

SOSAM M.2 2280 PCIe 4.0 SSD

DATASHEET V1.0

1. Key Specifications

Item	Specification
Form Factor	M.2 2280 M Key
Interface	PCIe 4.0 x4
Capacities	256GB, 512GB, 1TB, 2TB
Flash Memory	TLC NAND
Max Sequential Read (1MB block)	7100 MB/s
Max Sequential Write (1MB block)	6700 MB/s
Compliance	NVMe 2.0, PCIe Base Spec Rev.4.0
Supply Voltage	3.3V $\pm$ 5%
Supply Current	≥ 4 A
Max Power Consumption	≤ 3.5 W
Idle Power Consumption	≤ 0.6 W
Commercial Operating Temperature	0°C ~ +70°C
Industrial Operating Temperature	-20°C ~ +70°C
Storage Temperature	-40°C ~ +85°C
Dimensions	22mm $\times$ 80mm $\times$ 2.15mm
Weight	< 10 g

2. Product Description

2.1 Product Overview

The SOSAM M.2 2280 NVMe SSD adopts a 4-lane PCIe 4.0 interface to deliver exceptional read and write performance. It is equipped with full end-to-end data path protection and intelligent self-balancing technology, which effectively regulates performance and operating temperature for optimal stability, making it ideally suited for ultra-thin and compact devices.

2.2 Product Features

- PCIe 4.0 x4 interface
- Compliant with NVMe 2.0 Specification
- Host Memory Buffer (HMB) support
- L1.2 low-power state support
- Modern Standby low-power mode support
- Thermal throttling with adaptive thermal regulation
- Over-voltage and surge protection
- Power-loss protection (PLP)

3 . Product Specifications

3.1 Capacities

Form Factor	Flash Type	Capacity
M.2 2280	TLC	256GB
M.2 2280	TLC	512GB
M.2 2280	TLC	1TB
M.2 2280	TLC	2TB

Note: 1GB = 1,000,000,000 Bytes;

3.2 Performance

Form Factor	Flash Type	Capacity	Max Sequential Read (MB/s)	Max Sequential Write (MB/s)	4KB Random Read (IOPS)	4KB Random Write (IOPS)
M.2 2280	TLC	256GB	3400	2400	175K	150K
M.2 2280	TLC	512GB	6850	4800	175K	150K
M.2 2280	TLC	1TB	7100	6700	175K	150K
M.2 2280	TLC	2TB	7100	6700	175K	150K

Note: All performance data above are measured under the Windows 10 operating system using CrystalDiskMark 8.0.4 .

Test Methodology: The drive is tested as a secondary data drive, with a total write data volume of 1 GB per test and 5 write passes by default. Performance parameters may vary due to operating system, test environment and other factors. Actual test results may differ under different test conditions.

3.3 Electrical Characteristics

3.3.1 Input Voltage

Form Factor	Input Voltage
M.2 2280	3.3V $\pm$ 5%

3.3.2 Power Consumption

Capacity	Idle Power (avg)	Read Power (avg)	Write Power (avg)
256GB	0.55W	2.13W	2.21W
512GB	0.55W	3.40W	3.00W
1TB	0.57W	3.17W	3.30W
2TB	0.55W	3.25W	3.35W

3.4 Operating / Storage Environment

Item	Operating	Non-operating
Ambient Temperature	Commercial Grade: 0°C ~ 70°C Industrial Grade: -20 °C ~ +70 °C	-40°C ~ +85°C
Ambient Humidity	5% ~ 95% RH	5% ~ 95% RH

3.5 Reliability

Parameter	Value
Mean Time Between Failures (MTBF)	>2,000,000 hours
Uncorrectable Bit Error Rate (UBER)	$<10^{-16}$
Total Bytes Written (TBW)	256GB: 300TB
	512GB: 600TB
	1TB: 1200TB
	2TB: 2400TB

Note: Total Bytes Written (TBW) is calculated as:

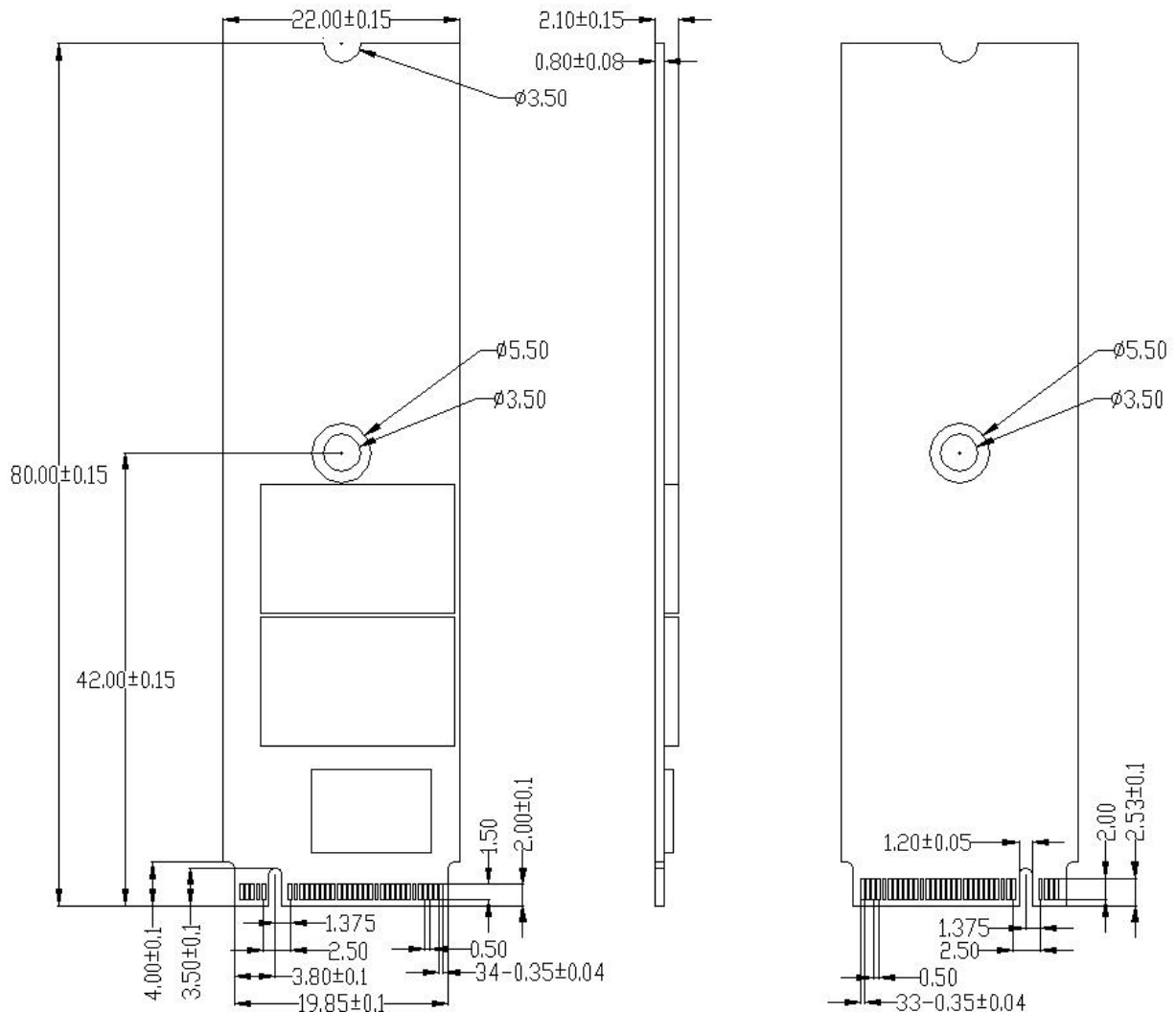
$TBW = \text{SSD capacity} \times \text{Average P/E cycles of NAND flash} / \text{Write Amplification Factor (WAF)}$

1. Average P/E cycles of NAND flash: 3000 cycles

2. Write Amplification Factor (WAF): ≈ 2.5

4. Physical Specifications

4.1 Dimension Drawing



M.2 2280 Outline Drawing (22 mm × 80 mm × 2.15 mm)

4.2 Weight

Form Factor	Weight
M.2 2280	<10.0g

5. Signal Definitions

Signal Name	Pin Number	I/O	Function Description	Pin Level
+3.3V	2, 4, 12, 14, 16,18, 70, 72, 74	I	+3.3V operating power supply	3.3V
GND	1, 3, 9, 15, 21,27, 33, 39, 45,51, 57, 71, 73, 75	—	Power / signal ground	0V
PETp3	7	O	PCIe RX3/TX3 differential signals	
PETn3	5			
PERp3	13	I		
PERn3	11			
PETp2	19	O	PCIe RX2/TX2 differential signals	
PETn2	17			
PERp2	25	I		
PERn2	23			
PETp1	31	O	PCIe RX1/TX1 differential signals	
PETn1	29			
PERp1	37	I		
PERn1	35			
PETp0	43	O	PCIe RX0/TX0 differential signals	
PETn0	41			
PERp0	49	I		
PERn0	47			
REFCLKP	55	I	PCIe external 100MHz differential reference clock input.It is recommended to add a 100nF capacitor on the host side.	
REFCLKN	53			
DAS/DSS#/LED#	10	O	Read/write activity indicator	
IIC_SCL	40	I/O		
IIC_SDA	42			
PERST#	50	I	PCIe Reset signal, active low	3.3V
CLKREQ#	52	I/O	PCIe reference clock request signal.It is recommended to pull up to 3.3V via a 10K resistor on the host side.	3.3V
PEWAKE#	54	I/O	PCIe PME Wake	3.3V
NC	67	I	No connection, unused	
RFU	30, 44, 56, 58, 68	—	Reserved for future use	
NC	6, 8, 20, 22, 24,26, 28, 32, 34,36, 38, 46, 48, 69	—	No connection, unused	

6. Command Set

6.1 NVMe Admin Command Set

Command	Notes
Create I/O Submission Queue	Up to 31 I/O SQ, support WRR & RR
Delete I/O Submission Queue	Up to 31 I/O SQ
Create I/O Completion Queue	Up to 31 I/O CQ
Delete I/O Completion Queue	Up to 31 I/O CQ
Identify	Support CNS 0 – CNS 2
Set Feature	Saved attribute is not supported
Get Feature	Saved attribute is not supported
Get Log Page	Extended data is not supported
Firmware Image Download	1 slots of images
Firmware Commit	Support activation without a reset
Abort	Abort a specific command previously submitted to admin SQ or I/O SQ
Format NVM	Support Secure Erase. Only one LBA format (512byte) supported. No PI & metadata setting supported.
Device Self-test	Not support
Sanitize	Not support

6.2 PCIe and NVM Express Registers

Description	Start Address	End Address	Protocol
PCI Register Summary			
PCI Header	00h	3Fh	PCI Capability
PCI Power Management Capability	40h	47h	PCI Capability
MSI Capability	50h	67h	PCI Capability
PCI Express Capability	70h	A3h	PCI Capability
MSI-X Capability	B0h	BBh	PCI Capability
Advanced Error Reporting Capability	100h	147h	PCI Capability
Device Serial Number Capability	148h	153h	PCI Capability
ARI Extended Capability	158h	15Fh	PCI Capability
Secondary PCI Express Extended Capability	168h	17Bh	PCI Capability
Latency Tolerance Reporting (LTR) Capacity	1D4h	1DBh	PCI Capability
L1 PM Substates Extended Capability	1DCh	1EBh	PCI Capability
RAS DES Extended Capability	1ECh	2D7h	PCI Capability
RASDP Extended Capability	2ECh	323h	PCI Capability

PCI Header Register Summary			
Identifier	Start Address	End Address	ID
Identifiers	00h	03h	ID
Command Register	04h	05h	CMD
Device Status	06h	07h	STS
Revision ID	08h	08h	RID
Class Code	09h	0Bh	CC
Cache Line Size	0Ch	0Ch	CLS
Master Latency Timer	0Dh	0Dh	MLT
Header Type	0Eh	0Eh	HTYPE
Built in Self-Test	0Fh	0Fh	BIST
Memory Register Base Address (lower 32-bits)	10h	13h	MLBAR (BAR0)
Memory Register Base Address (upper 32-bits)	14h	17h	MLBAR (BAR1)
Reserved	18h	1Bh	BAR2
Reserved	1Ch	1Fh	BAR3
Reserved	20h	23h	BAR4
Reserved	24h	27h	BAR5
Card Bus CIS Pointer	28h	2Bh	CCPTR
Subsystem Identifiers	2Ch	2Fh	SS
Expansion ROM Base Address	30h	33h	EROM
Capabilities Pointer	34h	34h	CAP
Reserved	35h	3Bh	R
Interrupt Information	3Ch	3Dh	INTR
Minimum Grant	3Eh	3Eh	MGNT
Maximum Latency	3Fh	3Fh	MLAT

6.3 Identify Command Tables

Identify Command Table Information	Byte
PCI Vendor ID	1:0
PCI Subsystem Vendor ID	3:2
Serial Number	23:4
Model Number	63:24
Firmware Revision	71:64
Recommended Arbitration Burst	72
IEEE OUI Identifier	75:73
Controller Multi-Path I/O and Namespace SharingCapabilities	76
Maximum Data Transfer Size	77
Controller ID	79:78
Version	83:80

RTD3 Resume Latency	87:84
RTD3 Entry Latency	91:88
Optional Asynchronous Events Supported	95:92
Controller Attributes	99:96
Read Recovery Levels Supported	101:100
Reserved	110:102
Controller Type	111
FRU Globally Unique Identifier	127:112
Command Retry Delay Time 1	129:128
Command Retry Delay Time 1	131:130
Command Retry Delay Time 1	133:132
Reserved	239:134
Refer to NVMe Management Interface	255:240
Optional Admin Command Support	257:256
Abort Command Limit	258
Asynchronous Event Request Limit	259
Firmware Updates	260
Log Page Attributes	261
Error Log Page Entries	262
Number of Power States Support	263
Admin Vendor Specific Command Configuration	264
Autonomous Power State Transition Attributes	265
Warning Composite Temperature Threshold	267:266
Critical Composite Temperature Threshold	269:268
Maximum Time for Firmware Activation	271:270
Host Memory Buffer Preferred Size	275:272
Host Memory Buffer Minimum Size	279:276
Total NVM Capacity	295:280
Unallocated NVM Capacity	311:296
Replay Protected Memory Block Support	315:312
Extended Device Self-test Time	317:316

Device Self-test Options	318
Firmware Update Granularity	319
Keep Alive Support	321:320
Host Controlled Thermal Management Attributes	323:322
Minimum Thermal Management Temperature	325:324
Maximum Thermal Management Temperature	327:326
Sanitize Capabilities	331:328
Host Memory Buffer Minimum Descriptor Entry Size	335:332
Host Memory Maximum Descriptor Entries	337:336
NVM Set Identifier Maximum	339:338
Endurance Group Identifier Maximum	341:340
ANA Transition Time	342
Asymmetric Namespace Access Capabilities	343
ANA Group Identifier Maximum	347:344
Number of ANA Group Identifier	351:348
Persistent Event Log Size	355:352
Reserved	511:356
Submission Queue Entry Size	512
Completion Queue Entry Size	513
Maximum Outstanding Commands	515:514
Number of Namespaces	519:516
Optional NVM Command Support	521:520
Fused Operation Support	523:522
Format NVM Attributes	524
Volatile Write Cache	525
Atomic Write Unit Normal	527:526
Atomic Write Unit Power Fail	529:528
NVM Vendor Specific Command Configuration	530
Namespce Write Protection Capabilities	531
Atomic Compare&Write Unit	533:532
Reserved	535:534

SGL Support	539:536
Maximum Number of Allowed Namespaces	543:540
Reserved	767:544
NVMe Subsystem NVMe Qualified Name	1023:768
Reserved	1791:1024
Refer to NVMe over Fabrics	2047:1792
power state 0 descriptor	2079:2048
power state 1 descriptor	2111:2080
...	...
power state 31 descriptor	3071:3040
reserved	4095:3072

7. SMART attributes

Attribute ID(Hex)	Attribute Description
01	Critical Warning
02	Composite Temperature
03	Available Spare
04	Available Spare Threshold
05	Percentage Used
06	Data Units Read
07	Data Units Written
08	Host Read Commands
09	Host Write Commands
0A	Controller Busy Time
0B	Power Cycles
0C	Power On Hours
0D	Unsafe Shutdowns
0E	Media and Data Integrity Errors
0F	Number of Error Information Log Entries
10	Warning Composite Temperature Time
11	Critical Composite Temperature Time

8. Ordering Information

Part Number	Memory Type	Capacity	Operating Temperature
KMSP4M8256BY2S2C	TLC	256GB	0°C ~ +70°C
KMSP4M8512BY2S4C	TLC	512GB	0°C ~ +70°C
KMSP4M81T0BY2D4C	TLC	1TB	0°C ~ +70°C
KMSP4M82T0BY2Q4C	TLC	2TB	0°C ~ +70°C
KMSP4M8256BY2S2W	TLC	256GB	-20°C ~ +70°C
KMSP4M8512BY2S4W	TLC	512GB	-20°C ~ +70°C
KMSP4M81T0BY2D4W	TLC	1TB	-20°C ~ +70°C
KMSP4M82T0BY2Q4W	TLC	2TB	-20°C ~ +70°C

9. General

Term	Description
AHCI*	Advanced Host Controller Interface
APM	Advanced Power Management
ATA	Advanced Technology Attachment
ATAPI	Advanced Technology Attachment Packet Interface
BER	Bit error rate, or percentage of bits that have errors relative to the total number of bits received
BIOS	Basic Input/Output System
CRC	Cyclic Redundancy Check
Chipset	A term used to define a collection of integrated components required to make a PC function.
DAS	Device Activity Signal
Device Initiated Link Power Management (DIPM)	The ability of the device to request SATA link power state changes.
DevSleep	Device Sleep
DIPM	Device Initiated Power Management (SATA hard disk drive).
DMA	Direct Memory Access
DPTF	Dynamic Platform Thermal Framework
DRAM	Dynamic Random Access Memory
eDrive	Microsoft* specification for a drive that complies to the TCG Opal 2.0 and IEEE1667* standards.
ECC	Error Correction Code
EEPROM	Electrically Erasable Programmable Read Only Memory
EXT	Extended
FPDMA	First Party Direct Memory Access.
FP	First Part
GB	Giga-byte defined as 1×10^9 bytes or 1,000,000,000 bytes. The total usable capacity of the SSD may be less than the total physical capacity of the SSD. This is due to the fact that a small portion of the SSD capacity is used for NAND Flash management and maintenance purposes.
Gb	Gigabit
HCI	Host Controller Interface
HCT	Hardware Compatibility Test
HDD	Hard Disk Drive
HET	High Endurance Technology

HIPM	Host Initiated Power Management
Host Initiated Link Power Management	The ability of the host to request SATAlink power state changes
Hot Plug	A term used to describe the removal or insertion of a SATAhard drive when the system is powered on
IDEMA	International Disk Drive Equipment and Materials Association
IMSM	Intel Matrix Storage Manager.
I/O	Input /Output
IOMeter	I/O Subsystem Measurement Tool
IOPS	Input/output Operations Per Second
ISO	International Standards Organization
KB	Kilobyte(1024bytes)
LBA	Logical Block Address.
Locking SP	Locking Security Provider
LPM	Link Power Management.The ability of the SATA link layer to enter one of two lower power consuming states,partial and slumber
MB	Mega-bytes defined as 1×10^6 bytes or 1,000,000 bytes.
MLC	Multi-level Cell
MP	Multi-Processor
MTBF	Mean time between failures.
Native Command Queuing (NCQ)	The ability of the SATA hard drive to re-order commands in order to maximize the efficiency of gathering data from the platters
NOP	No Operation
NVMe	Non-Volatile Memory Express
NTFS	NT File System
OEM	Original Equipment Manufacturer
Opal	A Trusted Computing Group(TCG)standard that defines an interface for managing a Self-Encrypting Drive (SED)
OS	Operating System
PB	Petabyte
PCB	Printed Circuit Board
PIO	Programmed Input /Output
Port	The point at which a SATA drive physically connects to the SATA controller
PSID	Physical Security ID,public drive-unique value
RAID	Redundant Array of Independent Disks
RDT	Reliability Demonstration Test
RMS	Root Mean Squared
RPM	Revolutions Per Minute
RTM	Release To Manufacture
SATA	Serial Advanced Technology Attachment.
SED	Self-Encrypting Drive

SFF	Small Form Factor
SLC	Single-level Cell
S.M.A.R.T.	Self-Monitoring, Analysis and Reporting Technology: an open standard for developing hard drives and software systems that automatically monitors a hard drive's health and reports potential problems.
SSD	Solid State Drive
TB	Terabyte
TYP	Typical
TBD	To Be Determined
TCG	Trusted Computing Group
UBER	Uncorrectable Bit Error Rate
VCCI	Voluntary Control Council for Interface
VPD	Vital Product Data
WHQL	Microsoft*windows Hardware Quality Labs
Write Cache	A memory device within a hard drive, which is allocated for the temporary storage of data before that data is copied to its permanent storage location.

For More Information

For Technical Support:

If additional support is needed, please visit the SOSAM website at <https://kumi-sosam.com/>

for the following topics:

- **Warranty Services:** Includes the warranty service policy and the RMA requestforms.
- **Technical Information:** Includes product data sheets and various storage product white papers.
- **Tools Section:** Includes frequently asked questions (FAQs).