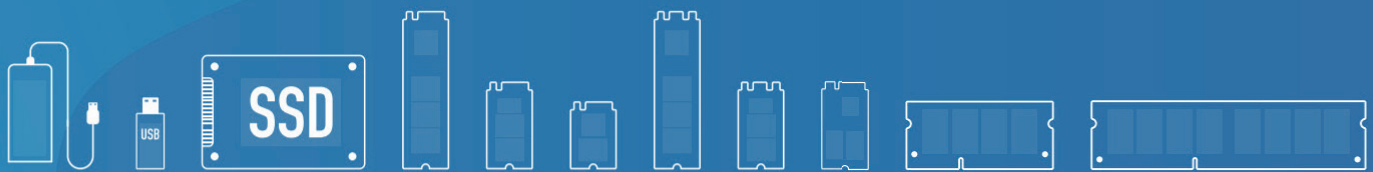


M.2 NVMe 2230 SSD Datasheet



- PCIe Gen 3x4
- NVMe 1.4 register interface and command set
- Support different power states and thermal throttling
- Modern Standby supported

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Revision History

Version	Date	Description
1.0	2022.12	Initial release

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Although considered final, these specifications are subject to change, as further product development and data characterization some-times occur. The results obtained in other operating environments may vary

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1. Introduction

1.1 Overview

The AP425 series delivers compact storage and optimized performance for traditional and innovative small-form-factor and embedded platforms in 256GB and 512GB.

This AP425 NVMe SSD product electrically complies with the PCIe Gen3 standards and supports NVMe 1.4 protocol. In order to meet the high quality, the AP425 NVMe SSD utilizes 3D TLC NAND Flash Memory. Moreover, to ensure the data integrity, many advanced technologies are used such as dynamic bad block management, dynamic and static wear-leveling, and Low-Density Parity Check (LDPC). The AP425 NVMe SSD drastically outperforms conventional Hard Disk Drives. In addition, the AP425 Series could also enable the realization of high capacity and highly reliable SSDs on the market.

1.2 Product Information

Model Name	Capacity	Part Number
AP425	256GB	CE430T5D100-256
	512GB	CE430T5D100-512

1.3 Features

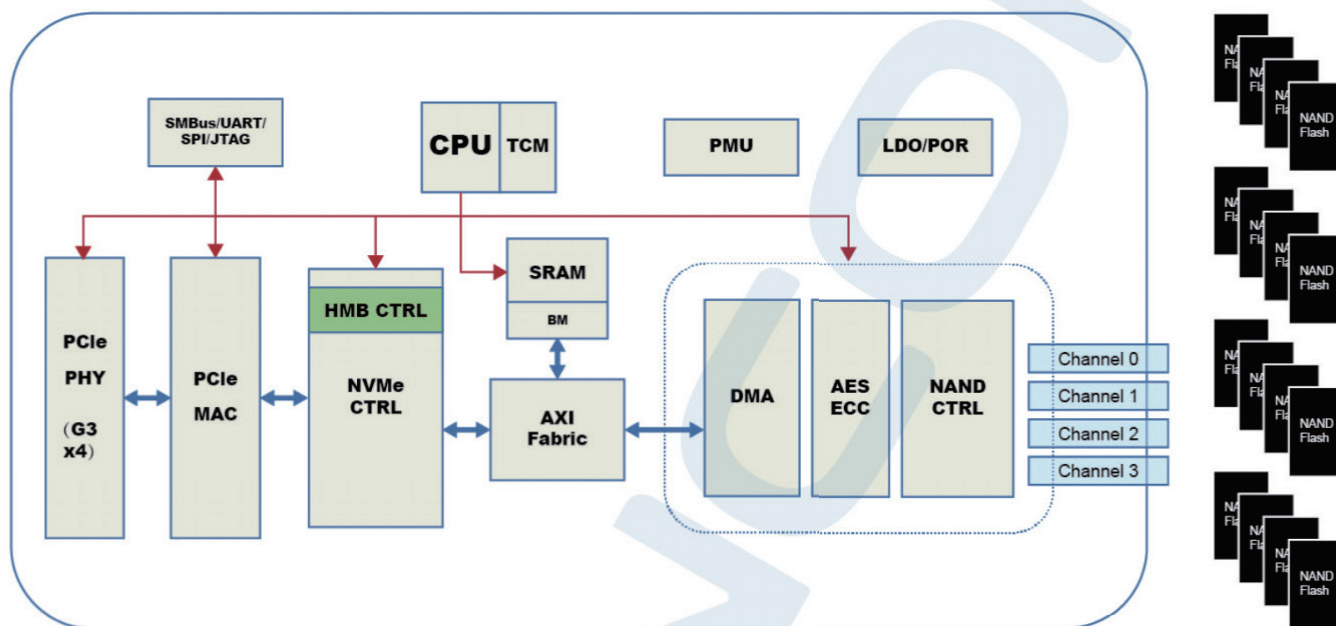
- High performance
- Low power consumption
- Increased system responsiveness
- High reliability
- Dynamic and static wear-leveling
- Garbage collection & TRIM
- Enhanced ruggedness
- High data integrity and security
- Modern Standby supported

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2. Architecture

The SYONCON SSD AP425 Series utilizes a cost-effective, high-performance PCIe-to-NAND controller to manage a full PCIe Gen 3(8 Gb/s) x 4 bandwidth with the host while managing multiple NAND flash memory devices on 4 channels.

Figure1. Block Diagram



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3. Product Specifications

This section provides details on the SYONCON SSD AP425 Series product specifications.

3.1 Capacity

Table 1. User Addressable Sectors

Unformatted Capacity	256GB	512GB
Total User Addressable Sectors in LBA Mode	500,118,192	1,000,215,216

Notes:

- 1 GB = 1,000,000,000 bytes; 1 sector = 512 bytes.
- LBA count shown represents total user storage capacity and will remain the same throughout the life of the drive. 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.

3.2 Performance

Table 2. Read/Write IOPS, Bandwidth, Latency

Performance ¹	256GB	512GB
Random Read/Write IOPS (Input/Output Operations per Second) ²		
4K Read (Up to)	196K	348K
4K Write (Up to)	288K	295K
Maximum Sustained Read and Write Bandwidth (CDM) ³		
Sequential Read (Up to)	3300 MB/s	3200 MB/s
Sequential Write (Up to)	1700 MB/s	2600 MB/s
Latency (AS SSD) ⁴		
Read	0.108 ms	0.107 ms
Write	0.110 ms	0.109 ms

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Notes:

1. Table is for reference only. Performance may vary based on SSD's firmware version, system hardware & configuration.
2. 4K Random Read/Write measured using CrystalDiskMark (CDM)V8.0.
3. Sequential Read/Write measured using CrystalDiskMark (CDM)V8.0.
4. Read/Write Latency measured using AS SSD Benchmark V2.0.

3.3 Test Equipment

Equipment	Item	Equipment	Item
CPU	Intel i7-11700K	Motherboard	PRIME Z590-P
Chipset	Intel Z590	Memory	HP16G 2666MHz 8G
Graphics Card	On Board VGA	OS SSD	BIWINTECH Phoenix SSD 512GB
Power Supply	HuntKey ATX-500W	OS Version	Windows 10 X64

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3.4 Electrical

Table 3. Operating Voltage and Power Consumption

Electrical Characteristics	256GB	512GB
Operating Voltage for 3.3V (+/- 5%)		
MIN	3.14V	
MAX	3.47V	
Power Consumption (Typical) ^{1,3}		
Active (Read)	1.30W	1.30W
Active (Write)	1.71W	1.99W
Idle ²	0.41W	0.28W
PS3 ⁴	19mW	14mW
PS4 ⁴	3.2mW	3.0mW

Notes:

1. Power Consumption measured using KEITHLEY 2280S.
2. Idle power measured using KEITHLEY 2280S.
3. A table for reference only. Power consumption may differ according to platform And test way.
4. Modern Standby supported

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3.5 Environmental Conditions

Table 4. Temperature, Shock, Vibration

Parameter	Value
Ambient Temperature	
Operating	0 to 70 °C
Non-Operating	-40 to 85 °C
Humidity, Shock, Vibration	
Humidity	20-95% R.H.
Shock ¹	1500G/0.5ms.
Vibration ²	6.0667 GRMS (20-2000Hz)

Notes:

1. Under condition that SSD is mounted securely with the input shock, measured using FSY-50.
2. Under condition that SSD is mounted securely with the input vibration, measured using FT-100.

3.6 Reliability

Table 5. Reliability Specifications

Parameter	Value
Uncorrectable Bit Error Rate (UBER)	1 sector in 10 ⁻¹⁶ bits read, max
Mean Time Between Failure (MTBF)	1,500,000 hours

Table 6. TBW and Warranty

Item		256GB	512GB
Warranty	TBW	94TB	188TB
	Period	3 years	

Note: *Total bytes written=[(Flash P/E cycle)x(number of bits in drive)] / WAF

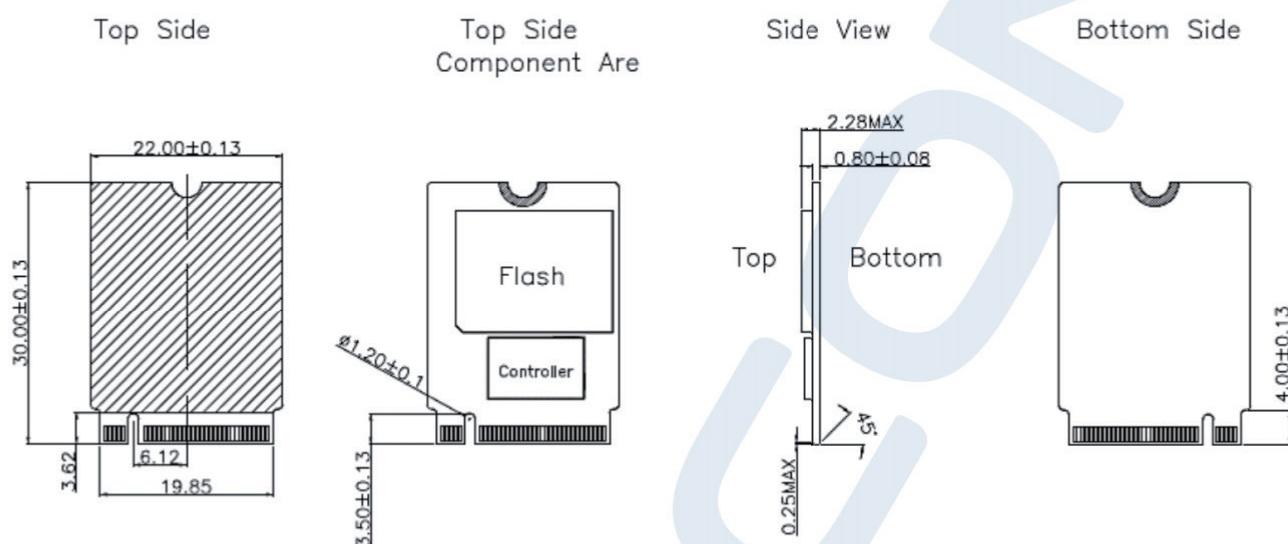
WAF=4

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4. Mechanical Information

Figure 2 shows the physical dimension of the SYONCON SSD AP425 Series. All dimensions are in millimeters.

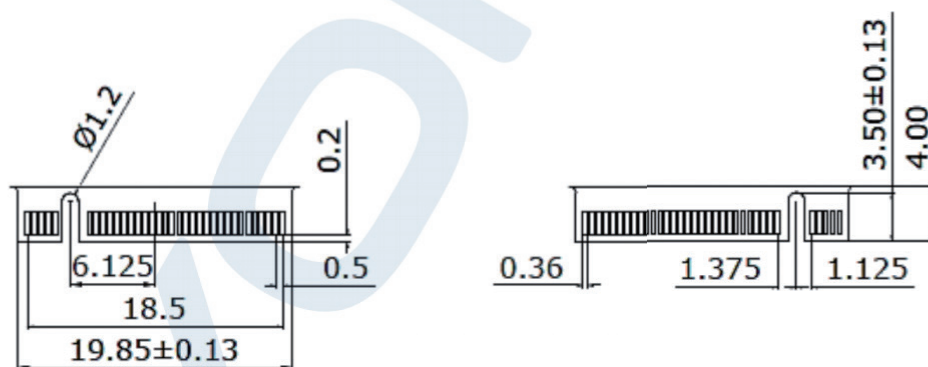
Figure 2. SYONCON SSD AP425 Dimensions



5. Pin and Signal Descriptions

5.1 Pin Locations

5.1 Pin Locations



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5.2 Signal Descriptions

Table 7. Connector Pin Signal Definitions

Pin#	Assignment	Description
1	GND	Ground
2	3.3V	3.3V power
3	GND	Ground
4	3.3V	3.3V power
5	PETn3	Transmitter differential pair, Lane 3
6	NC	No connect
7	PETp3	Transmitter differential pair, Lane 3
8	NC	No connect
9	GND	Ground
10	LED1#	Shows IO activity
11	PERn3	Receiver differential pair, lane3
12	3.3V	3.3V power
13	PERp3	Receiver differential pair, lane3
14	3.3V	3.3V power
15	GND	Ground
16	3.3V	3.3V power
17	PETn2	Transmitter differential pair,Lane 2
18	3.3V	3.3V power
19	PETp2	Transmitter differential pair,Lane 2
20	NC	No connect

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Pin#	Assignment	Description
21	GND	Ground
22	NC	No connect
23	PERn2	Receiver differential pair, lane2
24	NC	No connect
25	PERp2	Receiver differential pair, Lane2
26	NC	No connect
27	GND	Ground
28	NC	No connect
29	PETn1	Transmitter differential pair, Lane 1
30	NC	No connect
31	PETp1	Transmitter differential pair, Lane 1
32	NC	No connect
33	GND	Ground
34	NC	No connect
35	PERn1	Receiver differential pair, Lane1
36	NC	No connect
37	PERp1	Receiver differential pair, Lane1
38	DEVSLP	Device sleep (Not used)
39	GND	Ground
40	SMB_CLK	SMBus (System Management Bus) clock
41	PETn0	Transmitter differential signals ,lane0

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Pin#	Assignment	Description
42	SMB_DATA	SMBus (System ManagementBus) data
43	PETp0	Transmitter differential signals, lane0
44	ALERT#	Alert (Not used)
45	GND	Ground
46	NC	No connect
47	PERn0	Receiver differential pair, Lane0
48	NC	No connect
49	PERp0	Receiver differential pair, Lane0
50	PERST#	Fundamental reset
51	GND	Ground
52	CLKREQ#	Clock Request (Not used)
53	REFCLKn	Reference Clock port n
54	PEWAKE#	Signal for Link reactivation
55	REFCLKp	Reference Clock port p
56	MFG_DATA	Manufacturing Data line
57	GND	Ground
58	MFG_CLOCK	Manufacturing Clock line
59	Module Key	Module Key
60	Module Key	Module Key
61	Module Key	Module Key
62	Module Key	Module Key
63	Module Key	Module Key

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Pin#	Assignment	Description
64	Module Key	Module Key
65	Module Key	Module Key
66	Module Key	Module Key
67	NC	No connect
68	SUSCLK	Suspension 32.768 kHzclock (Not used)
69	PEDET	PE detect (Not used)
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. Supported Command Sets

The SYONCON SSD AP425 Series supports NVME commands described in this section.

6.1 Admin Command Set

The SYONCON SSD AP425 Series supports the Admin commands, which consists of:

- Delete I/O Submission Queue
- Create I/O Submission Queue
- Get Log Page
- Delete I/O Completion Queue
- Create I/O Completion Queue
- Identify
- Abort
- Set Features
- Get Features
- Asynchronous Event Request
- Namespace Management
- Firmware Commit

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- Firmware Image Download
- Device Self-test
- Format NVM
- Security Send
- Security Receive
- Sanitize

6.2 IO Command

The SYONCON SSD AP425 Series supports the IO command, which consists of:

- Flush
- Write
- Read
- Write Uncorrectable
- Compare
- Write Zeroes
- Dataset Management

6.3 Get Log Page Command

The SYONCON SSD AP425 Series supports the Get Log Page command, which consists of:

- Error Information
- SMART/Health Information
- Firmware Slot Information
- Command Effects Log
- Device Self-test
- Telemetry Host-Initiated
- Telemetry Controller-Initiated
- Persist Log
- Sanitize Status

6.3 Get Log Page Command

The SYONCON SSD AP425 Series supports the Get/Set Feature command, which consists of:

- Arbitration
- Power Management
- LBA Range Type
- Temperature Threshold
- Error Recovery
- Volatile Write Cache
- Number of Queues
- Interrupt Coalescing
- Interrupt Vector Configuration

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- Write Atomicity Normal
- Asynchronous Event Configuration
- Autonomous Power State Transition
- Host Memory Buffer
- Timestamp
- Host Controlled Thermal Management
- Non-Operational Power State Config
- Software Progress Marker

7. Certifications and Declarations

Certification	Description
CE Compliant	Indicates conformity with the essential health and safety requirements set out in European Directives Low Voltage Directive and EMC Directive.
RoHS Compliant	Restriction of Hazardous Substance Directive.

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