

PA4 series

Automotive-grade PCIe SSD

Specifications

Capacity

• U.2: 960 GB~7680 GB

E1.S: 960 GB~7680 GB

M.2 2280: 960 GB~7680 GB

M.2 2242: 960 GB~1920 GB

M.2 2230: 240 GB~960 GB

Components

Controller: Marvell 88SS1321
Flash: 1.2GHz 3D TLC
DRAM: LPDDR3/DDR4

Compliance

PCIe Gen4x4/ Gen4x2/ Gen3x4

 Surprise insertion / surprise removal (SISR) and hotplug capable (U.2/E1.S support)

Performance (up to)¹

Sequential read: 3,500 MB/s
Sequential write: 3,000 MB/s
Random 4K read: 500,000 IOPS
Random 4K write: 55,000 IOPS

Power management

Auto idle

PCle link power management

· Temperature monitoring and throttling

Storage technology (Optional)

Underfill

Conformal coating

Security (Optional)

TCG-OPAL 2.0

NVM Format

Support SED (TCG/AES)

Reliability

Advanced LDPC error correction

Global static and dynamic wear leveling

 Hardware Power Loss Protection (PLP) (For U.2 & E1.S form factor)

UBER: <1 sector per 10¹⁷ bits read

MTBF: 2.0 million hours

Endurance 2

480GB: 300TB
960GB: 600TB
1920GB:1200TB
3840GB: 2400TB
7680GB: 4800TB

Data retention

JESD218A-compliant

Compatibility

Windows 10/8.1/7

Windows Server 2016/2012 R2/2012

 CentOS, Fedora, FreeBSD, openSUSE, Red Hat, Ubuntu, VMware ESXi, Citrix, KVM

Mechanical form factor

U.2: 100.5 mm x 69.85 mm x 7 mm
M.2 2280: 80 mm x 22 mm x 3.5 mm
M.2 2242: 42 mm x 22 mm x 3.5 mm
M.2 2230: 30 mm x 22 mm x 3.5 mm
E1.S: 111.49 mm x 31.5 mm x 5.9 mm

Power consumption (TYP)

Active: <7.0 WIdle: <1.0 W

Environment

Operating temperature: -40–85 °C
 Storage temperature: -50–95 °C

Shock & vibration

Operating: 50 G
 (11 ms duration, half sine wave)

Non-operating: 1500 G
 (0.5 ms duration, half sine wave)

 Vibration: 10 G (peak,10–2000 Hz)

Warranty

• 3-year limited warranty³



Specification notes:

- Performance claims
 - 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 lometer. Random performance is sustained performance measured with 4K/8K transfer size, QD 32 and 4 KB alignment with lometer.
 - Performance test platform: CPU: Intel Core i7 4770K; motherboard: ASUS Z87-DELUXE; chipset: Intel Z87 Express; OS: Windows 8.1 Pro x64.
- Endurance claims 2.

 - DWPD stands for Drive Writes Per Day. TBW = DWPD * capacity * warranty * 365 / 1000.

 Access patterns used for random workload during endurance testing is compliant with the JESD219 standard.
- 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 PA4 series SSDs. 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: PA4 series SSD product list

PART NUMBER	CARACITY*	FLACUTVDE	FORM FACTOR
PART NUMBER	CAPACITY*	FLASH TYPE	FORM FACTOR
EXPA4R240GB	240GB *	3D TLC	M.2 2230
EXPA4R480GB	480GB *	3D TLC	M.2 2230
EXPA4R960GB	960GB *	3D TLC	M.2 2230
EXPA4Q960GB	960GB *	3D TLC	M.2 2242
EXPA4Q1920GB	1920GB *	3D TLC	M.2 2242
EXPA4M960GB	960GB *	3D TLC	M.2 2280
EXPA4M1920GB	1920GB *	3D TLC	M.2 2280
EXPA4M3840GB	3840GB *	3D TLC	M.2 2280
EXPA4M7680GB	7680GB *	3D TLC	M.2 2280
EXPA4U960GB	960GB *	3D TLC	U.2
EXPA4U1920GB	1920GB *	3D TLC	U.2
EXPA4U3840GB	3840GB *	3D TLC	U.2
EXPA4U7680GB	7680GB *	3D TLC	U.2
EXPA4E960GB	960GB *	3D TLC	E1.S
EXPA4E1920GB	1920GB *	3D TLC	E1.S
EXPA4E3840GB	3840GB *	3D TLC	E1.S
EXPA4E7680GB	7680GB *	3D TLC	E1.S

2. Part number decoder



- 1. Exascend
- 2. Product series (SC1/SC3/PC3/PC4/SE1/SE3/PE3/PE4/SI2/SI3/PI3/PE4/PI4/PA3/PA4)
- 3. Form factor

(A=2.5"; B=mSATA; M=M.2 2280; P=M.2 2260; Q=M.2 2242; R=M.2 2230; U=U.2; E=E1.S)

- 4. Capacity
- 5. Identifier (H= extended temp)



3. Product overview

3.1 PA4 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.

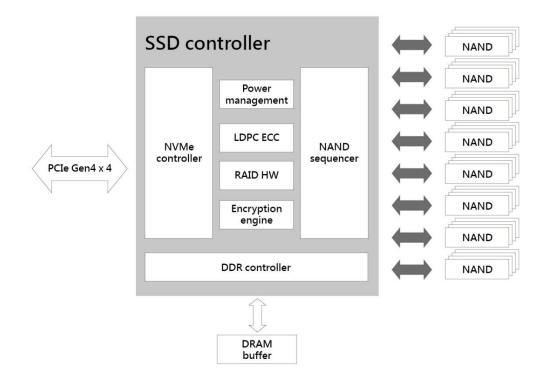
PA4 series product supports U.2, E1.S, and M.2 form factors, integrating high speed PCIe Gen 4 x 4 interface with third generation 3D TLC NAND flash memory technology, delivering capacities up to 8TB.

PA4 series products are offered in two product categories with different over-provisioning.

Key product highlights include:

- High I/O and throughput performance
- Next generation LDPC technology secures NAND endurance
- Advanced Flash management and global wear leveling algorithm extending drive life
- · High stability and reliability
- Temperature monitoring and intelligent management

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 PA4 series SSD provides you the ultimate performance and ultra-high reliability over traditional hard disk drive by achieving up to 3,500MB/s for sequential read, 2,600MB/s for sequential write, 600,000 IOPS for random read, 450,000 IOPS for steady state random write.

Exascend PA4 series 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 PA4 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: PA4 logical block address configuration

PA4 SERIES	UNFORMATTED CAPACITY (TOTAL USER ADDRESSABLE SECTORS IN LBA MODE)
240 GB	468,851,544
480 GB	937,703,088
960 GB	1,875,385,008
1,920 GB	3,750,748,848
3,840 GB	7,501,476,528
7,680 GB	15,002,931,888

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 - PA4 series

	UNIT	PA4 SERIES					
Capacity	GB	960GB	1920GB	3840GB	7680GB	3840GB	7680GB
Sequential read	MB/s	3,200	3,200	2,800	2,200	3,500	3,500
Sequential write	MB/s	1,800	3,000	2,800	2,200	3,000	3,000
Random read (4KB)	IOP S	240K	400K	400K	400K	500K	500K
Random write (4KB)	IOP S	30K	48K	50K	50K	55K	55K
DWPD (3 years)	0.6 @ JESD218 2 @ Sequential Write						
Form factor		M.2, E1	.S & U.2	M	1.2	E1.S	& U.2

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 lometer.
- 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	-40–85 °C
Storage temperature	-50–95 °C
Power supply voltage range	U.2 / E1.S: 12.0 V ±10% M.2: 3.3 V ± 5%
Humidity (non-condensing)	5-95% (Operating)
Vibration	10 G (peak, 10-2000 Hz)
Shock (operating)	50 G, (11 ms duration, half sine wave)
Shock (non-operating)	1500 G, (0.5 ms duration, half sine wave)

4.5 Power consumption

Table 6: PA4 series power consumption table

PARAMETER	VALUE	UNIT
Active power (average)	<7	W
Idle mode power (average)	<1.0	W

4.6 Reliability

Products in the Exascend PA4 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

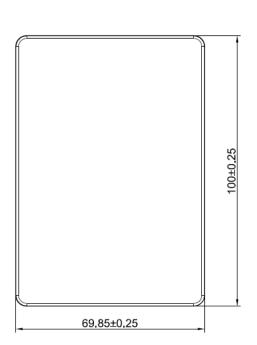
PARAMETER	VALUE
Mean Time Between Failures (MTBF) Mean Time Between Failures is a measure of how reliable a hardware product or a component is. The value describes the expected time between two failures.	2,000,000 hours
Uncorrectable Bit Error Rate (UBER) A metric for the rate of occurrence of data errors, equal to the number of data errors per bits read.	<1 sector per 10 ¹⁷
Endurance Rating (TBW) TBW stands for total bytes written whose access pattern is compliant with JESD218 standard.	480GB: 300TB 960GB: 600TB 1920GB:1200TB 3840GB: 2400TB 7680GB: 4800TB

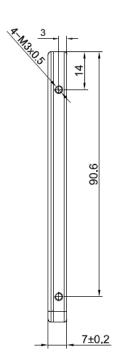


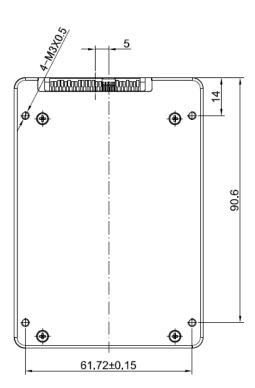
5. Physical dimension diagram

5.1 U.2 board

Figure 2: U.2 physical dimension diagram







GENERAL TOLERANCE IS ±0.15mm DIMENSION UNIT: mm

Table 8: Physical dimensions for U.2

PHYSICAL DIMENSIONS	VALUE	UNIT
Length	100	mm
Width	69.85	mm
Thickness	7	mm



5.2 PCIe M.2 2280

Figure 3: M.2 2280 physical dimension diagram

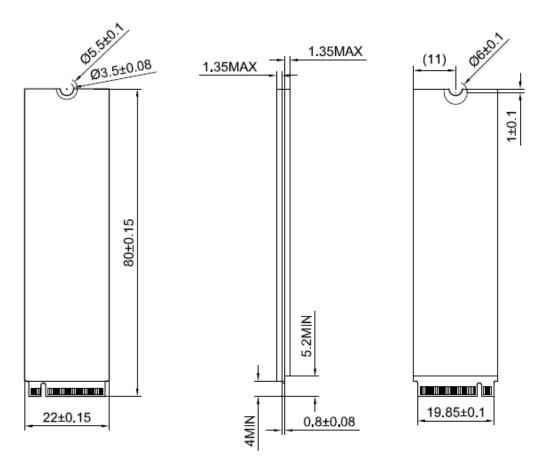


Table 9: Physical dimensions for M.2 2280

PHYSICAL DIMENSIONS	VALUE	UNIT
Length	80	mm
Width	22	mm
Thickness	3.5	mm



5.3 PCIe M.2 2242

Figure 4: M.2 2242 physical dimension diagram

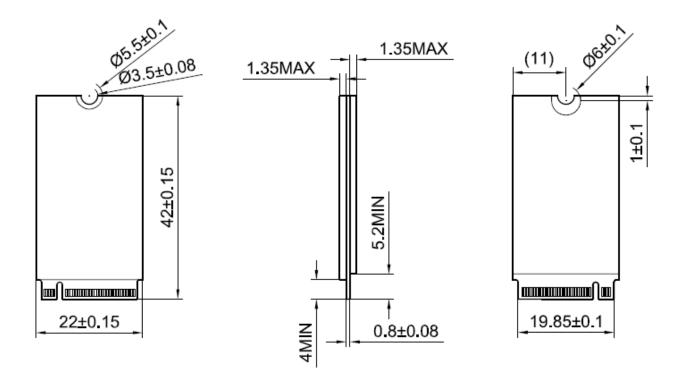


Table 10: Physical dimensions for M.2 2242

PHYSICAL DIMENSIONS	VALUE	UNIT
Length	42	mm
Width	22	mm
Thickness	3.5	mm



5.4 PCIe M.2 2230

Figure 5: M.2 2230 physical dimension diagram

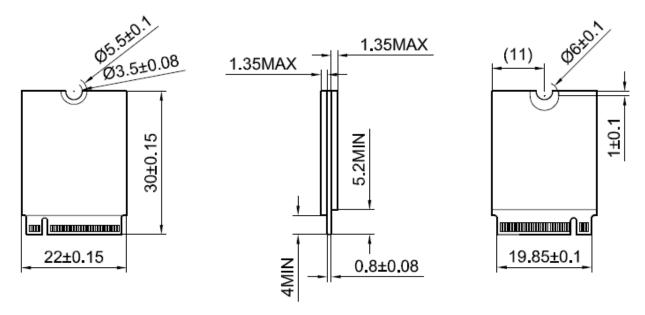


Table 11: Physical dimensions for M.2 2242

PHYSICAL DIMENSIONS	VALUE	UNIT
Length	30	mm
Width	22	mm
Thickness	3.5	mm



5.3 PCIe E1.S

Figure 6: E1.S physical dimension diagram

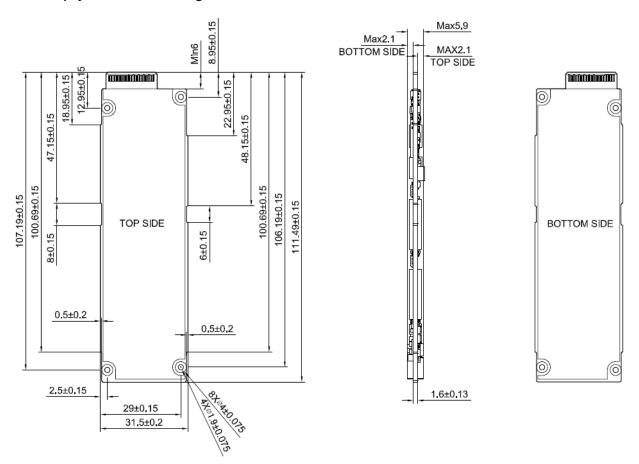


Table 12: Physical dimensions for E1.S

PHYSICAL DIMENSIONS	VALUE	UNIT
Length	111.49	mm
Width	31.5	mm
Thickness	5.9	mm



6. Pin Assignment

6.1 U.2 connector

Table 13: U.2 connector signal name, power pin assignment, and description

PIN NAME	SIGNAL NAME	DESCRIPTION	
S1	GND	Ground	
S2		Not used	
S 3		Not used	
S4	GND	Ground	
S5		Not used	
S6		Not used	
S 7	GND	Ground	
E1			
E2			
E3	3.3Vaux	3.3 V Power	
E4			
E5	PERST0#	Fundamental reset port 0	
E 6	Reserved	Reserved	
P1		Not used (SATA/SAS)	
P2		Not used (SATA/SAS)	
P3	CLKREQ	CLKREQ	
P4	IfDet_N	Interface detection (drive type)	
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	Hot-Plug	Ground	
P13	+12V_pre	12V Power	
P14	+12V	12 V Power	
P15	+12V	12 V Power	
E 7	REFCLK0+	Reference clock port 0 +	
E8	REFCLK0-	Reference clock port 0 -	
E9	GND	Ground	
E10	PERp0	+ Receive differential pair, channel 0	
E11	PERn0	- Receive differential pair, channel 0	
E12	GND	Ground	
E13	PETn0	- Transmit differential pair, channel 0	



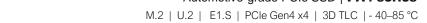
E14	PETp0	+ Transmit differential pair, channel 0	
E15	GND	Ground	
E16	Reserved	Reserved	
S8	GND	Ground	
S9		Not used (SATA/SAS)	
S10		Not used (SATA/SAS)	
S11	GND	Ground	
S12		Not used (SATA/SAS)	
S13		Not used (SATA/SAS)	
S14	GND	Ground	
S15	Reserved	Reserved	
S16	GND	Ground	
S17	PERp1	+ Receive differential pair, channel 1	
S18	PERn1	- Receive differential pair, channel 1	
S19	GND	Ground	
S20	PETn1	- Transmit differential pair, channel 1	
S21	PETp1	+ Transmit differential pair, channel 1	
S22	GND	Ground	
S23	PERp2	+ Receive differential pair, channel 2	
S24	PERn2	- Receive differential pair, channel 2	
S25	GND	Ground	
S26	PETn2	- Transmit differential pair, channel 1	
S27	PETp2	+ Transmit differential pair, channel 1	
S28	GND	Ground	
E17	PERp3	+ Receive differential pair, channel 3	
E18	PERn3	- Receive differential pair, channel 3	
E19	GND	Ground	
E20	PETn3	- Transmit differential pair, channel 3	
E21	PETp3	+ Transmit differential pair, channel 3	
E22	GND	Ground	
E23	SMCLK	SMBus clock	
E24	SMDAT	SMBus data	
E25	DualPortEn N	Dual port enable	



6.2 PCle M.2 connector

Table 14: M.2 connector signal name, power pin assignment, and description

Table 14. M.Z Connector S	ignai name, power pin assignmen	it, and description	
PIN NAME	SIGNAL NAME	DESCRIPTION	
1	GND	Ground	
2	3.3V	3.3V Power	
3	GND	Ground	
4	3.3V	3.3V Power	
5	PCIe 3 TXn	PCIe Lane 3 TX-	
6	Reserved	Reserved	
7	PCIe 3 TXp	PCIe Lane 3 TX+	
8	Reserved	Reserved	
9	GND	Ground	
10	DAS	Device Activity Signal	
11	PCIe 3 RXn	PCIe Lane 3 RX-	
12	3.3V	3.3V Power	
13	PCIe 3 RXp	PCIe Lane 3 RX+	
14	3.3V	3.3V Power	
15	GND	Ground	
16	3.3V	3.3V Power	
17	PCIe 2 TXn	PCIe Lane 2 TX-	
18	3.3V	3.3V Power	
19	PCIe 2 TXp	PCIe Lane 2 TX+	
20	NC	No Connection	
21	GND	Ground	
22	UART RX	Manufacturing Use	
23	PCIe 2 RXn	PCIe Lane 2 RX-	
24	NC	No Connection	
25	PCIe 2 RXp	PCle Lane 2 RX+	
26	Reserved	Reserved	
27	GND	Ground	
28	Reserved	Reserved	
29	PCIe 1 TXn	PCIe Lane 1 TX-	
30	Reserved	Reserved	
31	PCle 1 TXp	PCIe Lane 1 TX+	
32	UART TX	Manufacturing Use	
33	GND	Ground	
34	Reserved	Reserved	
35	PCIe 1 RXn	PCIe Lane 1 RX-	
36	Reserved	Reserved	
37	PCle 1 RXp	PCIe Lane 1 RX+	





38	Reserved	Reserved	
39	GND	Ground	
40	SCL	SMBus_SCL	
41	PCIe 0 TXn	PCIe Lane 0 TX-	
42	SDA	SMBus_SDA	
43	PCIe 0 TXp	PCIe Lane 0 TX+	
44	NC	No Connection	
45	GND	Ground	
46	NC	No Connection	
47	PCIe 0 RXn	PCIe Lane 0 RX-	
48	NC	No Connection	
49	PCIe 0 RXp	PCIe Lane 0 RX+	
50	PERST	PCIe Reset	
51	GND	Ground	
52	CLKREQ	PCIe Clock Request	
53	Ref CLKN	PCIe Reference clk-	
54	NC	No Connection	
55	Ref CLKP	PCIe Reference clk+	
56	NC	No Connection	
57	GND	Ground	
58	NC	No Connection	
59	PCIe Module Key		
60	PCIe Module Key		
61	PCIe Module Key		
62	PCIe Module Key		
63	PCIe Module Key		
64	PCIe Module Key		
65	PCIe Module Key		
66	PCIe Module Key		
67	NC	No Connection	
68	NC	No Connection	
69	NC	No Connection	
70	3.3V	3.3V Power	
71	GND	Ground	
72	3.3V	3.3V Power	
73	GND	Ground	
74	3.3V	3.3V Power	
75	GND	Ground	



6.3 E1.S connector

Table 15: E1.S connector signal name, power pin assignment, and description

PIN NAME	signal name, power pin assignme	SIGNAL NAME	
A1	1st mate	GND	
A2	1st mate	GND	
A3	1st mate	GND	
A4		GND	
	1st mate		
A5	1st mate	GND	
A6	2nd mate	GND	
A7	2nd mate	SMBCLK	
A8	2nd mate	SMBDAT	
A9	2nd mate	SMBRST#	
A10	2nd mate	LED#/ACTIVITY	
A11	2nd mate	PERST1#/CLKREQ#	
A12	1st mate	PRSNT0#	
A13	2nd mate	GND	
A14	2nd mate	REFCLKn1	
A15	1st mate	REFCLKp1	
A16	2nd mate	GND	
A17	2nd mate	PERn0	
A18	1st mate	PERp0	
A19	2nd mate	GND	
A20	2nd mate	PERn1	
A21	1st mate	PERp1	
A22	2nd mate	GND	
A23	2nd mate	PERn2	
A24	1st mate	PERp2	
A25	2nd mate	GND	
A26	2nd mate	PERn3	
A27	1st mate	PERp3	
A28	1st mate	GND	
B1	2nd mate	12V	
B2	2nd mate	12V	
В3	2nd mate	12V	
B4	2nd mate	12V	
B5	2nd mate	12V	
В6	2nd mate	12V	
В7	2nd mate	MFG	
B8	2nd mate	RFU	
	<u> </u>		



В9	2nd mate	DUALPORTEN#	
B10	2nd mate	PERSTO#	
B11	2nd mate	3.3 VAux	
B12	2nd mate	PWRDIS	
B13	1st mate	GND	
B14	2nd mate	REFCLKn0	
B15	2nd mate	REFCLKp0	
B16	1st mate	GND	
B17	2nd mate	PETn0	
B18	2nd mate	PETp1	
B19	1st mate	GND	
B20	2nd mate	PETn1	
B21	2nd mate	PETp1	
B22	1st mate	GND	
B23	2nd mate	PETn2	
B24	2nd mate	PETp2	
B25	1st mate	GND	
B26	2nd mate	PETn3	
B27	2nd mate	PETp3	
B28	1st mate	GND	

7. Compliance

Exascend PA4 series SSD complies with the following specifications:

- FCC
- CE
- RoHS

8. Supported NVMe commands

Exascend PA4 series SSDs 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 16: 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 17: 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 18: Get log commands

COMMAND NAME	CODE (UEV)	COMMAND NAME	CODE (UEV)
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. S.M.A.R.T. support

9.1 Overview of S.M.A.R.T. support

Data storage drives capture a variety of information during operation that may be used to analyze drive "health." Drive manufacturers have adopted S.M.A.R.T. (Self-Monitoring, Analysis, and Reporting Technology) to help warn system software, a system administrator, or a user of impending drive failure, when time still remains to take preventive action. The S.M.A.R.T. standard defines the protocols for reporting errors and for invoking self-tests to collect and analyze data on demand. The specification is flexible and provides for individual manufacturers to define their own unique vendor-specific information. This section describes the baseline S.M.A.R.T. commands and attributes supported by products in the Exascend PA4 series. Further, it is recommended to consult the list of public S.M.A.R.T. attributes.

9.2 S.M.A.R.T. health information

Table 19: S.M.A.R.T. health information

	: S.M.A.R.T. health information
BYTE	DESCRIPTION
00	Critical warning: This field indicates critical warnings for the state of the controller. Each bit corresponds to a critical warning type; multiple bits may be set. If a bit is cleared to '0', then that critical warning does not apply. Critical warnings may result in an asynchronous event notification to the host. Bits in this field represent the current associated state and are not persistent.
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 <i>available spare</i> 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 <i>compare</i> and <i>read</i> 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 <i>write</i> 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.
201:200	Temperature sensor 1: Contains the current temperature reported by temperature sensor 1 in degrees Kelvin.



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 three (3) years limited warranty for our automotive products.

The warranty period is the SHORTER OF:

- a period of three (3) 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.

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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.
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