SE4 series

Enterprise-grade SATA3 SSD

Specifications

Capacity
- SE4 Streaming
  - 2.5-inch: 240–7680 GB
  - M.2 2280: 240–7680 GB
- SE4 Pro
  - 2.5-inch: 240–3840 GB
  - M.2 2280: 240–1920 GB
- SE4 Boot
  - M.2 :2280 240–480 GB
- SE4 Max
  - 2.5-inch: 240–960 GB
  - M.2 2280: 240–480 GB

Components
- Controller: Marvell 88SS1074 / 88SS1080
- Flash: 3D TLC
- DRAM: DDR3

Compliance
- SATA 3.2 compatible with 6/3/1.5 Gb/s rates
- ATA/ATAPI ACS3 command set compliant
- NCQ: Up to 32 Queue Depth
- Enhance SMART ATA feature set
- Data set management TRIM command
- OS aware host hot plug / removal

Performance (up to)[1]
- Sequential read: 550 MB/s
- Sequential write: 535 MB/s
- Random 4K read: 98,000 IOPS
- Random 4K write: 24,000 IOPS

Power management
- DIPM / HIPM
- Auto idle
- SATA link power management
- Temperature monitoring and proprietary thermal management algorithm

Security (Optional)
- AES-256 encryption
- Full disk encryption (FDE) as self-encrypting drive (SED) with TCG Opal 2.0
- Security erase
- Cryptographic firmware image signing

Physical insertion cycles
- Nominal: 2000 (Optional: 5000)

Latency (QD1)
- Read: 100 µs
- Write: 40 µs

Reliability
- Advanced LDPC error correction
- Global static and dynamic wear leveling
- Hardware power-off protection
- UBER: <1 sector per 10^{17} bits read
- MTBF: 2.0 million hours

Endurance (JESD219 enterprise, client, @5years)[2]
- SE4 Streaming: 0.6 DWPD, 1.5 DWPD
- SE4 Pro: 1.5 DWPD, 5 DWPD
- SE4 Boot: 1.0 DWPD, 3 DWPD
- SE4 Max: 5 DWPD, 10 DWPD

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
- 2.5-inch: 100.5 mm x 69.85 mm x 7 mm
- M.2 2280: 80 mm x 22 mm x 3.6 mm

Power consumption (TYP)
- Active: <4 W
- Idle: <0.5 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: 1500 G
  (0.5 ms duration, half sine wave)
- Vibration: 10 G
  (peak,10–2000 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.

Table of Contents

Product datasheet

1. Order information

The following table lists the standard part number for Exascend SE4 series SSD, for design service inquiries on operating temperature, capacity, over-provisioning, endurance, performance, and power, please contact Exascend sales support, or email us at: sales@exascend.com.

Table 1: SE4 series SSD product list

PART NUMBER	CONFIGURATION	CAPACITY*	FLASH TYPE	FORM FACTOR
EXSE4M480GB	Streaming	480GB	3D TLC	M.2 2280
EXSE4M960GB	Streaming	960GB	3D TLC	M.2 2280
EXSE4M1920GB	Streaming	1920GB	3D TLC	M.2 2280
EXSE4M3840GB	Streaming	3840GB	3D TLC	M.2 2280
EXSE4M7680GB	Streaming	7680GB	3D TLC	M.2 2280
EXSE4M480GB-P	Pro	480GB	3D TLC	M.2 2280
EXSE4M960GB-P	Pro	960GB	3D TLC	M.2 2280
EXSE4M1920GB-P	Pro	1920GB	3D TLC	M.2 2280
EXSE4M240GB-X	Max	240GB	3D TLC	M.2 2280
EXSE4M480GB-X	Max	480GB	3D TLC	M.2 2280
EXSE4M240GB-T	Boot	240GB	3D TLC	M.2 2280
EXSE4M480GB-T	Boot	480GB	3D TLC	M.2 2280
EXSE4A240GB	Streaming	240GB	3D TLC	2.5”
EXSE4A480GB	Streaming	480GB	3D TLC	2.5”
EXSE4A960GB	Streaming	960GB	3D TLC	2.5”
EXSE4A1920GB	Streaming	1920GB	3D TLC	2.5”
EXSE4A3840GB	Streaming	3840GB	3D TLC	2.5”
EXSE4A7680GB	Streaming	7680GB	3D TLC	2.5”
EXSE4A480GB-P	Pro	480GB	3D TLC	2.5”
EXSE4A960GB-P	Pro	960GB	3D TLC	2.5”
EXSE4A1920GB-P	Pro	1920GB	3D TLC	2.5”
EXSE4A3840GB-P	Pro	3840GB	3D TLC	2.5”
EXSE4A240GB-X	Max	240GB	3D TLC	2.5”
EXSE4A480GB-X	Max	480GB	3D TLC	2.5”
EXSE4A960GB-X	Max	960GB	3D TLC	2.5”
EXSE4M240GB-WP	With PLP	240GB	3D TLC	M.2 2280
EXSE4M480GB-WP	With PLP	480GB	3D TLC	M.2 2280

2. Part number decoder

1	2	3	4	5	6
EX	SE4	M	480GB	-	**

1. Exascend

2. Product series
(SC1/SC3/PC3/PC4/SE1/SE3/SE4/PE3/PE4/SI2/SI3/PI3/PE4/PI4)

3. Form factor

(A=2.5”; B=mSATA; M=M.2 2280; N=M.2 2260; Q=M.2 2242; U=U.2; E=E1.S)

4. Capacity

5. Hyphen

6. Identifier

H= extended temp

X= Max

P= Pro

T= Boot

R=RED approved

WP= with PLP

3. Product overview

Exascend provides customizable hardware and firmware design service of cutting-edge SSD products for advanced storage systems. Our products are designed specifically for high reliability server, enterprise data center, and cloud computing applications. Combining world class design R&D, and engineering support capabilities, Exascend strives to provide customers with the best-in-class product and service, enabling enhanced boot times, faster application loading, reduced power consumption and extended reliability. To explore more about our extended engineering support services, i.e., tailored capacity, over-provisioning, operating temperature range, endurance, performance, power, and longevity, please contact Exascend sales representative, or email us at: sales@exascend.com.

The SE4 series support full-disk self-encryption (SED), featuring FIPS-certified AES-256 hardware encryption engine to provide hardware-based secure data encryption without sacrificing SSD performance. The SED supports TCG Opal 2.0 for trusted computing. When TCG Opal is not enabled, system BIOS can alternatively enable and manage full drive data encryption (FDE) via ATA security command set. Please note, TCG Opal and ATA security function set cannot be activated simultaneously.

Exascend's SE4 series is designed for demanding enterprise-level workloads. It supports up to 5 drive writes per day (DWPD) under JESD219 enterprise workloads – or 10 DWPD under JESD219 client workloads – for 5 years.

SE4 Streaming series:
Designed for read-intensive enterprise-class workloads, supporting up to 0.6 DWPD under JESD219 enterprise workloads – or 1.5 DWPD under JESD219 client workloads – for 5 years.

SE4 Pro series:
Optimized for mixed read and write-intensive enterprise-class workloads, supporting up to 1.5 DWPD under JESD219 enterprise workloads – or 5 DWPD under JESD219 client workloads – for 5 years.

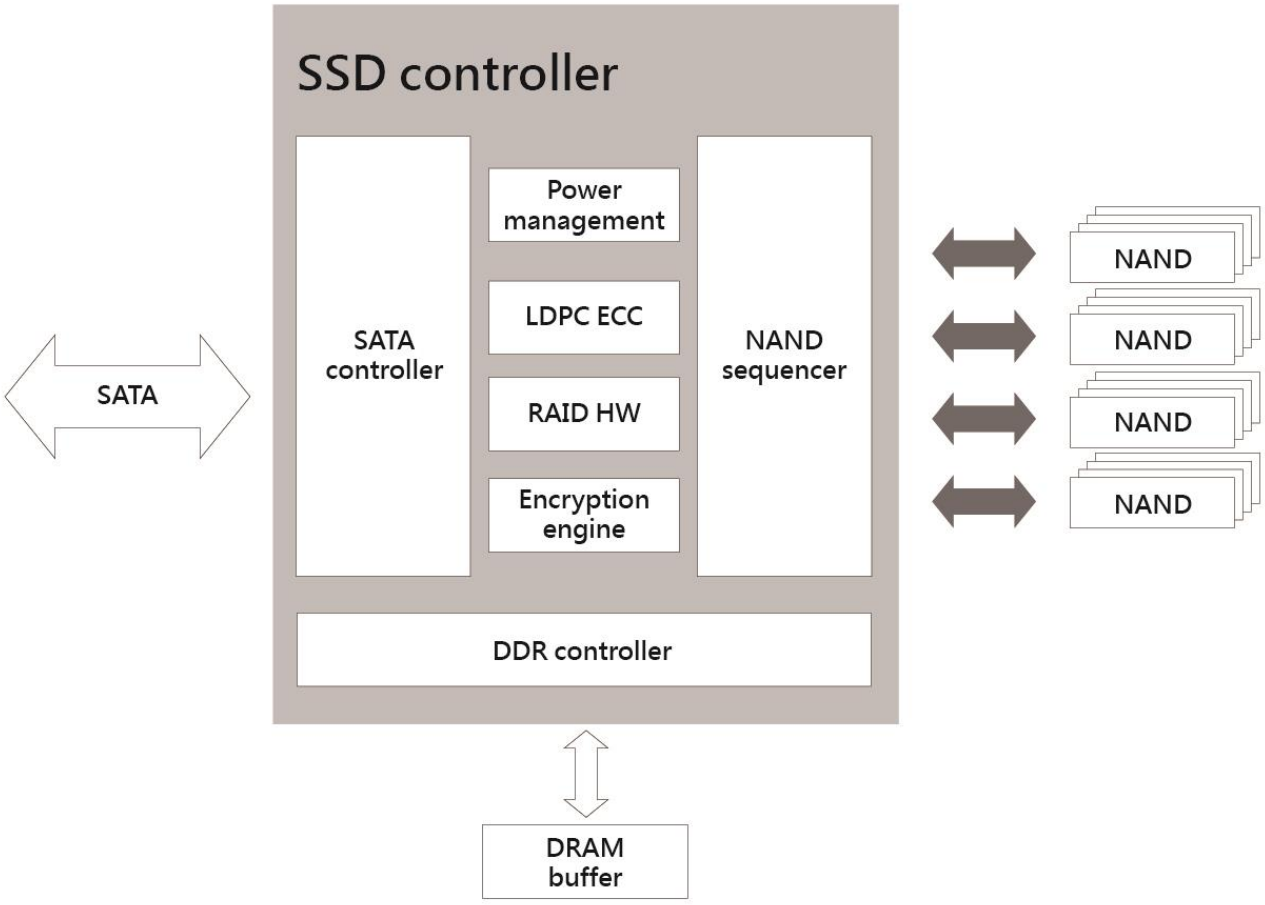
SE4 Max series:
Ideal for extreme, intensive workloads, supporting up to 5 DWPD under JESD219 enterprise workloads – or up to 10 DWPD under JESD219 client workloads – for 5 years.

SE4 Boot series:
Engineered for enterprise-class system boot applications and journaling workloads, supporting up to 1 DWPD under JESD219 enterprise workloads – or 3 DWPD under JESD219 client workloads – for 5 years.

SE4 series product highlights:

- High I/O performance and throughput bandwidth
- Consistent I/O latency and QoS for enterprise workloads
- Advanced flash management and global wear leveling algorithm that extend drive life
- End-to=End Data path protection
- Full disk encryption (FDE) as self-encrypting drive (SED) with TCG Opal 2.0
- RAID ECC for exceptional reliability and stability
- Self-Monitoring, Analysis and Reporting Technology (S.M.A.R.T.)
- Proprietary thermal management ensuring consistent performance
- Hardware and firmware-based power loss protection reducing risk of data corruption and device failure
- *Optional firmware feature customization and tuning services*

Figure 1: SSD functional logic diagram



4. Detailed specifications

The Exascend SE4 series provides extreme performance and ultra-high reliability, delivering speeds up to 550 MB/s sequential read, 535 MB/s sequential write, 98,000 IOPS random read, and 24,000 IOPS full drive random write. Available in a wide variety of form factors, configurations and storage capacities, the SE4 series is ideal for enterprise applications that demand storage devices that can handle extreme workloads and offer steadfast reliability.

4.1 Capacity

Table 2: SE4 logical block address configuration

SE4 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 – SE4 series

	UNIT	SE4 BOOT SERIES		SE4 STREAMING SERIES					
Capacity	GB	**240 GB**	**480 GB**	**240 GB**	**480 GB**	**960 GB**	**1,920 GB**	**3,840 GB**	**7,680 GB**
Sequential read (128KB)	MB/s	550	550	550	550	550	550	550	535
Sequential write (128KB)	MB/s	520	535	290	520	535	535	535	535
Random read (4KB)	IOPS	95,000	98,000	85,000	95,000	98,000	98,000	98,000	75,000
Random write (4KB)	IOPS	18,000	35,000	10,000	18,000	20,000	22,000	24,000	10,000
TBW (JESD219 enterprise)	TBW	433	866	260	520	1,000	2,000	4,000	8,000
TBW (JESD219 client)	TBW	1,300	2600	650	1,300	2,600	5,000	10,000	20,000
DWPD (5 years)		1 @ JESD219 enterprise 3 @ JESD219 client		0.6 @ JESD219 enterprise 1.5 @ JESD219 client					
Form factor		M.2		M.2 & 2.5 Inch					

Table 3: Drive performance – SE4 series (continue)

	UNIT	SE4 MAX SERIES				SE4 PRO SERIES			
Capacity	GB	**240 GB**	**480 GB**	**960 GB**	**1,920 GB**	**480 GB**	**960 GB**	**1,920 GB**	**3,840 GB**
Sequential read (128KB)	MB/s	550	550	550	550	550	550	550	550
Sequential write (128KB)	MB/s	520	535	535	535	535	535	535	535
Random read (4KB)	IOPS	98,000	98,000	98,000	98,000	98,000	98,000	98,000	98,000
Random write (4KB)	IOPS	60,000	65,000	72,000	72,000	35,000	40,000	42,000	42,000
TBW (JESD219 enterprise)	TBW	2,200	4,400	8,500	17,000	1,400	2,700	5,500	11,000
TBW (JESD219 client)	TBW	4,500	9,000	18,000	36,000	3,000	5,600	12,000	24,000
DWPD (5 years)		5 @ JESD219 enterprise 10 @ JESD219 client				1.5 @ JESD219 enterprise 3 @ JESD219 client			
Form factor		M.2 & 2.5 Inch			2.5 Inch	M.2 & 2.5 Inch			2.5 Inch

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 Latency

Table 4: Drive latency – SE4 series

PARAMETER	UNIT	SE4 SERIES					
		240 GB	480 GB	960 GB	1.92 TB	3.84 TB	7.68TB
Read (TYP)	µs	100	100	100	110	110	110
Write (TYP)	µs	40	40	40	40	40	40

Notes:
- Measured with device connected as secondary drive.
- Actual performance may vary based on the hardware, software, and overall system configuration.
- Latency is measured through FIO with QD1 random read/write workload when the drive has entered steady state.
- Performance test platform: CPU: Intel Core i7 4770K; motherboard: ASUS Z87-DELUXE; chipset: Intel Z87 Express; OS: Windows 8.1 Pro x64.

4.4 Quality of Service

Table 5: QoS – SE4 Series (Boot / Streaming)

Specification	Unit	Queue Depth = 1 (Boot Series)		Queue Depth = 1 (Streaming Series)					
		240GB	480GB	240GB	480GB	960GB	1920GB	3840GB	7680GB
Quality of Service (99%)									
Reads	µs	150	150	150	150	150	150	150	150
Writes	µs	1500	1500	250	250	250	250	250	250
Quality of Service (99.9%)									
Reads	µs	200	200	200	200	200	200	200	200
Writes	µs	2000	2000	750	750	750	750	750	750
Quality of Service (99.99%)									
Reads	µs	350	350	350	350	350	350	350	350
Writes	µs	3000	3000	1500	1500	1500	1500	1500	1500

Table 6: QoS – SE4 Series (MAX / PRO)

Specification	Unit	Queue Depth = 1 (max series)				Queue Depth = 1 (pro series)			
		240GB	480GB	960GB	1920GB	480GB	960GB	1920GB	3840GB
Quality of Service (99%)									
Reads	µs	150	150	150	150	150	150	150	150
Writes	µs	120	120	120	120	180	180	180	180
Quality of Service (99.9%)									
Reads	µs	200	200	200	200	200	200	200	200
Writes	µs	300	300	300	300	500	500	500	500
Quality of Service (99.99%)									
Reads	µs	350	350	350	350	350	350	350	350
Writes	µs	800	800	800	800	1000	1000	1000	1000

4.5 Environment specification

Table 7: Environmental specification table

PARAMETER	VALUE
Operating temperature	0–70 °C
Storage temperature	-40–85 °C
Power supply voltage range	2.5": 5.0 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)

4.6 Power consumption

Table 8: SE4 series power consumption table

PARAMETER	UNIT	240GB	480GB	960GB	1920GB	3840GB	7680GB
Idle Average	W	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Random Read (1MB Transfer)	W	<2.7	<2.7	<2.8	<2.7	<2.7	<2.7
Random Write (1MB Transfer)	W	<2.8	<3.8	<3.9	<3.8	<3.8	<3.8
Sequential Read (1MB Transfer)	W	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8
Sequential Write (1MB Transfer)	W	<2.7	<3.8	<4.1	<4.1	<4.1	<4.1

4.7 Reliability

Products in the Exascend SE4 series meet or exceed SSD endurance and data retention requirements as specified in the JESD218 standard. Reliability specifications are listed in the following table.

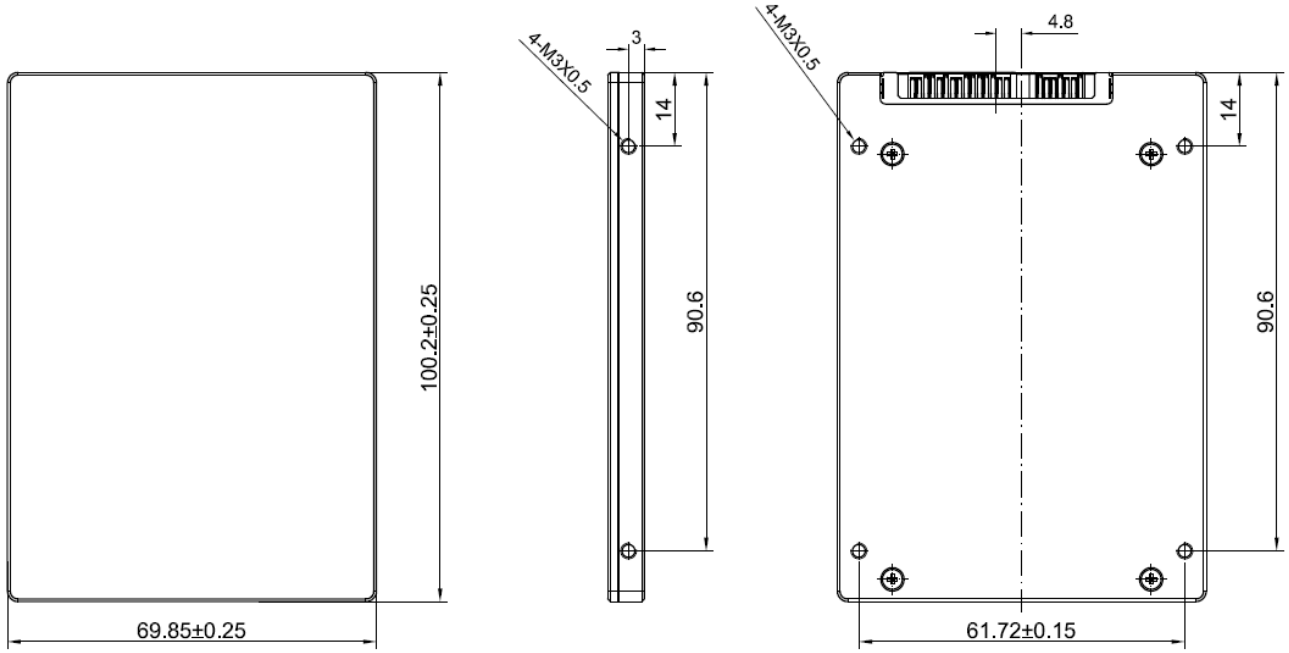
Table 9: Reliability table

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.	240GB : 250TB 480GB : 500TB 960GB : 1000TB 1920GB : 2000TB 3840GB : 4000TB 7680GB : 8000TB

5. Physical dimension diagram

5.1 SATA 2.5 Inch board

Figure 2: 2.5 Inch physical dimension diagram



GENERAL TOLERANCE IS ±0.15mm
DIMENSION UNIT: mm

Table 10: Physical dimensions for SATA 2.5 Inch

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

5.2 SATA M.2 2280

Figure 3: SATA M.2 2280 physical dimension diagram

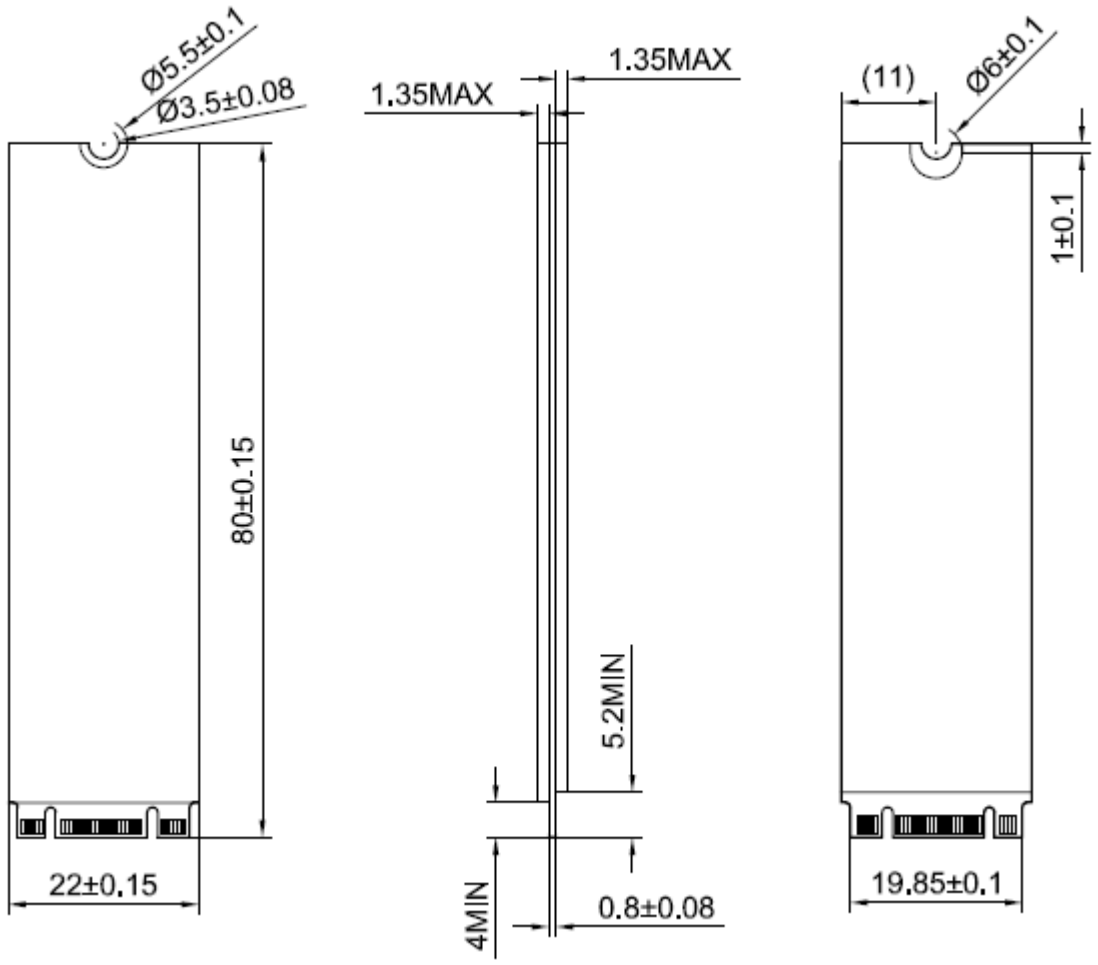


Table 11: Physical dimensions for M.2 2280

PHYSICAL DIMENSIONS	VALUE	UNIT
Length	80	mm
Width	22	mm
Thickness	3.6	mm

6. Pin Assignment

6.1 SATA 2.5 Inch connector

Table 12: 2.5 inch connector signal name, power pin assignment, and description

PIN NAME	SIGNAL NAME	DESCRIPTION
S1	GND	Ground
S2	R+	+ Differential Receive Signal
S3	R-	- Differential Receive Signal
S4	GND	Ground
S5	T-	- Differential Transmit Signal
S6	T+	+ Differential Transmit Signal
S7	GND	Ground
P1	NC	NO Connect
P2	HW_Trigger_IN	Hardware erase input(3V~10V)
P3	Devslp	Enter/Exit DevSleep
P4	HW_Trigger_IN_Return	Hardware Erase Return
P5	GND	Ground
P6	GND	Ground
P7	5V	5V Power,Pre-charge
P8	5V	5V Power
P9	5V	5V Power
P10	GND	Ground
P11	DAS	Device Activity Signal
P12	GND	Ground
P13	12V	12V Power（Not Used）
P14	12V	12V Power（Not Used）
P15	12V	12V Power（Not Used）

6.2 SATA3 M.2 connector

Table 13: M.2 connector signal name, power pin assignment, 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	PCIe Lane 2 RX+
26	Reserved	Reserved
27	GND	Ground
28	Reserved	Reserved
29	PCIe 1 TXn	PCIe Lane 1 TX-
30	Reserved	Reserved
31	PCIe 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	PCIe 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

7. Compliance

Exascend SE4 series SSD complies with the following specifications:

- FCC
- CE
- RoHS

8. Supported ATA commands

Exascend SE4 series SSDs support the ATA commands that are shown in the following table. For details about the ATA commands, please refer to the ATA/ATAPI ACS3 command set specifications.

Table 14: Supported ATA Command Set

COMMAND NAME	CODE (HEX)	COMMAND NAME	CODE (HEX)
NOP	00h	Read Multiple	C4h
Data Set Management	06h	Write Multiple	C5h
Read Sectors	20h	Set Multiple Mode	C6h
Read Sectors EXT	24h	Read DMA	C8h
Read DMA EXT	25h	Write DMA	CAh
Read Native Max Address EXT	27h	Write Multiple FUA EXT	CEh
Read Multiple EXT	29h	Standby Immediate	E0h
Read Log EXT	2Fh	IDLE Immediate	E1h
Write Sectors	30h	Standby	E2h
Write Sectors EXT	34h	IDLE	E3h
Write DMA EXT	35h	Read Buffer	E4h
Set Max Address EXT	37h	Check Power Mode	E5h
Write Multiple EXT	39h	Sleep	E6h
Write DMA FUA EXT	3Dh	Flush Cache	E7h
Write Log EXT	3Fh	Write Buffer	E8h
Read Verify Sectors	40h	Read Buffer DMA	E9h
Read Verify Sectors EXT	42h	Flush Cache EXT	EAh
Write Uncorrectable EXT	45h	Write Buffer DMA	EBh
Read Log DMA EXT	47h	Identify Device	ECh
Write Log DMA EXT	57h	Set Features	EFh
Read FPDMA Queued	60h	Security Set Password	0xF1
Write FPDMA Queued	61h	Security Unlock	0xF2
Set Date & Time EXT	77h	Security Erase Prepare	0xF3
Accessible Max Address	78h	Security Erase Unit	0xF4
Execute Device Diagnostic	90h	Security Freeze Lock	0xF5
Download Micro Code	92h	Security Disable Password	0xF6
Download Micro Code DMA	93h	Read Native Max Address	0xF8
SMART	B0h	Set Max Address	0xF9
Sanitize Device	B4h		

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 SE4 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 15: S.M.A.R.T. health information

ID (Dec)	ID(Hex)	Attribute Name	Description
1	01h	Raw Read Error Rate	Total event count for all correctable and un-correctable ecc, it would be cleared to 0 when exceeding FFFFFFFFFFFFh
5	05h	Retired Block Count	Retired block count after leaving factory
9	09h	Power-On Hours	Power on time, culmulative over the life of the device, integer number in hour time units
12	0Ch	Device Power Cycle Count	Culmulative number of power cycle events over the life of the device
165	A5h	Maximum Erase Count	Maximum erase count of all the blocks in the device
166	A6h	Minimum Erase Count	Minimum erase count of all the blocks in the device
167	A7h	Average Erase Count	Average erase count of all the blocks in the device
169	A9h	Remain life/Media Wearout Indicator	Indicate the worn-out status of the device
170	AAh	Available Reserved Space	Percentage of reserved blocks remaining in op
171	ABh	Program Fail Count	Total count of program fails
172	ACh	Erase Fail Count	Total count of erase fails
174	AEh	Unexpected Power Loss	Total count of unexpected power loss events
183	B7h	Total Sata Link Down Grade Link Count	Total count of the number of times SATA interface selected lower signaling rate due to error Byte0~1: count of failing SATA connection Byte2~3: count of SATA1 Byte4~5: count of SATA2
194	C2h	Temperature	Byte0~1: current temperature Byte2~3: minimum temperature Byte4~5:maximum temperature
198	C6h	ECC On-the-Fly Error Count	Count of un-correcable ecc (UECCC). It is cleared at power-on reset.
199	C7h	Current Sata Interface Crc Count	Count of SATA interface CRC during this power on, it would be cleard to zero during power off
241	F1h	Lifetime Writes from Host System	Data written by host (GB=1024*1024*1024 Byte)
242	F2h	Lifetime Reads to Host System	Data read to host (GB=1024*1024*1024 Byte)
249	F9h	Total Nand Writes	Total data written to NAND (GB=1024*1024*1024 Byte)
250	FAh	Current Sata Link Down Grade Link Count	Count of the number of times SATA interface selected lower signaling rate due to error during this power on, it would be cleared to 0 during power off Byte0~1: count of failing SATA connection Byte2~3: count of SATA1 Byte4~5: count of SATA2
251	FBh	Total Sata Interface Crc Count	Life-time SATA interface CRC count

9.3 S.M.A.R.T. Sub command

The SMART feature set command has several separate sub-commands which are selective by host to write it to the devices' features registers before issuing the S.M.A.R.T. The sub-commands are listed below.

Table 16: S.M.A.R.T. sub command

Command	Sub-Code
SMART Read Data	D0
SMART Read Attribute Thresholds	D1
SMART Enable/Disable Attribute AutoSave	D2
SMART Execute Off-Line Immediate	D4
SMART Read Log	D5
SMART Write Log	D6
SMART Enable Operations	D8
SMART Disable Operations	D9
SMART Return Status	DA

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The warranty period is the SHORTER OF:

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- 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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- 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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Revision history

Table 17: SE4 datasheet revision history

REVISION	DESCRIPTION	DATE
001	First released	Nov, 2021
002	Update dimension diagram	Jan, 2022
003	Add SMbus Signal	Mar, 2022
004	Add with PLP product	Jul, 2022
005	Modify performance	Oct, 2022
006	Add 7680GB	Dec, 2022
007	Modify format	Feb, 2023
008	Modify format	Jun, 2023