AS422
Product Specification

- Support SATA interface rate of 6 Gb/s
- Ultra high-performance and low power consumption
- Support dynamic power management and SMART
- TRIM command supported

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Revision History

Version	Date	Description
1.0	Nov 2021	Initial release
2.0	Dec 2021	Add 1 TB Capacity

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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

This AS422 Series SSD (solid state Drive) of BIWIN fully consists of semiconductor devices using NAND Flash Memory which provide high reliability and high performance for a storage media. It embedded platforms in four capacity sizes: 128G, 256GB，512GB and 1TB

This AS422 Series SSD product electrically complies with the SATA-III standards and is electrically compatible with a serial ATA disk drive. In order to meet the high quality, AS422 SSD utilizes high performance SATA-III SSD controller and 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 error correction code (ECC).

1.2 Product Information

Model Name	Part Number	Capacity
AS422	CMA59V51M00-128	128GB
	CMA59V51M00-256	256GB
	CMA59V51M00-512	512GB
	CMA59V51M00-1TB	1TB

Controller	Flash	Capacity	Firmware
SM2259XT2	1 EA K9B1TD8J1A	128GB	U1122A0
	2 EA K9B1TD8J1A	256GB	
	2 EA K9C2TD8J5A	512GB	
	4 EA K9C2TD8J5A	1TB	

1.3 Features

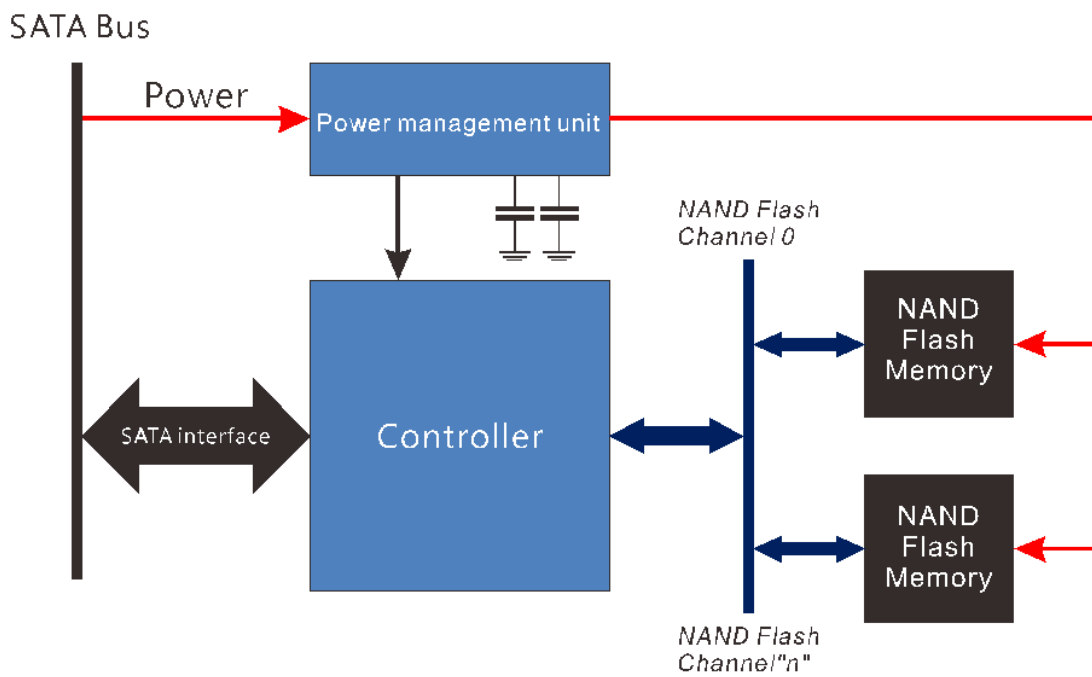- High performance
- Increased system responsiveness
- High reliability
- Small form-factor
- Minimum weight
- Enhanced ruggedness

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2. Architecture

The BIWIN SSD AS422 SSD Series utilizes a cost-effective, high-performance BIWIN SATA-to-NAND controller to manage a full SATA 6 Gb/s bandwidth with the host while managing multiple NAND flash memory devices on 2 channels.

Figure 1. Block Diagram

3. Product Specifications

This section provides details on the BIWIN SSD AS422 Series product specifications.

3.1 Capacity

Table 1. User Addressable Sectors

Unformatted Capacity	128GB	256GB	512GB	1TB
Total User Addressable Sectors in LBA Mode	250,069,680	500,118,192	1,000,215,216	2,000,409,264

Notes:

1. 1GB = 1,000,000,000 bytes; 1 sector = 512 bytes.

2. 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

issued for NAND flash management and maintenance purposes.

3.2 Performance

Table 2. Read/Write IOPS, Bandwidth, Latency

Performance	128GB	256GB	512GB	1TB
Random Read/Write IOPS (Input/Output Operations per Second)(CDM)[2]				
4K Read(Up to)	30K	55K	74K	70K
4K Write(Up to)	47K	75K	75K	72K
Maximum Sustained Read and Write Bandwidth（CDM）[2]				
Sequential Read (Up to)	470MB/s	544MB/s	548MB/s	546MB/s
Sequential Write (Up to)	209MB/s	407MB/s	496MB/s	485MB/s
Latency[3]				
Read	0.032ms	0.031ms	0.032ms	0.030ms
Write	0.199ms	0.190ms	0.149ms	0.147ms

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Notes:

1.   Performance may vary depending on SSD's firmware, system hardware & configuration and other factors.

2.   Performance measured using CDM tested with QD32 Thread.

3.   Device measured using AS SSD; Read/Write latency measured on sequential 4 K transfers with queue depth set to 32.

3.3 Test Equipment

Equipment	Item	Equipment	Item
CPU	Intel i9-10900K	Motherboard	ROG STRIX Z490-A
Chipset	Intel Z490	Memory	BIWIN DDR4 2666MHz 16G
Graphics Card	On Board VGA	OS SSD	BIWINTECH Phoenix SSD 512GB
Power Supply	HuntKey ATX-500W	OS Version	Windows 10 X64

Notes: Capacity of 128GB, 256GB and 512GB share the same test equipment.

3.4 Electrical

Table 3. Operating Voltage and Power Consumption

Electrical Characteristics	128GB	256GB	512GB	1TB
Operating Voltage for 3.3V (+/- 5%)				
Min	3.14V			
Max	3.47V			
Power Consumption (Typical)				
Active (Read)	0.66W	0.68W	0.68W	0.68W
Active (Write)	0.69W	0.85W	1.14W	1.55W
Idle	0.20W	0.20W	0.21W	0.21W

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Notes:

1.   Active power measured using KEITHLEY 2280S.

2.   Idle power measured using KEITHLEY 2280S.

3.5 Environmental Conditions

Table 4. Temperature, Shock, Vibration

Parameter	Value
Ambient Temperature	
Operating	0 to 70 ℃
Non-Operating	-40 to 85 ℃
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
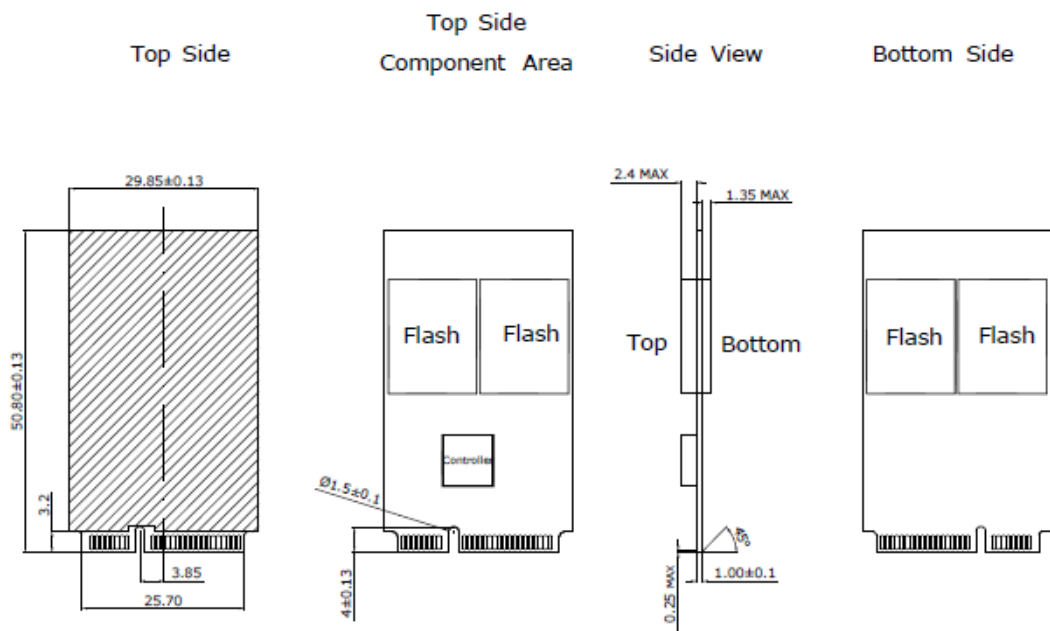
Item		128GB	256GB	512GB	1TB
Warranty	TBW	94TB	187TB	375TB	750TB
	Period	3 years			

Note: *Total bytes written= [(Flash P/E cycle)x(number of bits in drive)] / WAF   WAF=4.0

4. Mechanical Information

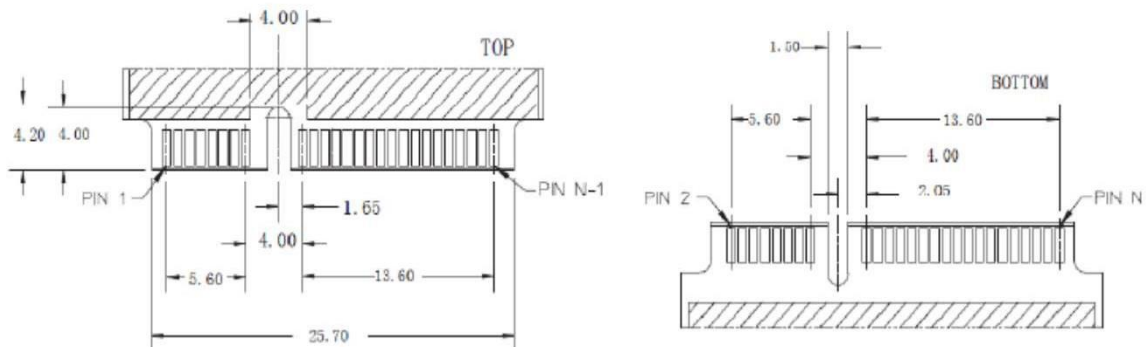Figure 2 shows the physical dimension of the BIWIN SSD AS422 Series. All dimensions are in millimeters.

Figure 2. BIWIN SSD AS422 Dimensions

5. Pin and Signal Descriptions

5.1 Pin Locations

Figure 5. Signal and Power Segment Pins

5.2 Signal Descriptions

Table 7. Connector Pin Signal Definitions

Pin#	Assignment	Description
1	N/A	N/A
2	+3.3V	3.3V source
3	N/A	N/A
4	GND	Return Current Path
5	N/A	N/A
6	N/A	N/A
7	N/A	N/A
8	N/A	N/A
9	GND	Return Current Path
10	N/A	N/A
11	N/A	N/A
12	N/A	N/A
13	N/A	N/A
14	N/A	N/A
15	GND	Return Current Path
16	N/A	N/A
17	N/A	N/A
18	GND	Return Current Path
19	Detection Pin	Connect to GND
20	N/A	N/A
21	GND	Return Current Path
22	N/A	N/A
23	+B(port1)	SATA differential TX+ based on SSD
24	+3.3V	3.3V source
25	-B(port1)	SATA differential TX- based on SSD
26	GND	Return Current Path
27	GND	Return Current Path

28	N/A	N/A
29	GND	Return Current Path
30	N/A	N/A
31	-A(port1)	SATA differential RX- based on SSD
32	N/A	N/A
33	+A(port1)	SATA differential RX+ based on SSD
34	GND	Return Current Path
35	GND	Return Current Path
36	Reserved	No Connect
37	GND	Return Current Path
38	Reserved	No Connect
39	+3.3V	3.3V source
40	N/A	N/A
41	+3.3V	3.3V source
42	N/A	N/A
43	GND	Return Current Path
44	N/A	N/A
45	Reserved	No Connect
46	N/A	N/A
47	N/A	N/A
48	N/A	N/A
49	N/A	N/A
50	GND	Return Current Path
51	GND	Return Current Path
52	+3.3V	3.3V source

6. Supported Command Sets

The BIWIN SSD AS422 Series supports ATA (Advanced Technology Attachment) commands described in this section.

6.1 ATA General Feature Command Set

The BIWIN SSD AS422 Series supports the ATA General Feature command set (non-PACKET), which consists of:

- EXECUTE DEVICE DIAGNOSTIC
- FLUSH CACHE
- IDENTIFY DEVICE
- READ DMA
- READ SECTOR(S)
- READ VERIFY SECTOR(S)
- SEEK
- SET FEATURES
- WRITE DMA
- WRITE SECTOR(S)
- READ MULTIPLE
- SET MULTIPLE MODE
- WRITE MULTIPLE

The BIWIN SSD AS422 Series also supports the following optional commands:

- READ BUFFER
- WRITE BUFFER
- NOP
- DOWNLOAD MICROCODE

6.2 Power Management Command Set

The BIWIN SSD AS422 Series supports the Power Management command set, which consists of:

- CHECK POWER MODE
- IDLE
- IDLE IMMEDIATE
- STANDBY
- STANDBY IMMEDIATE

6.3 Security Mode Feature Set

The BIWIN SSD AS422 Series supports the Security Mode command set, which consists of:

- SECURITY SET PASSWORD
- SECURITY UNLOCK
- SECURITY ERASE PREPARE
- SECURITY ERASE UNIT
- SECURITY FREEZE LOCK

- SECURITY DISABLE PASSWORD

6.4 SMART Command Set

The BIWIN SSD AS422 Series supports the SMART command set, which consists of:

- SMART ENABLE OPERATIONS
- SMART DISABLE OPERATIONS
- SMART ENABLE/DISABLE AUTOSAVE
- SMART RETURN STATUS

The BIWIN SSD AS422 Series also supports the following optional commands:

- SMART EXECUTE OFF-LINE IMMEDIATE
- SMART READ DATA
- SMART READ LOG
- SMART WRITE LOG

6.5 Data Set Management Command Set

The BIWIN SSD AS422 Series supports the Data Set Management command set Trim attribute, which consists of:

- DATA SET MANAGEMENT EXT

6.6 Host Protected Area Command Set

The BIWIN SSD AS422 Series supports the Host Protected Area command set, which consists of:

- READ NATIVE MAX ADDRESS
- SET MAX ADDRESS
- READ NATIVE MAX ADDRESS EXT
- SET MAX ADDRESS EXT

The BIWIN SSD AS422 Series also supports the following optional commands:

- SET MAX SET PASSWORD
- SET MAX LOCK
- SET MAX FREEZE LOCK
- SET MAX UNLOCK

6.7 48-Bit Address Command Set

The BIWIN SSDAS422 Series supports the 48-bit Address command set, which consists of:

- FLUSH CACHE EXT
- READ DMA EXT
- READ NATIVE MAX ADDRESS EXT
- READ SECTOR(S) EXT
- READ VERIFY SECTOR(S) EXT
- SET MAX ADDRESS EXT
- WRITE DMA EXT

- WRITE MULTIPLE EXT
- WRITE SECTOR(S) EXT
- WRITE UNCORRECTABLE EXT

6.8 Device Configuration Overlay Command Set

The BIWIN SSD AS422 Series supports the Device Configuration Overlay command set, which consists of:

- DEVICE CONFIGURATION FREEZE LOCK
- DEVICE CONFIGURATION IDENTITY
- DEVICE CONFIGURATION RESTORE
- DEVICE CONFIGURATION SET

6.9 General Purpose Log Command Set

The BIWIN SSD AS422 Series supports the General-Purpose Log command set, which consists of:

- READ LOG EXT
- WRITE LOG EXT

6.10 Native Command Queuing

The BIWIN SSD AS422 Series supports the Native Command Queuing (NCQ) command set, which includes:

- READ FPDMA QUEUED
- WRITE FPDMA QUEUED

Note: With a maximum queue depth equal to 32.

6.11 Software Settings Preservation

The BIWIN SSD AS422 Series supports the SET FEATURES parameter to enable/disable the preservation of software settings.

6.12 Device Initiated Power Management (DIPM)

The BIWIN SSD AS422 Series supports the SET FEATURES parameter to enable Device Initiated Power Management.

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.

8. Product Picture

Model Name： AS422