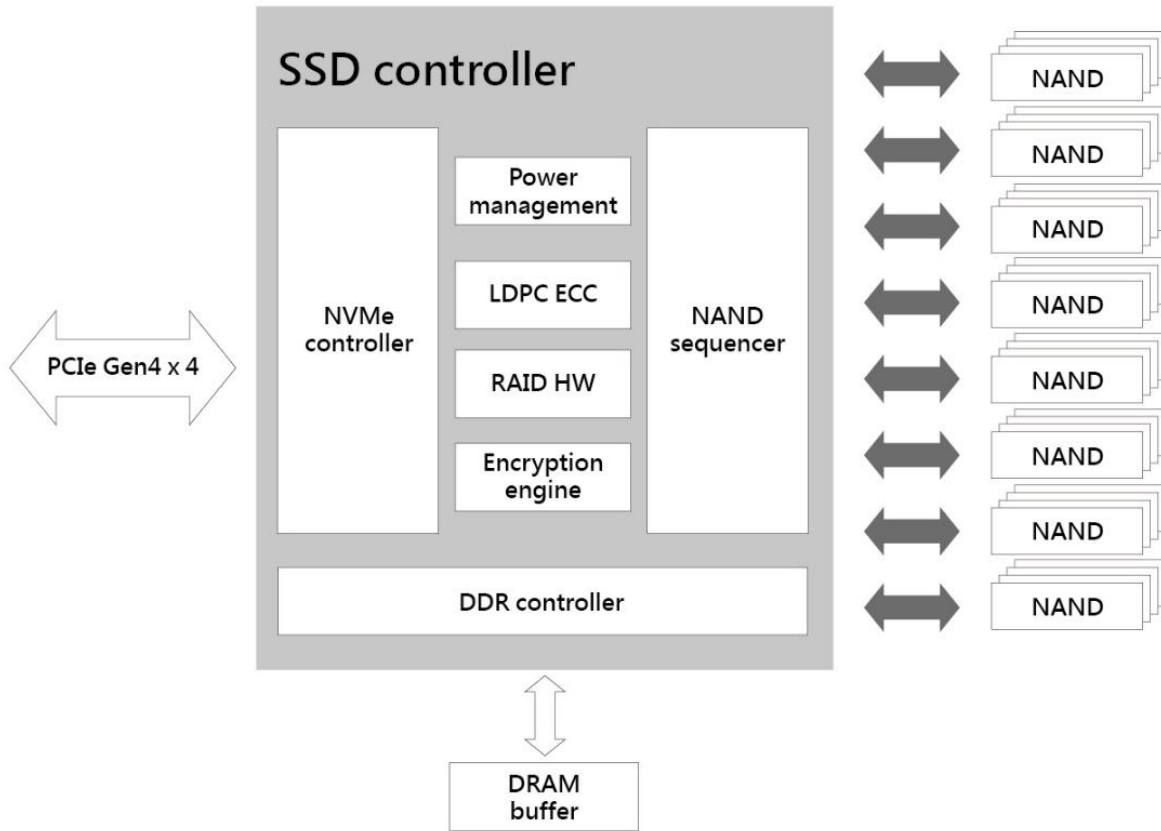
3.1 Exascend PD4 Series

Exascend provides customizable hardware and firmware design, manufacturing, and service of cutting-edge SSD products and advanced storage systems. Our products are designed specifically for high reliability commercial, enterprise data center, and cloud computing applications. By combining world class design R&D, and superior execution in delivery and support capabilities, Exascend strives to provide customers with the best in class product and service, enabling enhanced boot times, faster application load times, reduced power consumption and extended reliability.

Exascend PD4 series product supports U.3 form factors, integrating high speed PCIe Gen 4 x 4 interface with third generation 3D TLC NAND flash memory technology, delivering capacities up to 15.36TB.

Key product highlights include:

- Consistently High IOPS, Throughput and Sustained Low Latency
- Roughly up to 1.5 / 3.3 DWPD for 5 years Endurance
- Firmware Upgrade without Reset
- Support up to 128 Namespaces and Different Encryption Keys for Data Isolation
- Whole Disk Encryption with AES-XTS 256bit & Security Erase
- EUI64/NGUID
- Data Path Protection Guaranteed UBER within 10-17
- Enterprise Power Failure Protection Technology
- Temperature Monitoring and Throttling
- Self-Monitoring, Analysis, and Reporting Technology (S.M.A.R.T)
- Flexible Power Management
- Hot Pluggable
- Device Self-test
- Support NVMe-MI for Out-of-band Management
- Data Set Management Command (TRIM)
- Timestamp
- Weighted Round Robin (WRR)
- Telemetry
- Sanitize
- Secure Boot
- Secure Download
- Persistent Event Log

Figure 1: SSD functional logic diagram

3.2 Customization and tuning services

Exascend provides customized hardware and firmware design services, tailoring cutting-edge SSD products for advanced storage systems. Combining world-class R&D and engineering support capabilities, Exascend provides customers with best-in-class products and services, enabling enhanced boot times, faster-loading applications, reduced power consumption, and extended reliability. To learn more about our extended engineering support services, e.g., tailored capacity, over-provisioning, extended operating temperature range, endurance, performance, power, and longevity, please contact your Exascend account manager or send us an email at sales@exascend.com.

4. Detailed specifications

Exascend PD4 SSD provides you the ultimate performance and ultra-high reliability over traditional hard disk drive by achieving up to 7,100MB/s for sequential read, 7,000MB/s for sequential write, 1,600,000 IOPS for random read, 680,000 IOPS for steady state random write.

Exascend PD4 SSD consists solely of semiconductor devices, it does not contain any mechanical part such as platter (disk), motor and suspension as traditional hard disk drive. Thus, it exhibits superior performance, capacity, reliability, ruggedness, low power, and small form factor profiles that qualified to be the best storage solution for enterprise application with extreme workloads and increased MTBF requirements.

Exascend PD4 SSD uses a single-chip Flash controller to manage multiple NAND Flash memory modules. The controller works with a host system to allow data to be written to and read from the Flash memory modules through a PCIe interface.

4.1 Capacity

Table 2: Exascend PD4 series logical block address configuration

PD4 series	TOTAL USER ADDRESSABLE SECTORS IN LBA MODE (512 Bytes)	TOTAL USER ADDRESSABLE SECTORS IN LBA MODE (4096 Bytes)
6400 GB	12,502,446,768	1,562,805,846
12800 GB	25,004,872,368	3,125,609,046
25600 GB	50,009,723,568	6,251,215,446
7680 GB	15,002,931,888	1,875,366,486
15360 GB	30,005,842,608	3,750,730,326
30720 GB	60,011,664,048	7,501,458,006

Notes:
- The LBA count shown represents total user-accessible storage capacity and will remain the same throughout the drive's lifetime.
- The total usable capacity of the SSD may be less than the total physical capacity because a small portion of the capacity is used for NAND flash management and maintenance purposes.

4.2 Performance

Table 3: Drive performance – PD4 Series

	UNIT	PD4 SERIES					
Capacity	GB	6400GB	12800GB	25600GB	7680GB	15360GB	30720GB
Sequential Read (128K)	GB/s	6.9	7.1	7.1	6.9	7.1	7.1
Sequential Write (128K)	GB/s	7.0	7.0	7.0	7.0	7.0	7.0
Sustained Read (128K)	GB/s	6.9	7.1	7.1	6.9	7.1	7.1
Sustained Write (128K)	GB/s	7.0	7.0	7.0	7.0	7.0	7.0
Random read (4KB)	IOPS	1600K	1600K	1500K	1600K	1600K	1480K
Random write (4KB)	IOPS	660K	680K	650K	340K	420K	360K
Random read (8KB)	IOPS	850K	850K	850K	850K	850K	850K
Random write (8KB)	IOPS	380K	400K	370K	180K	220K	190K
Random 4KB 70/30 Read/Write	IOPS	960K	960K	950K	790K	810K	790K
Random 8KB 70/30 Read/Write	IOPS	600K	600K	590K	410K	440K	430K
DWPD (5 years)		3.3 @ JESD219			1.5 @ JESD219		
TBW		37,640	75,280	150,560	20,530	41,060	82,120
Form factor		U.3					

Notes:
- Measured with device connected as secondary drive.
- Actual performance may vary based on the hardware, software, and overall system configuration.
- Sequential performance is measured with 128 KB transfer size, QD 32 and 4 KB alignment with Iometer.
- Random performance is sustained performance measured with 4K/8K transfer size, QD 32 and 4 KB alignment with Iometer.
- Performance test platform: CPU: Intel Core i7 4770K; motherboard: ASUS Z87-DELUXE; chipset: Intel Z87 Express; OS: Windows 8.1 Pro x64.

4.3 Environment specification

Table 5: Environmental specification table

PARAMETER	VALUE
Operating temperature	Ambient: 0–35℃ Case: 0-70℃
Storage temperature	-40–85 °C
Power supply voltage range	U.3: 12.0 V ±10%
Humidity (non-condensing)	5–95% (Operating)
Vibration	3.10 G (peak, 2–500 Hz)
Shock (non-operating)	1000 G, (0.5 ms duration, half sine wave)

4.4 Power consumption

Table 6: PD4 series power consumption table

PARAMETER	VALUE	UNIT
Avg Sequential/Random Read	<19/20	W
Avg Sequential/Random Write	<23/24	W
Idle mode power (average)	<8.0	W

4.5 Reliability

Products in the Exascend PD4 series meet or exceed SSD endurance and data retention requirements as specified in the JESD218 standard. Reliability specifications are listed in the following table.

Table 7: Reliability table

PARAMETER	VALUE
Mean Time Between Failures (MTBF) Mean Time Between Failures is a measure of how reliable a hardware product or a component is. The value describes the expected time between two failures.	2,000,000 hours
Uncorrectable Bit Error Rate (UBER) A metric for the rate of occurrence of data errors, equal to the number of data errors per bits read.	<1 sector per 10^{17}

5. Physical dimension diagram

5.1 U.3 board
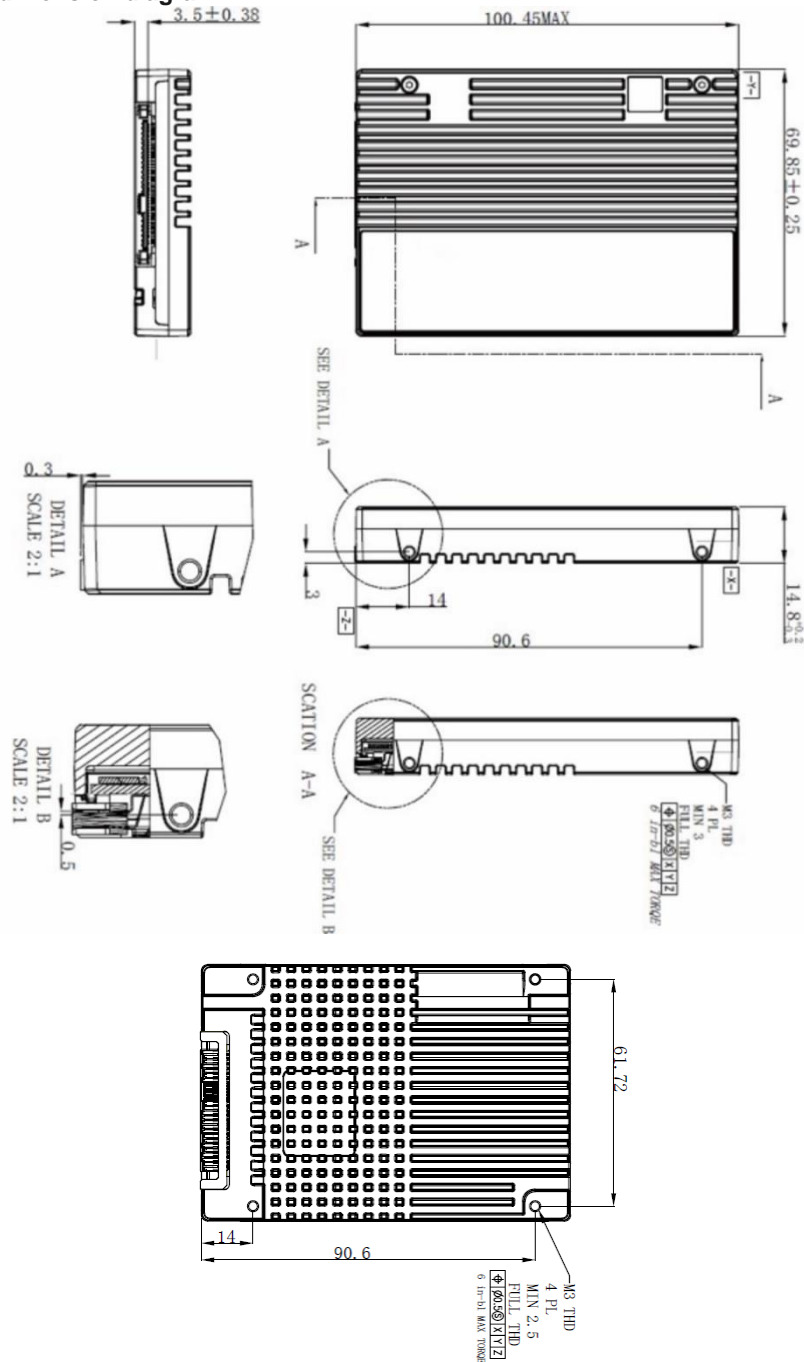
Figure 2: U.3 physical dimension diagram

Table 8: Physical dimensions for U.3

PHYSICAL DIMENSIONS	VALUE	UNIT
Length	100	mm
Width	69.85	mm
Thickness	14.8	mm

6. Pin Assignment

6.1 U.3 connector

Table 14: U.3 connector signal name, power pin assignment, and description

PIN NAME	SIGNAL NAME	DESCRIPTION
S1	GND	Ground
S2	PETp0	Transmitter differential pair, Lane 0
S3	PETn0	Transmitter differential pair, Lane 0
S4	GND	Ground
S5	PERn0	Receiver differential pair,Lane 0
S6	PERn0	Receiver differential pair,Lane 0
S7	GND	Ground
E1	REFCLK1+	Reference clock port 1
E2	REFCLK1-	Reference clock port 1
E3	3.3Vaux	3.3 V Power
E4	PERST1#	Fundamental reset port 1
E5	PERST0#	Fundamental reset port 0
E6	GND	Ground on device and IfDet2# on host
P1		Not used (SATA/SAS)
P2		Not used (SATA/SAS)
P3	PWRDIS	Current reserved
P4	IfDet#	Interface type detect
P5	GND	Ground
P6	GND	Ground
P7		Not used (SATA/SAS)
P8		Not used (SATA/SAS)
P9		Not used (SATA/SAS)
P10	PRSNT_N	Presence detection (also used for drive type)
P11	Activity	Activity signal from the drive
P12	GND	Ground
P13	+12V_pre	12V Power
P14	+12V	12 V Power
P15	+12V	12 V Power
E7	REFCLK0+	Reference clock port 0 +
E8	REFCLK0-	Reference clock port 0 -
E9	GND	Ground
E10	RSVD	Reserved
E11	RSVD	Reserved
E12	GND	Ground
E13	RSVD	Reserved

E14	RSVD	Reserved
E15	GND	Ground
E16	HPT1	Host Port Type 1
S8	GND	Ground
S9	PETp1	Transmitter differential pair, Lane 1
S10	PETn1	Transmitter differential pair, Lane 1
S11	GND	Ground
S12	PERn1	Receiver differential pair, Lane 1
S13	PERp1	Receiver differential pair, Lane 1
S14	GND	Ground
S15	HPT0	Host Port Type 0
S16	GND	Ground
S17	PETp2	Transmitter differential pair, Lane 2
S18	PETn2	Transmitter differential pair, Lane 2
S19	GND	Ground
S20	PERn2	Receiver differential pair, Lane 2
S21	PERp2	Receiver differential pair, Lane 2
S22	GND	Ground
S23	PETp3	Transmitter differential pair, Lane 3
S24	PETn3	Transmitter differential pair, Lane 3
S25	GND	Ground
S26	PERn3	Receiver differential pair, Lane 3
S27	PERp3	Receiver differential pair, Lane 3
S28	GND	Ground
E17	RSVD	Reserved
E18	RSVD	Reserved
E19	GND	Ground
E20	RSVD	Reserved
E21	RSVD	Reserved
E22	GND	Ground
E23	SMCLK	SMBus clock
E24	SMDAT	SMBus data
E25	DualPortEn N	Dual port enable

7. Compliance

Exascend PD4 SSD complies with the following specifications:

- FCC
- CE
- RoHS

8. Supported NVMe commands

Exascend PD4 SSD support the NVMe commands that are shown in the following table. For details about the NVMe commands, please refer to the NVMe 1.4 command set specifications.

Table 17: Admin commands

COMMAND NAME	CODE (HEX)	COMMAND NAME	CODE (HEX)
Delete I/O submission queue	00h	Abort	08h
Create I/O completion queue	01h	Set features	09h
Get log page	02h	Get features	0Ah
Delete I/O submission queue	04h	Asynchronous event request	0Ch
Create I/O completion queue	05h	Firmware commit	10h
Identify	06h	Firmware image download	11h

Table 18: I/O commands

COMMAND NAME	CODE (HEX)	COMMAND NAME	CODE (HEX)
Flush	00h	Compare	05h
Write	01h	Dataset management	09h
Read	02h	Write zeroes	08h
Write uncorrectable error	04h		

Table 19: Get log commands

COMMAND NAME	CODE (HEX)	COMMAND NAME	CODE (HEX)
Reserved	00h	S.M.A.R.T. / health information	02h
Error information	01h	Firmware information	03h

9. Supported Command Descriptions

9.1 Supported Mandatory Log Page

The NVMe Admin Command Set defines the commands that may be submitted to the Admin Submission Queue. Exascend PD4 series support below listed mandatory and optional admin command set.

Supported NVMe mandatory admin command set
- Create I/O submission queue
- Create I/O completion queue
- Delete I/O completion queue
- Delete I/O submission queue
- Get Log Page
- Identify
- Abort
- Set Features
- Get Features
- Asynchronous Event Notification

Supported NVMe optional admin command set
- Namespace Management
- Namespace Attachment
- Firmware Commit
- Firmware Image Download
- Format NVM (User Data Erase supported)
- Device Self-test
- Sanitize

9.2 NVM Command Set

Exascend PD4 series support below listed mandatory and optional NVMe command set.

Supported NVMe mandatory command set
- Flush
- Write
- Read

Supported NVMe optional command set
- Dataset Management (Deallocate only)

9.3 Supported Get Log Page Command

The Get Log Page command returns a data buffer containing the log page requested. Exascend PD4 Series SSD support below listed mandatory and optional get log page commands.

Supported Mandatory Log Page
- Error Information Log (01h)
- SMART / Health Information Log (02h)

  Details refer to Table 25: Supported Standard SMART/Health Information Log (Log Identifier 02h)

- Firmware Slot Information Log (03h)
- Changed Namespace List Log (04h)
- Commands Supported and Effects Log (05h)
- Device Self-test Log (06h)

  Details refer to Table 27: Supported Device Self-test Log (Log Identifier 06h)
- Telemetry Host-Initiated Log (07h)

  Details refer to Table 28: Supported Telemetry Host-Initiated log (Log Identifier 07h)
- Telemetry Controller-Initiated Log (08h)

  Details refer to Table 29: Supported Telemetry Controller-Initiated Log (Log Identifier 08h)

- Persistent Event Log (0Dh)

  Details refer to Table 30: Supported Persistent Event Log (Log Identifier 0Dh)
- Sanitize Status Log (81h)

  Details refer to Table 31: Supported Sanitize Status Log (Log Identifier 81h)

Supported Vendor Unique Log Page

- Vendor Specific SMART (CAh)

  Details refer to Table 26: Supported Additional SMART/Health Information Log (Log Identifier CAh)

9.4 S.M.A.R.T/Health Attributes

Exascend PD4 series SMART and health information is over the life of the controller and is retained across power cycles. The following table lists the supported SMART attributes.

Table 20: Supported Standard SMART/Health Information Log (Log Identifier 02h)

BYTE	DESCRIPTION
00	**Critical warning:** This field indicates critical warnings for the state of the controller. These bits if set, flag various warning sources. Critical warnings may result in an asynchronous event notification to the host. <table><tr><td>Bit</td><td>Definition</td></tr><tr><td>0</td><td>If set to '1', then the available spare space has fallenbelow the threshold.</td></tr><tr><td>1</td><td>If set to '1', then the temperature has exceeded a critical threshold.</td></tr><tr><td>2</td><td>If set to '1', then the percentage ot device Life Used exceeds 100 that degrades device reliability.</td></tr><tr><td>3</td><td>If set to '1', then the media has been placed in read only mode.</td></tr><tr><td>4</td><td>If set to '1', then the volatile memory backup devicehas failed. This field is only valid if the controller has a volatile memory backup solution.</td></tr><tr><td>7:5</td><td>Reserved</td></tr></table>
2:1	**Composite temperature:** Contains a value corresponding to a temperature in degrees Kelvin that represents the current composite temperature of the controller and namespace(s) associated with that controller. The manner this value is computed is implementation-specific and may not represent the actual temperature of any physical point in the NVM subsystem. The value of this field may be used to trigger an asynchronous event. Warning and critical overheating composite temperature threshold values are reported by the WCTEMP and CCTEMP fields in the Identify Controller data structure.
3	**Available spare:** Contains a normalized percentage (0 to 100%) of the remaining spare capacity available.
4	**Available spare threshold:** When the *available spare* falls below the threshold indicated in this field, an asynchronous event completion may occur. The value is indicated as a normalized percentage (0 to 100%).
5	**Percentage used:** Contains a vendor-specific estimate of the percentage of NVM subsystem life used based on the actual usage and the manufacturer's prediction of NVM life. A value of 100 indicates that the estimated endurance of the NVM in the NVM subsystem has been consumed but may not indicate an NVM subsystem failure. The value allowed to exceed 100. Percentages greater than 254 shall be represented as 255. This value shall be updated once per power-on hour (when the controller is not in a sleep state).
47:32	**Sectors read:** Contains the number of 512-byte user data units read from the controller; This value is reported in thousands (i.e., a value of 1 corresponds to 1000 units of 512 bytes read) and is rounded up. When the LBA size is a value other than 512 bytes, the controller shall convert the amount of data read to 512-byte units.

63:48	**Sectors written:** Contains the number of 512-byte user data units written to the controller. This value is reported in thousands (i.e., a value of 1 corresponds to 1000 units of 512 bytes written) and is rounded up. When the LBA size is a value other than 512 bytes, the controller shall convert the amount of data written to 512-byte units. For the NVM* command set, logical blocks written as part of write operations shall be included in this value.
79:64	**Host read commands:** Indicates the number of read commands completed by the controller. For the NVM command set, this is the number of *compare* and *read* commands
95:80	**Host write commands:** Indicates the number of write commands completed by the controller. For the NVM command set, this is the number of *write* commands.
111:96	**Controller busy time:** Contains the amount of time the controller is busy with I/O commands. The controller is busy when there is a command outstanding to an I/O queue (specifically, a command was issued via an I/O submission queue tail doorbell write and the corresponding completion queue entry has not been posted yet to the associated I/O completion queue). This value is reported in minutes.
127:112	**Power cycles:** Contains the number of power cycles.
143:128	**Power-on hours:** Indicates the number of actively power-on hours. This does not include time the controller was powered and in a lower state condition.
159:144	**Number of unsafe shutdowns:** Indicates the number of unsafe shutdowns. This count is incremented when a shutdown notification (CC.SHN) is not received prior to loss of power
175:160	**Number of media errors:** Indicates the number of occurrences where the controller detected an unrecovered data integrity error. Errors such as uncorrectable ECC, CRC checksum failure, or LBA tag mismatch are included in this field.
195:192	**Warning composite temperature time:** Indicates the amount of time in minutes that the controller is operational and the Composite Temperature is greater than or equal to the Warning Composite Temperature Threshold (WCTEMP) field and less than the Critical Composite Temperature Threshold (CCTEMP) field in the Identify Controller data structure. If the value of the WCTEMP or CCTEMP field is 0h, then this field is always cleared to 0h regardless of the Composite Temperature value.
199:196	**Critical composite temperature time:** Contains the amount of time in minutes that the controller is operational, and the Composite Temperature is greater the Critical Composite Temperature Threshold (CCTEMP) field in the Identify Controller data structure. If the value of the CCTEMP field is 0h, then this field is always cleared to 0h regardless of the Composite Temperature value.
219:216	**Thermal Management Temperature 1 Transition Count:** Contains the number of times that performed thermal management action once exceeds TMT1 threshold.
223:220	**Thermal Management Temperature 2 Transition Count:** Contains the number of times that performed thermal management action once exceeds TMT2 threshold.
227:224	**Total Time for Thermal Management Temperature1:** Contains the number of seconds that performed thermal management action once exceeds TMT1 threshold.
231:228	**Total Time for Thermal Management Temperature2:** Contains the number of seconds that performed thermal management action once exceeds TMT2 threshold.

9.5 Additional S.M.A.R.T/Health Attributes

Exascend PD4 series vendor specific SMART and health information is over the life of the controller and is retained across power cycles. The following table lists the supported additional SMART attributes.

Table 21: Supported Additional SMART/Health Information Log (Log Identifier CAh)

BYTE	Attribute	DESCRIPTION
0	AB (Program Fail Count)	Raw value: shows total count of program fails. Normalized value: beginning at 100, shows the percent remaining of allowable program fails.
2:1	Reserved	
3	Normalized Value	
4	Reserved	
10:5	Current raw value	
11	Reserved	
12	AC (Erase Fail Count)	Raw value: shows total count of erase fails. Normalized value: beginning at 100, shows the percent remaining of allowable erase fails.
14:13	Reserved	
15	Normalized Value	
16	Reserved	
22:17	Current raw value	
23	Reserved	
24	AD (Wear-Leveling Count)	Raw value: Bytes 1-0: Min. erase cycle. Bytes 3-2: Max. erase cycle. Bytes 5-4: Avg. erase cycles. Normalized value: decrements from 100 to 0.
26:25	Reserved	
27	Normalized Value	
28	Reserved	
34:29	Current raw value	
35	Reserved	
36	B8 (End to End Error Detection Count)	Raw value: reports number of End-to-End detected and uncorrected errors by hardware. Normalized value: always 100.
38:37	Reserved	
39	Normalized Value	
40	Reserved	
46:41	Current raw value	
47	Reserved	
48	C7 (CRC Error Count)	Raw value: shows total number of PCIe Interface CRC errors encountered, as specified in PCIe Link Performance Counter Parameter for "Bad TLP". Byte 0~3: The CRC Error Count of its Port. Normalized value: always 100.
50:49	Reserved	
51	Normalized Value	
52	Reserved	
58:53	Current raw value	
96	EA (Thermal Throttle Status)	Raw value: reports Percent Throttle Status and Count of events. Byte 0: Throttle status reported as integer percentage. (100 is active, 0 is inactive.) Bytes 1-4: Throttling event count. Number of times thermal throttle has activated. Preserved over power cycles. Byte 5: Reserved. Normalized value: always 100.
9:87	Reserved	
99	Normalized Value	
100	Reserved	
106:101	Current raw value	
132	F4 (NAND Bytes Written)	Nand sectors written divided by 65536 (1count=32MiB). Normalized value: 100
134:133	Reserved	
135	Normalized Value	
136	Reserved	
142:137	Current raw value	
143	Reserved	
144	F5 (Host Bytes Written)	Host sectors written divided by 65536 (1count=32MiB). Normalized value: 100.
146:145	Reserved	
147	Normalized Value	
148	Reserved	
154:149	Current raw value	
155	Reserved	

156	F6 (the remaining lifetime of the system area)	The current value is normalized; represents the number of write operations used in the system tray. Value 0x64/100 (d) reflects the fact that in the system area allotted space for write operations exhausted.	
158:157	Reserved		
159	Normalized Value		
160	Reserved		
166:161	Current raw value		
167	Reserved		
168	FA (NAND Bytes Read)	Raw value: Raw value reports the number of read from NAND in 32MiB increments. Normalized value: always 100.	
170:169	Reserved		
171	Normalized Value		
172	Reserved		
178:173	Current raw value		
179	Reserved		
180	E7 (Temperature)	Raw value: reports Max Min and current temperature in Kelvin since shipping out. Byte 0-1: The maximum temperature value sampled from the temperature sensor. Bytes 2-3: The min temperature value sampled from the temperature sensor. Bytes 4-5: The current temperature value sampled from the temperature sensor. Normalized value: always 100.	
182:181	Reserved		
183	Normalized Value		
184	Reserved		
190:185	Current Raw Value		
191	Reserved		
192	E8 (Power Consumption)	Raw value: reports Max Min and average power consumption in watts. Byte 0-1: The maximum power consumption value. Bytes 2-3: The min average power consumption value. Bytes 4-5: The average power consumption value Normalized value: always 100	
194:193	Reserved		
195	Normalized Value		
196	Reserved		
202:197	Current Raw Value		
203	Reserved		
204	AF (Power on Temperature)	Raw value: reports Max Min and current temperature in Kelvin since power on. Byte 0-1: The maximum temperature value sampled from the temperature sensor. Bytes 2-3: The min temperature value sampled from the temperature sensor. Bytes 4-5: The current temperature value sampled from the temperature sensor. Normalized value: always 100.	
206:205	Reserved		
207	Normalized Value		
208	Reserved		
214:209	Current Raw Value		
215	Reserved		
227	Reserved		
228	F2 (Read Fail Count)	Raw Value of Read Fail Count. Normalized Value: 100.	
230:229	Reserved		
231	Normalized Value		
232	Reserved		
238:233	Current Raw Value		
239	Reserved		
240	EB (Thermal Throttle Time)	Raw value: Throttle Status and total throttling time. Byte 0: 1 Throttling is active, 0 Throttling is not active. Bytes 1-4: the total time of throttling active in minutes since this time power on. Bytes 5: reserve. Normalized value: always 100	
242:241	Reserved		
243	Normalized Value		
244	Reserved		
250:245	Current Raw Value		
251	Reserved		
252	ED (Flash Error Media Count)	Raw value: The count of Host Read Flash Media Error. Normalized value: always 100.	
254:253	Reserved		
255	Normalized Value		
256	Reserved		
262:257	Current Raw Value		
263	Reserved		

9.6 Device Self-test Log

Exascend PD4 series support Device self-test (DST) operation which is a diagnostic testing sequence that tests the functionality of the drive. Failures or the percentage complete of the operation during self-test reported in Device Self-test Log (Log Identifier 06h). Log will be cleared after power cycle.

Table 22: Supported Device Self-test Log (Log Identifier 06h)

BYTE	Attribute	DESCRIPTION
0	Current Device Self-Test Operation	This field defines the current device self-test operation.
1	Current Device Self-Test Completion	This field defines the completion status of the current device self- test.
3:2	Reserved	
31:4	Newest Self-test Result Data Structure	Details refer to NVMe 1.4 specification Get Log Page - Self-test Result Data Structure
…	…	…
563:536	20th newest Self-test Result Data Structure	Details refer to NVMe 1.4 specification Get Log Page - Self-test Result Data Structure

Legal information

Limited Warranty Policy

Exascend, Inc. ("Exascend") warrants that Exascend's product, in its original sealed packaging, will be free from defects in materials and workmanship. Subject to the conditions and limitations set forth below, Exascend will either repair or replace any part of its products that prove defective by reason of improper workmanship or materials. This warranty is non-transferable and valid only for the original purchaser of the Exascend products, except where prohibited by law. The original sales receipt or invoice, or a copy thereof, is required to establish the purchase date and original purchaser.

1. This warranty supersedes all other warranties and representations, whether oral or written, between you and Exascend. Exascend makes no other warranties, including any warranty of merchantability or fitness for a particular purpose, whether expressly or implied.

2. All warranties, whether express or implied, are limited to the periods of time set forth below. Some states and jurisdictions do not allow such exclusion of implied warranties, limitations or warranty period, so above restrictions may not apply to you.

3. Exascend may acknowledge or read and save the data and information (collectively, "Information") stored in the product during after-services. Exascend hereby agrees that Exascend will not disclose any Information to any third parties, except Exascend's employees, who may need to access the Information, with or without your prior written consent.

Warranty Terms

We offer five (5) years limited warranty for our enterprise products.

The warranty period is the SHORTER OF:

- a period of five (5) years beginning from the date of purchase; or
- the period ending when the drive reached advertised DWPD or TBW rating; or
- the period ending when the device's Lifespan indicator has reached 0% or below.

This Limited Warranty will not apply to, and Exascend will have no liability or obligation with respect to, problems or damage resulting from any of the following: (i) accident, modification, neglect, abuse, careless or incorrect handling, misuse or improper operation, disassembly, misapplication or use in unusual physical environments or under operating conditions not approved by Exascend (including, but not limited to, use of the Product with an improper voltage supply); (ii) normal wear and tear; (iii) removal of label(s) or sticker(s) provided on or with the Product (including all warranty or quality-control stickers, product serial or electronic numbers); (iv) problems relating to or residing in non-Exascend hardware, software or other items with which the Product is used; (v) use in an environment, in a manner or for a purpose for which the Product was not designed or not in accordance with Exascend's published documentation; (vi) installation, modification, alteration or repair by

anyone other than Exascend or its authorized representatives; (vii) problems that do not relate to materials or workmanship or that have an insignificant impairment on the use or operation of the Product; or (viii) problems related to consumables; (ix) Product purchased "AS-IS" or "with known faults, defects or problems." Additionally, Exascend will have no liability or obligation to recover any data in the Product.

Disclaimer of liability

Exascend, Inc. reserves the right to make changes to specifications and product descriptions such as but not limited to numbers, parameters and other technical information contained herein without notice. Please contact Exascend, Inc. to obtain the latest specifications. Exascend, Inc. grants no warranty with respect to this datasheet, explicit or implied, and is not liable for direct or indirect damages. Some states do not grant the exclusion of incidental damages and as such this statement may not be valid in such states. The provisions of the datasheet do not convey to the purchaser of the device any license under any patent right or other intellectual property right of Exascend, Inc.

Customers must not use Exascend products in applications where a device failure or malfunction may cause personal injury or death, e.g., in life support systems or devices.

Exascend shall not be liable for any loss, injury or damage caused by use of the products in any of the following applications:

- Medical-related devices, life support, medical measurement devices, etc.
- Control devices for trains, ships, mass transportation systems or automotive vehicles, etc.
- Specific applications including military/defense-related equipment, aerospace, nuclear facility control systems, etc.
- Safety systems for disaster prevention/crime prevention, etc.

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Revision history

Table 21: Exascend PD4 series datasheet revision history

REVISION	DESCRIPTION	DATE
001	First released	March, 2022
002	Update Performance	May, 2022
003	Update PIN assignment	Jan, 2023
004	Update 15.36TB	Jan, 2023
005	Add 30.72TB/25.6TB	Feb, 2023
006	Add TBW info.	Aug, 2023
007	Add Sustained Performance	Sep, 2023