

# **SATA 2.5" SSD (Small Plastic) Specification**

## Product Overview

- Capacities
  - 128GB, 256GB, 512GB
- Form Factor
  - 2.5" SSD
- SATA Interface
  - SATA Gen3
  - SATA Revision 3.2
- Flash Interface
  - Transfer rate up to 533MT/s
- Performance<sup>1</sup>
  - Read: up to 550 MB/s
  - Write: up to 500 MB/s
- Reliability
  - Mean Time Between Failure (MTBF)  
2,000,000 hours
- Advanced Flash Management
  - Dynamic Wear Leveling
  - Bad Block Management
  - TRIM
  - SMART
  - Over-Provision
  - Firmware Update
  - SmartZIP™
- Power Consumption<sup>2</sup>
  - Power supply of 2.5" SSD: 5V±5%
  - Active Mode (Typ.) < 2,120 mW
  - Idle < 365 mW
  - DEVSLP mode: < 5 mW
- Temperature Range
  - Operation: 0°C ~ 70°C
  - Storage: -40°C ~ 85°C
- RoHS-Compliant

# 1. Introduction

## 1.1 General Description

Axeme’s 2.5” SATA Solid State Disk (SSD) delivers all the advantages of flash disk technology with Serial ATA I/II/III interface, including being fully compliant with standard 2.5-inch form factor, providing low power consumption compared to traditional hard drive and hot-swapping when removing/replacing/upgrading flash disks. The device is designed based on the standard 7-pin interface for data segment and 15-pin for power segment, as well as operating at a maximum operating frequency of 200MHz with 30MHz external crystal. Moreover, it can reach up to 550MB/s read as well as 500MB/s write high performance measured by CrystalDiskMark v5.0).

Table1 – Device Order Summary

Part Number	Capacity	Operation	Storage
H6A4A11128G5AZ	128GB	0°C ~ 70°C	-40°C ~ 85°C
H6A4A11256G5AZ	256GB	0°C ~ 70°C	-40°C ~ 85°C
H6A4A11512G5AZ	512GB	0°C ~ 70°C	-40°C ~ 85°C

## 1.2 Controller Block Diagram

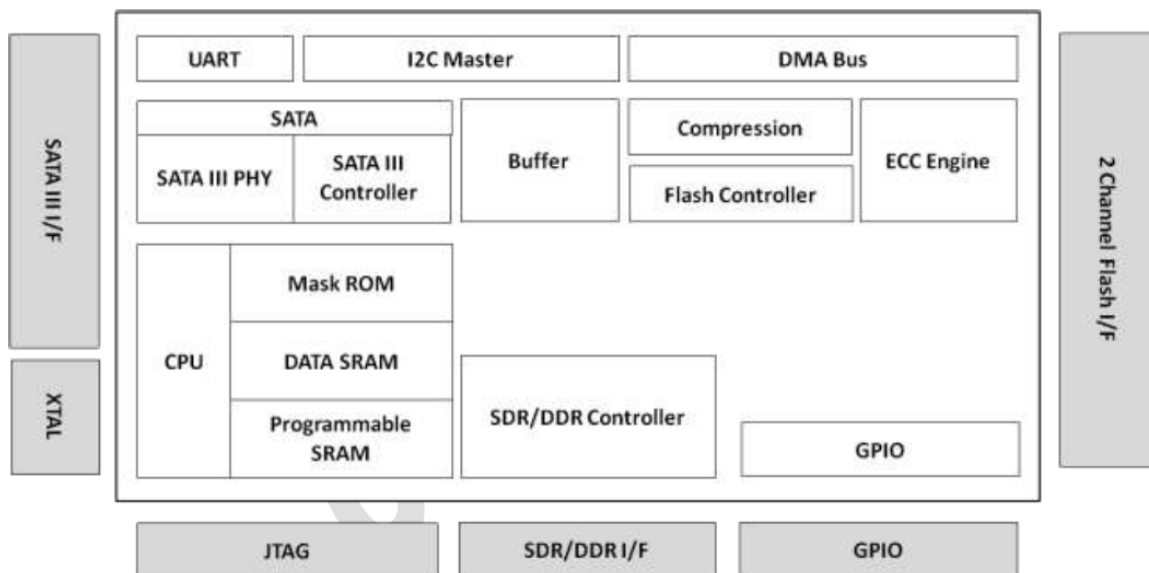


Figure 1-1 2.5” SATA SSD Controller Block Diagram

### 1.3 Product Block Diagram

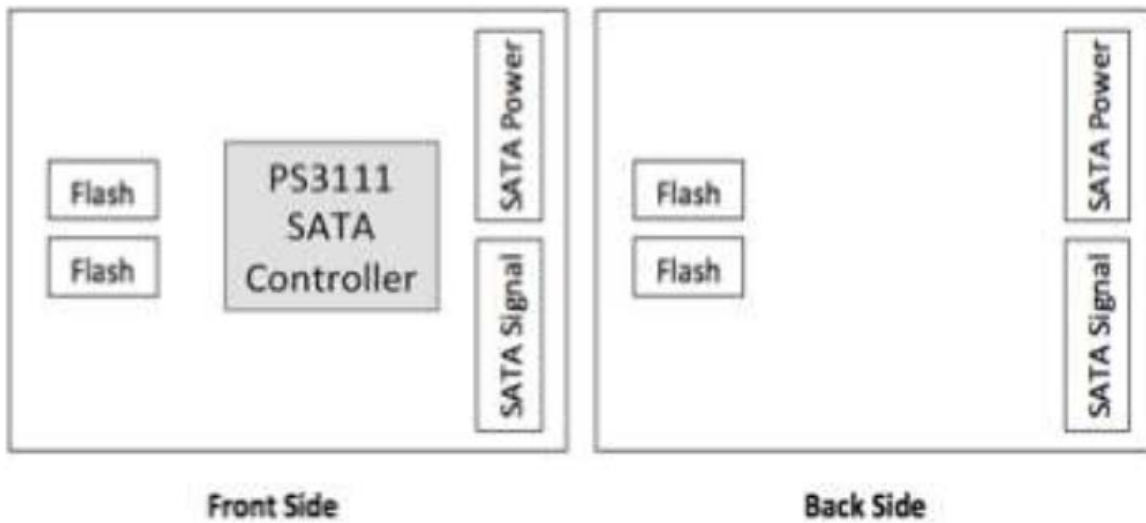


Figure 1-1 2.5" SATA SSD Product Block

### 1.4 Product Block Diagram

#### 1.4.1. Error Correction Code (ECC)

Flash memory cells will deteriorate with use, which might generate random bit errors in the stored data. Thus, 2.5" SATA SSD applies the LDPC (Low Density Parity Check) of ECC algorithm, which can detect and correct errors occur during read process, ensure data been read correctly, as well as protect data from corruption.

#### 1.4.2. Wear Leveling

NAND flash devices can only undergo a limited number of program/erase cycles, when flash media is not used evenly, some blocks get updated more frequently than others and the lifetime of device would be reduced significantly. Thus, wear leveling is applied to extend the lifespan of NAND flash by evenly distributing write and erase cycles across the media.

Axeme provides advanced wear leveling algorithm, which can efficiently spread out the flash usage through the whole flash media area. Moreover, by implementing both dynamic and static wear leveling algorithms, the life expectancy of the NAND flash is greatly improved.

#### 1.4.3. Bad Block Management

Bad blocks are blocks that do not function properly or contain more invalid bits causing stored data unstable, and their reliability is not guaranteed. Blocks that are identified and marked as bad by the manufacturer are referred to as "Early Bad Blocks". Bad blocks that are developed during the lifespan of the flash are named "Later Bad Blocks". Axeme implements an efficient bad block management algorithm to detect the factory produced bad blocks and manages bad blocks that appear with use. This practice prevents data being stored into bad blocks and further improves the data reliability.

#### 1.4.4. TRIM

TRIM is a feature which helps improve the read/write performance and speed of solid state drives (SSD). Unlike hard disk drives (HDD), SSDs are not able to overwrite existing data, so the available space gradually becomes smaller with each use. With the TRIM command, the operating system can inform the SSD so that blocks of data that are no longer in use can be removed permanently. Thus, the SSD will perform the erase action, which prevents unused data from occupying blocks at all time.

#### 1.4.5. SMART

SMART, an acronym for Self-Monitoring, Analysis and Reporting Technology, is an open standard that allows a solid state drive to automatically detect its health and report potential failures. When a failure is recorded by SMART, users can choose to replace the drive to prevent unexpected outage or data loss. Moreover, SMART can inform users impending failures while there is still time to perform proactive actions, such as save data to another device.

#### 1.4.6. Over-Provision

Over Provisioning refers to the preserving additional area beyond user capacity in a SSD, which is not visible to users and cannot be used by them. However, it allows a SSD controller to utilize additional space for better performance and WAF. With Over Provisioning, the performance and IOPS (Input/Output Operations per Second) are improved by providing the controller additional space to manage P/E cycles, which enhances the reliability and endurance as well. Moreover, the write amplification of the SSD becomes lower when the controller writes data to the flash.

#### 1.4.7. Firmware Upgrade

Firmware can be considered as a set of instructions on how the device communicates with the host. Firmware will be upgradable when new features are added, compatibility issues are fixed, or read/write performance gets improved.

## **1.5 Low Power Management**

#### 1.5.1. DEVSLP Mode (Optional)

With the increasing need of aggressive power/battery life, SATA interfaces include a new feature, Device Sleep (DEVSLP) mode, which helps further reduce the power consumption of the device. DEVSLP enables the device to completely power down the device PHY and other sub-systems, making the device reach a new level of lower power operation. The DEVSLP does not specify the exact power level a device can achieve in the DEVSLP mode, but the power usage can be dropped down to 5mW or less.

#### 1.5.2. DIPM/HIPM Mode

SATA interfaces contain two low power management states for power saving: Partial and Slumber modes. For Partial mode, the device has to resume to full operation within 10 microseconds, whereas the device will spend 10 milliseconds to become fully operational in the Slumber mode. SATA interfaces allow low power modes to be initiated by Host (HIPM, Host Initiated Power Management) or Device (DIPM, Device Initiated Power Management). As for HIPM, Partial or Slumber mode can be invoked directly by the software. For DIPM, the device will send requests to enter Partial or Slumber mode.

## **1.6 Power Loss Protection: Flushing Mechanism (Optional)**

Power Loss Protection is a mechanism to prevent data loss during unexpected power failure. DRAM is a volatile memory and frequently used as temporary cache or buffer between the controller and the NAND flash to improve the SSD performance. However, one major concern of the DRAM is that it is not able to keep data during power failure. Accordingly, the controller applies the GuaranteedFlush technology, which requests the controller to transfer data to the cache. For controller, SDR performs as a cache, and its size is 32MB. Only when the data is fully committed to the NAND flash will the controller send acknowledgement (ACK) to the host. Such implementation can prevent false-positive performance and the risk of power cycling issues.

Additionally, it is critical for a controller to shorten the time the in-flight data stays in the cache. Thus, Axeme's controller applies an algorithm to reduce the amount of data resides in the cache to provide a better performance. This SmartCacheFlush technology allows incoming data to only have a "pit stop" in the cache and then move to the NAND flash at once. If the flash is jammed due to particular file sizes (such as random 4KB data), the cache will be treated as an "organizer", consolidating incoming data into groups before written into the flash to improve write amplification.

In sum, with Flush Mechanism, controller proves to provide the reliability required by consumer, industrial, and enterprise-level applications.

## **1.7 Advanced Device Security Features**

### **1.7.1. Secure Erase**

Secure Erase is a standard ATA command and will write all "0xFF" to fully wipe all the data on hard drives and SSDs. When this command is issued, SSD controller will erase its storage blocks and return to its factory default settings.

### **1.7.2. Write Protect**

When a SSD contains too many bad blocks and data are continuously written in, then the SSD might not be usable anymore. Thus, Write Protect is a mechanism to prevent data from being written in and protect the accuracy of data that are already stored in the SSD.

## **1.8 SSD Lifetime Management**

### **1.8.1. Thermal Monitor (Optional)**

Thermal monitors are devices for measuring temperature, and can be found in SSDs in order to issue warnings when SSDs go beyond a certain temperature. The higher temperature the thermal monitor detects, the more power the SSD consumes, causing the SSD to get aging quickly. Hence, the processing speed of a SSD should be under control to prevent temperature from exceeding a certain range. Meanwhile, the SSD can achieve power savings.

## **1.9 Adaptive Approach to Performance Tuning**

### **1.9.1. Throughput**

Based on the available space of the disk, The controller will regulate the read/write speed and manage the performance of throughput. When there still remains a lot of space, the firmware will continuously perform read/write action. There is still no need to implement garbage collection to allocate and release memory, which will accelerate the read/write processing to improve the performance. Contrarily, when the space is going to be used up, the controller will slow down the read/write processing, and implement garbage collection to release memory. Hence, read/write performance will become slower.

### **1.9.2. Predict & Fetch**

Normally, when the host tries to read data from the SSD, the SSD will only perform one read action after receiving one command. However, the controller applies Predict & Fetch to improve the read speed. When the host issues sequential read commands to the SSD, the SSD will automatically expect that the following will also be read commands. Thus, before receiving the next command, flash has already prepared the data. Accordingly, this accelerates the data processing time, and the host does not need to wait so long to receive data.

### **1.9.3. SmartZIP™**

Write data to the NAND Flash costs time. To improve the write speed performance, the controller launches with compression technique—SmartZIP™.

Whether a file could be compressed or not depending on the file type, for file types have redundancy data pattern, through our embedded encode engine, we could reduce the amount of data that is actually written to the Flash. Comparing to the SSD without the compression, write efficiency is raised and the SSD endurance is also improved since Flash could be benefit from less data written for a longer SSD lifetime.

## 2. Product Specification

- Capacity
  - From 128GB up to 512GB
  - Support 48-bit addressing mode
- Electrical/Physical Interface
  - Compliant with SATA Revision 3.2
  - Compatible with SATA 1.5Gbps, 3Gbps and 6Gbps interface
  - Support power management
  - Support expanded register for SATA protocol 48 bits addressing mode
  - Embedded BIST function for SATA PHY for low cost mass production
- Supported NAND Flash
  - Support up to 16 Flash Chip Enables (CE) within single design
  - Support 8-bit I/O NAND Flash
  - Support Toggle 3.0 and ONFI 4.0 interface
- ECC Scheme
  - 2.5" SSD applies the LDPC (Low Density Parity Check) of ECC algorithm.
- UART/ GPIO
- Support SMART and TRIM commands
- LBA Range
  - IDEMA standard
- Performance

Capacity	Part Number	Sequential (CDM)		ATTO	
		Read (MB/s)	Write (MB/s)	Read (MB/s)	Write (MB/s)
128GB	H6A4A11128G5AZ	550	450	560	540
256GB	H6A4A11256G5AZ	550	490	560	540
512GB	H6A4A11512G5AZ	550	490	560	540

Note1 : Performance was estimated based on TLC NAND flash.

Note2 : Sequential R/W is measured while testing sequential R/W 5 times by CrystalDiskMark.



### 3. ENVIRONMENTAL SPECIFICATIONS

#### 3.1 Environmental Conditions

##### 3.1.1. Temperature and Humidity

Table 3-1 High Temperature

	Temperature	Humidity
Operation	70°C	0% RH
Storage	85°C	0% RH

Table 3-2 Low Temperature

	Temperature	Humidity
Operation	0°C	0% RH
Storage	-40°C	0% RH

Table 3-3 High Humidity

	Temperature	Humidity
Operation	40°C	90% RH
Storage	40°C	93% RH

Table 3-4 Temperature Cycling

	Temperature
Operation	0°C
	70°C <sup>1</sup>
Storage	-40°C
	85°C

Notes:

1. The operation temperature is measured by the case temperature, in which can be decided via the S.M.A.R.T. Airflow is suggested and it will allow device to be operated at appropriate temperature for each component during heavy workloads environment.

##### 3.1.2. Shock

Table 3-5 Shock

	Acceleration Force
Non-operational	1500G

##### 3.1.3. Vibration

Table 3-6 Vibration

	Condition	
	Frequency/Displacement	Frequency/Acceleration
Non-operational	20Hz~80Hz/1.52mm	80Hz~2000Hz/20G

### 3.1.4. Drop

Table 3-7 Drop

	Height of Drop	Number of Drop
Non-operational	80cm free fall	6 face of each unit

### 3.1.5. Bending

Table 3-8 Bending

	Force	Action
Non-operational	≥ 50N	Hold 1min/5times

### 3.1.6. Durability

Table 3-9 Durability

	Condition
operational	1000 mating cycles

### 3.1.7. Electrostatic Discharge (ESD)

Table 3-10 ESD

	+/- 4KV
Contact ESD	Device functions are affected, but EUT will be back to its normal or operational state automatically.

### 3.1.8. EMI Compliance

Table 3-11 EMI

Specification
FCC: CISPR22 ; CISPR32 CE: EN55022 ; EN55032 BSMI 13438

## 3.2 MTBF

MTBF, an acronym for Mean Time Between Failures, is a measure of a device's reliability. Its value represents the average time between a repair and the next failure. The measure is typically in units of hours. The higher the MTBF value, the higher the reliability of the device. The predicted result of 2.5" SATA SSD is more than 2,000,000 hours.

### 3.3 Certification & Compliance

Table 3-12 Certification &amp; Compliance

Specification
RoHS SATA III (SATA Rev. 3.2) Up to ATA/ATAPI-8 (Including S.M.A.R.T)

## 4. ENVIRONMENTAL SPECIFICATIONS

### 4.1 Supply Voltage

Table 4-1 Supply Voltage

Parameter	Rating
Operating Voltage	5V ± 5%

### 4.2 Power Consumption

Table 4-2 Power Consumption in mW

Capacity	Part Number	Power Consumption					
		Read (mW)	Write (mW)	Partial (mW)	Slumber (mW)	Idle (mW)	DEVSLP (mW)
128GB	H6A4A11128G5AZ	1600	1720	20	14	320	4.9
256GB	H6A4A11256G5AZ	1620	1750	19	15	320	4.9
512GB	H6A4A11512G5AZ	1900	2000	22	15	335	4.9

**NOTES:**

1. The average value of power consumption is achieved based on 100% conversion efficiency.
2. The measured power voltage is 5V.
3. Samples were measured under ambient temperature.
4. Sequential R/W is measured while testing sequential R/W 5 times by CrystalDiskMark.  
DEVSLP is measured while entering device sleep mode for 5 minutes.
5. Power Consumption may differ according to flash configuration and platform.

## 5. INTERFACE

### 5.1 Pin Assignment and Descriptions

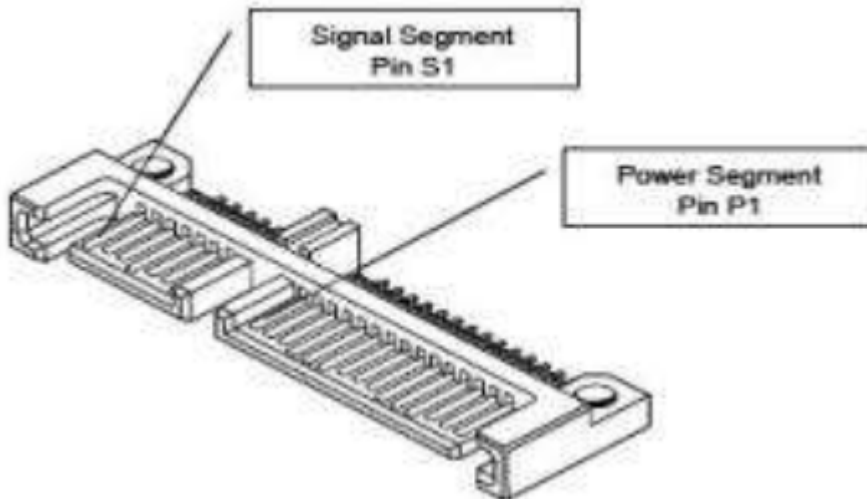


Figure 5-1 2.5" SATA SSD Pin Assignment

Table 5-1 Signal Segment Pin Assignment and Descriptions

Pin Number	Function
S1	GND
S2	A+ (Differential Signal Pair A)
S3	A – (Differential Signal Pair A)
S4	GND
S5	B – (Differential Signal Pair B)
S6	B+ (Differential Signal Pair B)
S7	GND

Table 5-2 Power Segment Pin Assignment and Descriptions

Pin Number	Function
P1	Not Used (3.3V)
P2	Not Used (3.3V)
P3	DEVSLP
P4	GND
P5	GND
P6	GND
P7	5V pre-charge
P8	5V
P9	5V
P10	GND
P11	Reserved
P12	GND
P13	Not Used (12V pre-charge)
P14	Not Used (12V)
P15	Not Used (12V)

## 6. SUPPORTED COMMANDS

### 6.1 ATA Command List

The following ATA command list table is followed by ATA8-ACS4 SPEC.

Table 6-1 ATA Command List

Op Code	Description	Op Code	Description
00h	NOP	C9h	Read DMA without Retry
06h	Data Set Management	CAh	Write DMA
10h-1Fh	Recalibrate	CBh	Write DMA without Retry
20h	Read Sectors	CEh	Write Multiple FUA EXT
21h	Read Sectors without Retry	E0h	Standby Immediate
24h	Read Sectors EXT	E1h	Idle Immediate
25h	Read DMA EXT	E2h	Standby
27h	Read Native Max Address EXT	E3h	Idle
29h	Read Multiple EXT	E4h	Read Buffer
2Fh	Read Log EXT	E5h	Check Power Mode
30h	Write Sectors	E6h	Sleep
31h	Write Sectors without Retry	E7h	Flush Cache
34h	Write Sectors EXT	E8h	Write Buffer
35h	Write DMA EXT	E9h	READ BUFFER DMA
37h	Set Native Max Address EXT	EAh	Flush Cache EXT
38h	CFA Write Sectors Without Erase (Cfast Only)	EBh	Write Buffer DMA
39h	Write Multiple EXT	ECh	Identify Device
3Dh	Write DMA FUA EXT	EFh	Set Features
3Fh	Write Long EXT	EFh 02h	Enable volatile write cache
40h	Read Verify Sectors	EFh 03h	Set transfer mode
41h	Read Verify Sectors without Retry	EFh 05h	Enable the APM feature set
42h	Read Verify Sectors EXT	EFh 10h	Enable use of SATA features et
44h	Zero EXT	EFh 10h 02h	Enable DMA Setup FIS Auto-Activate optimization
45h	Write Uncorrectable EXT	EFh 10h 03h	Enable Device-initiated interface power state (DIPM) transitions
47h	Read Log DMA EXT	EFh 10h 06h	Enable Software Settings Preservation (SSP)
57h	Write Log DMA EXT	EFh 10h 07h	Enable Device Automatic Partial to Slumber transitions
60h	Read FPDMA Queued	EFh 10h 09h	Enable Device Sleep
61h	Write FPDMA Queued	EFh 55h	Disable read look-ahead
70h-7Fh	Seek	EFh 66h	Disable reverting to power-on defaults
90h	Execute Device Diagnostic	EFh 82h	Disable volatile write cache
91h	Initialize Device Parameters	EFh 85h	Disable the APM feature set
92h	Download Microcode	EFh 90h	Disable use of SATA feature set
93h	Download Microcode DMA	EFh 90h 02h	Disable DMA Setup FIS Auto-Activate optimization

Op Code		Description	Op Code			Description
B0h		SMART	EFh	90h	03h	Disable Device-initiated interface power state (DIPM) transitions
B0h	D0h	SMART READ DATA	EFh	90h	06h	Disable Software Settings Preservation (SSP)
B0h	D1h	SMART READ ATTRIBUTE THRESHOLDS	EFh	90h	07h	Disable Device Automatic Partial to Slumber transitions
B0h	D2h	SMART ENABLE/DISABLE ATTRIBUTE AUTOSAVE	EFh	90h	09h	Disable Device Sleep
B0h	D3h	SMART SAVE ATTRIBUTE VALUES	EFh	AAh		Enable read look-ahead
B0h	D4h	SMART EXECUTE OFF-LINE IMMEDIATE	EFh	CCh		Enable reverting to power-on defaults
B0h	D5h	SMART READ LOG	F1h			Security Set Password
B0h	D6h	SMART WRITE LOG	F2h			Security Unlock
B0h	D8h	SMART ENABLE OPERATIONS	F3h			Security Erase Prepare
B0h	D9h	SMART DISABLE OPERATIONS	F4h			Security Erase Unit
B0h	DAh	SMART RETURN STATUS	F5h			Security Freeze Lock
B0h	DBh	SMART ENABLE/DISABLE AUTOMATIC OFF-LINE	F6h			Security Disable Password
B1h		Device Configuration	F8h			Read Native Max Address
B4h		Sanitize	F9h			Set Max Address
C4h		Read Multiple	F9h	01h		SET MAX SET PASSWORD
C5h		Write Multiple	F9h	02h		SET MAXLOCK
C6h		Set Multiple Mode	F9h	03h		SET MAX UNLOCK
C8h		Read DMA	F9h	04h		SET MAX FREEZE LOCIC

## 6.2 Identify Device Data

The following table details the sector data returned by the IDENTIFY DEVICE command of ATA8-ACS4 SPEC

Table 6-2 List of Device Identification

Word	F: Fixed V: Variable X: retired/obsolete /reserved	Default Value	Description
0	F	0040h	General configuration bit-significant information
1	X	*1	Obsolete
2	F	C837h	Specific configuration
3	X	0010h	Obsolete
4-5	X	00000000h	Retired
6	X	003Fh	Obsolete
7-8	X	00000000h	Reserved for assignment by the Compact Flash Association
9	X	0000h	Retired
10-19	V	Varies	Serial number (20 ASCII characters)
20-21	X	00000000h	Retired
22	X	0000h	Obsolete

Word	F: Fixed V: Variable X: retired/obsolete /reserved	Default Value	Description
23-26	V	Varies	Firmware revision (8 ASCII characters)
27-46	V	Varies	Model number (xxxxxxx)
47	F	8010h	7:0- Maximum number of sectors transferred per interrupt on MULTIPLE commands
48	F	4000h	Trusted Computing feature set options(not support)
49	F	2F00h	Capabilities
50	F	4000h	Capabilities
51-52	X	000000000h	Obsolete
53	F	0007h	Words 88 and 70:64 valid
54	X	*1	Obsolete
55	X	0010h	Obsolete
56	X	003Fh	Obsolete
57-58	X	*2	Obsolete
59	F	0110h	Sanitize and Number of sectors transferred per interrupt on MULTIPLE commands
60-61	V	*3	Maximum number of sector ( 28bit LBA mode)
62	X	0000h	Obsolete
63	F	0407h	Multi-word DMA modes supported/selected
64	F	0003h	PIO modes supported
65	F	0078h	Minimum Multiword DMA transfer cycle time per word
66	F	0078h	Manufacturer's recommended Multiword DMA transfer cycle time
67	F	0078h	Minimum PIO transfer cycle time without flow control
68	F	0078h	Minimum PIO transfer cycle time with IORDY flow control
69	F	1F00h	Additional Supported (support download microcode DMA)
70	X	0000h	Reserved
71-74	X	0000000000000000h	Reserved for the IDENTIFY PACKET DEVICE command
75	F	001Fh	Queue depth
76	F	850Eh	Serial SATA capabilities
77	F	0006h	Serial ATA Additional Capabilities
78	F	004Ch	Serial ATA features supported
79	F	0040h	Serial ATA features enabled
80	F	0FF8h	Major Version Number
81	F	0000h	Minor Version Number
82	F	746Bh	Command set supported
83	F	7D01h	Command set supported
84	F	4163h	Command set/feature supported extension
85	F	7469h	Command set/feature enabled
86	F	BC01h	Command set/feature enabled

Word	F: Fixed V: Variable X: retired/obsolete /reserved	Default Value	Description
87	F	4163h	Command set/feature default
88	F	007Fh	Ultra DMA Modes
89	F	000Ah	Time required for security erase unit completion
90	F	001Eh	Time required for Enhanced security erase completion
91	F	0000h	Current advanced power management value
92	F	FFFEh	Master Password Revision Code
93	F	0000h	Hardware reset result. For SATA devices, word 93 shall be set to the value 0000h.
94	X	0000h	Obsolete
95	F	0000h	Stream Minimum Request Size
96	F	0000h	Streaming Transfer Time – DMA
97	F	0000h	Streaming Access Latency – DMA and PIO
98-99	F	00000000h	Streaming Performance Granularity
100-103	V	*4	Maximum user LBA for 48 bit Address feature set
104	F	0000h	Streaming Transfer Time – PIO
105	F	0008h	Maximum number of 512-byte blocks per DATA SET MANAGEMENT command
106	F	4000h	Physical sector size/Logical sector size
107	F	0000h	Inter-seek delay for ISO-7779 acoustic testing in microseconds
108-111	V	Varies	World Wide Name
112-115	X	0000000000000000h	Reserved
116	X	0000h	Reserved
117-118	F	00000000h	Words per logical Sector
119	F	401Ch	Supported settings
120	F	401Ch	Command set/Feature Enabled/Supported
121-126	X	0h	Reserved
127	X	0000h	Obsolete
128	F	0021h	Security status
129-140	V	Varies	Vendor specific
141	V	Varies	Vendor specific
142-159	V	Varies	Vendor specific
160	X	0000h	Reserved for CFA
161-167	X	0h	Reserved for CFA
168	V	Varies	Device Nominal Form Factor
169	F	0001h	DATA SET MANAGEMENT command is supported
170-173	F	0000000000000000h	Additional Product Identifier
174-175	X	00000000h	Reserved
176-205	F	0h	Current media serial number
206	F	0000h	SCT Command Transport
207-208	X	00000000h	Reserved
209	F	4000h	Alignment of logical blocks within a physical block



Word	F: Fixed V: Variable X: retired/obsolete /reserved	Default Value	Description
210-211	F	00000000h	Write-Read-Verify Sector Count Mode 3 (not support)
212-213	F	00000000h	Write-Read-Verify Sector Count Mode 2 (not support)
214-216	X	0h	Obsolete
217	F	0001h	Non-rotating media device
218	X	0000h	Reserved
219	X	0000h	NV Cache relate (not support)
220	V	0000h	Write read verify feature set current mode
221	X	0000h	Reserved
222	F	10FFh	Transport major version number
223	F	0000h	Transport minor version number
224-229	X	0h	Reserved
230-233	F	0000000000000000h	Extend number of user addressable sectors
234	F	0001h	Minimum number of 512-byte data blocks per DOWNLOAD MICROCODE command for mode 03h
235	F	FFFEh	Maximum number of 512-byte data blocks per DOWNLOAD MICROCODE command for mode 03h
236-254	X	0h	Reserved
255	F	XXA5h XX is variable	Integrity word (Checksum and Signature)

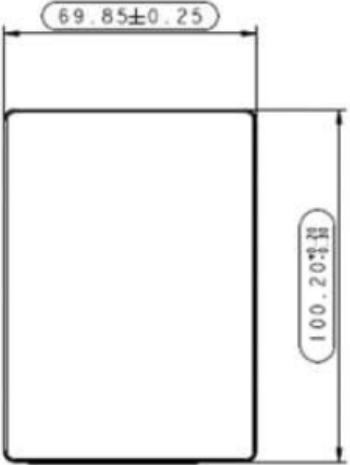
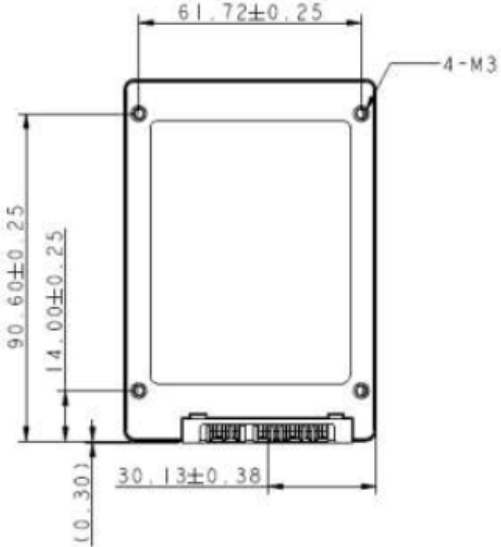
Table 6-3 List of Device Identification for Each Capacity

Capacity	*1 (Word 1/Word 54)	*2 (Word 57 – 58)	*3 (Word 60 – 61)	*4 (Word 100 – 103)
128GB	3FFFh	FBFC10h	EE7C2B0h	EE7C2B0h
256GB	3FFFh	FBFC10h	FFFFFFFFh	1DCF32B0h
512GB	3FFFh	FBFC10h	FFFFFFFFh	3B9E12B0

## 7. PHYSICAL DIMENSION

Form factor: 2.5" SSD

Dimensions: 100mm (L) x 69.85mm (W) x 7.00mm (H)

View Direction	Diagram
Top	 <p>Top view diagram showing dimensions: <math>69.85 \pm 0.25</math> mm (width) and <math>100.20 \pm 0.05</math> mm (length).</p>
Bottom	 <p>Bottom view diagram showing dimensions: <math>61.72 \pm 0.25</math> mm (width), <math>90.60 \pm 0.25</math> mm (length), <math>14.00 \pm 0.25</math> mm (mounting hole offset), <math>4-M3</math> (mounting holes), <math>30.13 \pm 0.38</math> mm (SATA connector offset), and <math>0.30</math> mm (SATA connector offset).</p>

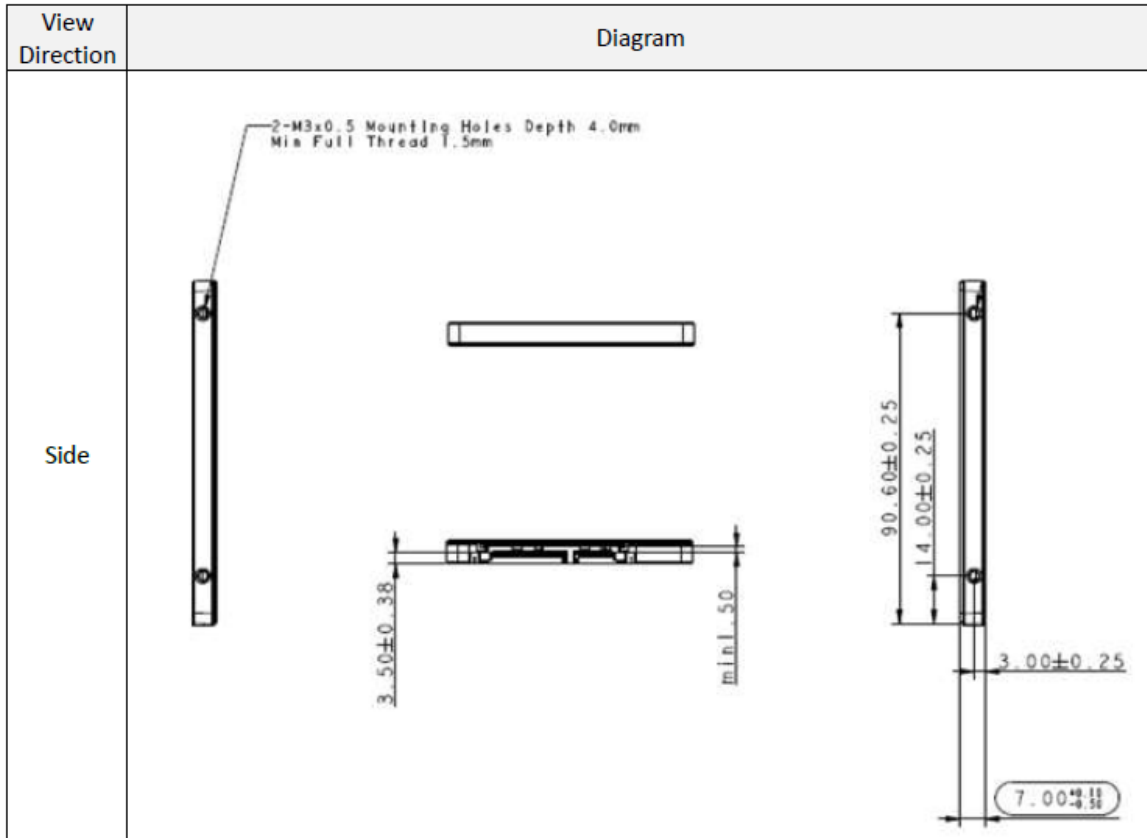


Figure 7-1 Product Mechanical Diagram and Dimensions

## 8. REFERENCES

The following table is to list out the standards that have been adopted for designing the product.

Table 8-1 List of Standards References

Title	Acronym/Source
RoHS	Restriction of Hazardous Substances Directive;
Serial ATA Revision 3.2	<a href="http://www.sata-io.org">http://www.sata-io.org</a>
ATA-8 spec	<a href="http://www.t13.org">http://www.t13.org</a>
FCC: CISPR22	Federal Communications Commission;
CE: EN55022	Consumer electronics certification;
BSMI: 13438	The Bureau of Standards, Metrology and Inspection;

## 9. TERMINOLOGY

The following table is to list out the acronyms that have been applied throughout the document.

Table 9-1 List of Terminology

Term	Definitions
ATTO	Commercial performance benchmark application
DDR	Double data rate (SDRAM)
ASPM	Active States Power Management
APST	Autonomous Power State Transition
LBA	Logical block addressing
MB	Mega-byte
GB	Giga-byte
TB	Tera-byte
MTBF	Mean time between failures
PCIe	PCI Express / Peripheral Component Interconnect Express
S.M.A.R.T.	Self-monitoring, analysis and reporting technology
SSD	Solid state disk

## **10. PRODUCT WARRANTY POLICY**

In the event the Product does not conform to the specification within Axeme agreed warranty period and such inconformity is solely attributable to Axeme's cause, Axeme agrees at its discretion replace or repair the nonconforming Product. Notwithstanding the foregoing, the aforementioned warranty shall exclude the inconformity arising from, in relation to or associated with:

- (1) alternation, modification, improper use, misuse or excessive use of the Product;
- (2) failure to comply with Axeme's instructions;
- (3) Axeme's compliance with customer (including customer's suppliers, subcontractors or downstream customers) indicated instructions, technologies, designs, specifications, materials, components, parts;
- (4) combination of the Product with other materials, components, parts, goods, hardware, firmware or software not developed by Axeme; or
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