

PCIe M.2 NVMe Quasi-Industrial SSD Datasheet

Product interface

M.2 2280

capacity

128GB/256GB/512GB/1TB/2TB

function

1 MB sequential read speed: up to 3600MB/s (maximum typical value)

1 MB sequential write speed: up to 3200MB/s (maximum typical value)

4 K random read: up to 550K I/O operations per second (maximum typical value)

4 K random write: Maximum 430K I/O operations (maximum typical value)

power dissipation

operating power consumption: 3.6W (maximum typical value)

Static power consumption: 0.85W (maximum typical value)

temperature

working range: -20℃ to +70℃

storage: -40℃ to +85℃

Dimension specifications (length*width,height/mm)

M.2 2280mm：

(80±0.15)mm×(22±0.15)mm，2.15(MAX)mm

reliability

Mean Time Between Failures (MTBF): 2.0 million hours

Interface specifications and protocols

supports the NVMe 1.4 specification standard

supports PCIe 3.0x4

Adaptive PCIe2.0/1.0 x1, x2, x4

supports S.M.A.R.T features.

supports hot swapping

supports TRIM commands

vibration compatibility

Non-working mode:3.13 Grms (5Hz ~800Hz)

Shock resistance

Non-working: 1500G,0.5ms, 3axis

compatibility

supports Windows 7/8.1/10

supports mainstream Linux operating systems

supports Kylin/UOS/Zhongke Fangde/Tianmai/Yihui/Ruihua and other operating systems.

Domestic operating system

Company Statement

This specification shall be subject to all YOTTAWIN handbooks or terms of use provided or made available to the customer. This specification is subject to change and/or being updated without notice.

The customer assumes sole and exclusive responsibility for compliance with safety, environmental, export, trade, and other applicable laws and regulations with respect to this specification. in addition, The customer shall assume sole and exclusive responsibility for any embedded or other use of the devices described in this specification in nuclear or ultra-hazardous applications, as well as in applications that could cause property damage, bodily injury, or death. All specifications are subject to change without notice .

Safety Instructions for Use

For the safety of users, please read and follow all instructions, warning signs, precautions, and notes in this manual before using and operating the equipment.

- Carefully read these safety instructions;
- Save this manual for long-term reference;
- Read the chapter detailing the operating environment of this device;

To prevent damage to the equipment caused by over voltage, over current, etc. during operation:

- Ensure the use of voltage and power settings;
- Ensure the correctness of the interface signal access level;

Do not attempt to repair the equipment.

In the following cases, the equipment must be repaired by authorized personnel:

- The equipment is immersed in liquid;
- Being dropped, physically damaged or otherwise impaired;
- There is obvious damage.

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1 Brief Introduction

M.2 2280 NVME solid-state drives are engineered with high-performance NAND flash memory and robust firmware architecture, delivering high storage capacities, rapid system boot, silent operation, and low-latency random access. Designed for harsh and mission-critical environments, these SSDs provide exceptional durability, including width temperature operation and advanced shock and vibration resistance.

-Supports PCIe 3.0×4, with backward compatibility for PCIe 2.0×4 and PCIe 1.0×4;

-Supports NVMe 1.4 protocol with backward compatibility for NVMe 1.3;

-Supports LDPC error correction algorithms;

-Supports soft shutdown;

-Supports wear leveling to extend the lifespan of flash memory media;

-Standard M.2 weight ≤20 grams, specific dimensions(80±0.15)×(22±0.15),2.15(MAX)mm;

2 Size Of Product

2.1 capacity

Table1 Capacity Correspondence

Physical Capacity	128GB	256GB	512GB	1TB	2TB
Available Capacity	119.24GB	238.47GB	476.94GB	953.87GB	1907.73GB

Note：

1. Due to the need to allocate part of the capacity for flash memory management and maintenance, the available capacity of SSDs will be smaller than their nominal capacity.

2.2 Performance

Table2 Maximum Read and Write Performance

parameter	128GB	256GB	512GB	1TB	2TB	unit
Maximum sequential read performance of 1MB	1225	2400	3450	3600	3600	MB/s
Maximum sequential write performance of 1MB	1055	2100	3180	3200	3200	MB/s
Maximum random read performance of 4KB	183	350	540	540	550	KIOPS
Up to 4KB maximum random write performance	200	359	420	430	430	KIOPS

Note：

1. Performance data may deviate slightly due to differences in test tools and test environments..

2.4KB =4096Bytes。

3.Sequential read/write testing was conducted on Linux systems using FIO3.27 with a block size of 1MB and queue depth of 1024.

4.Random performance testing was conducted on an empty SSD using FIO3.27 in a Linux system with a block size of 4KB and queue depth of 1024.

Table3 IO response latency

Parameter	128GB	256GB	512GB	1TB	2TB	unit
4KB Read Latency(max)			78（Type）			us
4KB Write Latency(max)			13（Type）			us

Note：

1. The above latency measurements were obtained using sequential 4KB (4,096 bytes) IO operations with IOMeter configured at queue depth 1 and SSD write cache enabled. Variations in latency data may occur due to differences in testing tools and environments.

2.3 electrical character

Table4 Operating Voltage

Item	Range
Supply Voltage	3.3V±5%

Table5 Power Consumption

parameter	128GB	256GB	512GB	1TB	2TB	unit
Power consumption during write operation	1.74	2.03	2.62	3.51	3.60	W
idle power consumption	0.65	0.66	0.66	0.77	0.85	W

Note：

1. The operating power consumption is measured under the following conditions: 1 MB (1,048,576 bytes) IO operations, a queue depth of 1024, sequential write operations on an empty SSD, and the maximum average power consumption is collected from an external independent power supply during read operations..

2.4 ambient condition

Table6 Temperature

environmental parameter	Value	unit	Note
working temperature	-20 ~ +70	℃	
Storage temperature	-40 ~ +85	℃	

Working humidity	5 ~ 95	%
Storage humidity	95 (non-coagulable)	%

2.5 reliability

Table7 Reliability Specifications

Reliability parameter		Value	condition
UBER (Uncorrectable Bit Error Rate)	M.2	$1e^{-16}$	
MTBF (Mean Time Between Failures)		2.0 million hours	

Note：

1. Refer to Table 1 in the JESD218 specification for UBER, FFR, and Workload values.

2.6 Endurance

Table8 Endurance specifications

Endurance parameters	128GB	256GB	512GB	1TB	2TB	unit
TBW	128	256	512	1,024	2,048	TB
DWPD	1.0	1.0	1.0	1.0	1.0	times
Warranty period	3	3	3	3	3	Year

Note：

1. The total write volume (TBW) and warranty period are determined by whichever comes first.

2. TBW: Terabytes Written (Terabytes Written), the total amount of data written. (Refer to JESD219A specification for TBW write amplification testing value set at 3.5)

3 Mechanical information

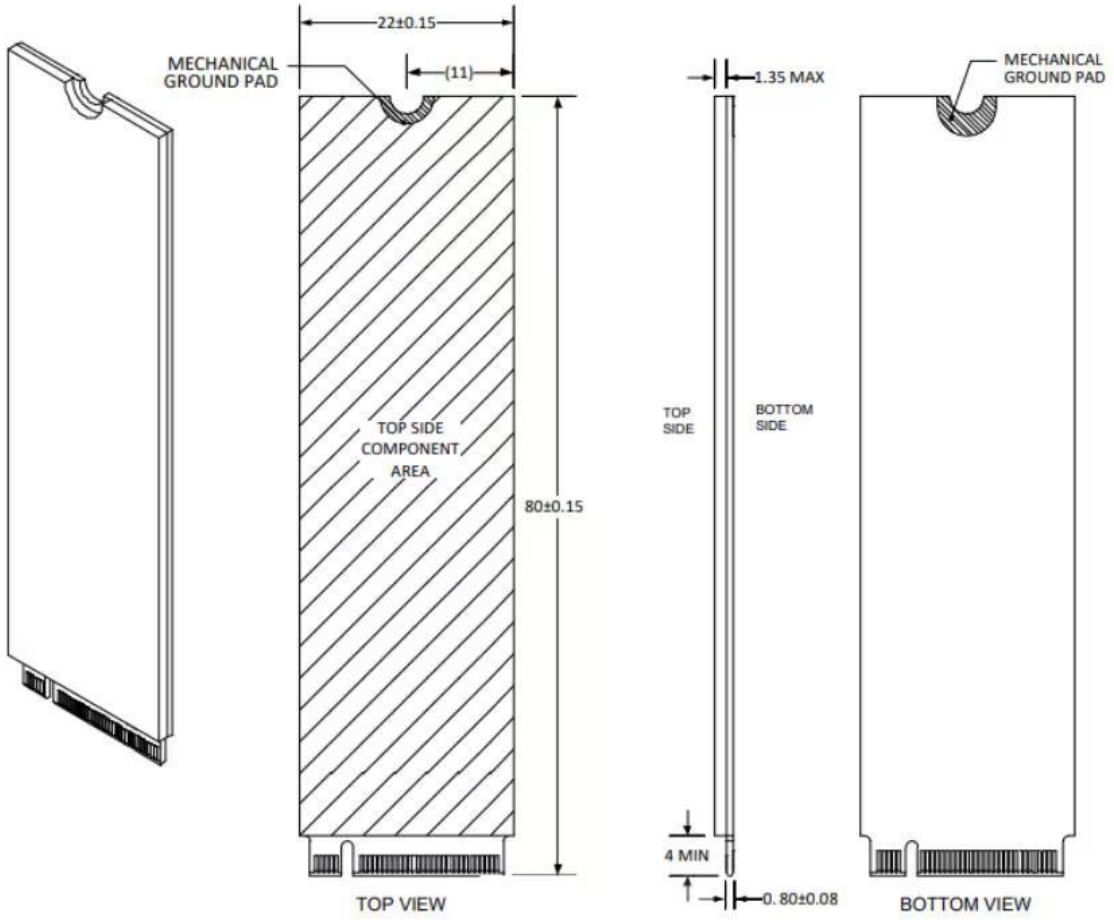

Figure 1 M.2" View (unit: mm)

Table9 Dimension Specifications

Item	Length (mm)	width (mm)	Thickness (mm)
M.2	80 ± 0.15	22 ± 0.15	2.15(MAX)

4 Pin and Signal Description

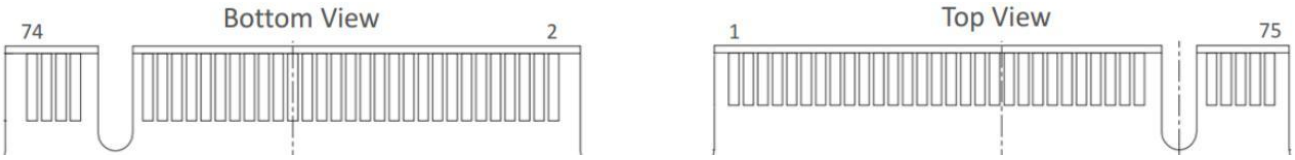

Figure 2Pin distribution of M.2 2280 SSD

Table10 Signal Definition for M.2 Interface SSD control board

M.2 NVMe Pin			
PIN#	Description	PIN#	Description
74	3.3V	75	GND
72	3.3V	73	GND
70	3.3V	71	GND
68	N/C	69	N/C
66	M key	67	Destroy#trigger
64		65	M key
62		63	
60		61	
58	N/C	59	
56	N/C	57	GND
54	N/C	55	REFCLKP
52	CLKREQ#	53	REFCLKN
50	PERST#	51	GND
48	N/C	49	PERp0
46	N/C	47	PERn0
44	N/C	45	GND
42	N/C	43	PETp0
40	N/C	41	PETn0
38	N/C	39	GND
36	Destroy_LED#	37	PERp1
34	N/C	35	PERn1
32	N/C	33	GND
30	N/C	31	PETp1
28	N/C	29	PETn1
26	N/C	27	GND
24	N/C	25	PERp2
22	N/C	23	PERn2
20	N/C	21	GND
18	3.3V	19	PETp2
16	3.3V	17	PETn2

14	3.3V	15	GND
12	3.3V	13	PERp3
10	LED#/DAS/DSS#	11	PERn3
8	N/C	9	GND
6	N/C	7	PETp3
4	3.3V	5	PETn3
2	3.3V	3	GND
		1	GND

5 Product Principle Flowchart

The internal schematic diagram of the SSD product is shown in the following figure, consisting of a power management unit, NVMe controller, FLASH storage unit, and cache.

The main function of the product is to manage data storage and reading. The main controller of the electronic disk interacts with the host port through the M.2 interface, parses the valid data through the NVMe protocol, verifies the link, and distributes it to the flash memory chip array for storage management.

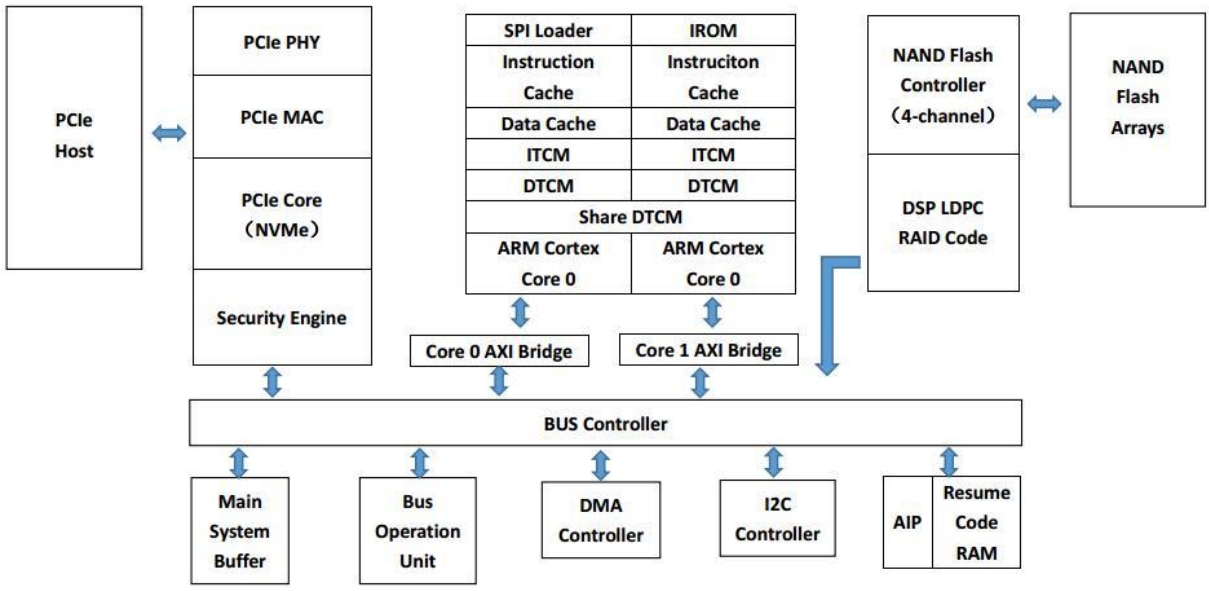

Figure 3 Block diagram of SSD control board product principle

6 Command and Command Set

The management commands and I/O commands supported in the NVMe 1.4 protocol are listed in the table below.

Table11 Supported NVMe 1.4 Command List

Command level	Command Name
Admin Command set	Create I/O Submission Queue
	Delete I/O Submission Queue
	Create I/O Completion Queue
	Delete I/O Completion Queue
	Identify
	Set Feature
	Get Feature
	Get Log Page
	Firmware Image Download
	Firmware Commit
	Abort
	Asynchronous Event Request
	Format NVM
	Device Self-test
	Sanitize
I/OCommand Set	Flush
	Write
	Read
	Write Uncorrectable
	Dataset Management

7 Model

Table12 Product Model Table

Product form	model	capacity	remarks
M.2 2280	HEPEM8128G3B-NFT3W	128GB	/
	HEPEM8256G3B-NFT3W	256GB	
	HEPEM8512G3B-NFT3W	512GB	
	HEPEM8001T3B-NFT3W	1TB	
	HEPEM8002T3B-NFT3W	2TB	

8 Install

8.1 power supply mode

The operating voltage of the electronic board is DC (3.3±0.165) V.

8.2 Unboxing inspection and precautions

a) Before opening the box, inspect whether the product packaging is intact and check for any signs of compression or damage.

b) After implementing static electricity protection measures, the anti-static bag may be opened to remove the product. Upon removal, visually inspect the product's appearance to ensure it remains intact.

8.3 Installation and Preparation

a) After implementing electrostatic protection measures, remove the product from the electrostatic protective bag.

b) Check if the environment is functioning properly;

c) Check whether the signal and power connectors are functioning properly.

9 Maintenance and Care

Maintenance and servicing of the SSD control board shall be conducted every two years, and the SSD must be powered off during maintenance. Maintenance contents include:

a) Inspect for physical integrity; wipe the connector with alcohol.

b) Check for any looseness in connectors and fasteners. If loosening is detected, reinforce them promptly.

10 Precautions and Requirements

10.1 transport

a) Packaged products can be transported by conventional means of transportation. During transportation, appropriate measures should be taken to protect against rain and snow.

b) Concomitant transportation with corrosive substances such as acids and alkalis is prohibited;

c) Do not stack heavy objects on top of products;

d) Handle with care during transportation.

10.2 keep in storage

The product is recommended to be stored in a dedicated warehouse with a temperature range of 0°C to 35°C, relative humidity not exceeding 80%, and free from strong magnetic fields. The product must not be stored together with acids, alkalis, or corrosive substances.