

Phison Electronics Corporation  
**Enterprise SSD Series**

**SRE100**

**SRE120**

**SME100**

**SME110**

**2.5" SATA SSD (SB2506B-Slim)**

**Version 2.4**

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## Revision History

Revision	Draft Date	History	Author
1.0	2018/11/26	Preliminary Release	Kyle Yu
1.1	2019/02/15	Update SRE100 and SME110 series.	Elsa Chen
1.2	2019/02/22	Add product line	Larry Li
1.3	2019/03/07	Add Power consumption	Elsa Chen
1.4	2019/03/11	update wording	Larry Li
1.5	2019/03/18	Add SRE050	Larry Li
1.6	2019/03/21	Update TBW	Larry Li
1.7	2019/03/24	Update TBW and DWPD	Larry Li
1.8	2019/03/26	Adjust spec	Larry Li
1.9	2019/04/18	1. Update identify device command. 2. Update housing outline	Elsa Chen
2.0	2019/5/6	Add SRE120	Larry Li
2.1	2019/5/7	Adjust spec	Larry Li
2.2	2019/7/23	Add ch3.3.	Elsa Chen
2.3	2019/8/1	Adjust product overview.	Elsa Chen
2.4	2019/8/6	Modify power supply voltage.	Elsa Chen

## Product Overview

SRE100 Series	SME110 Series
<ul style="list-style-type: none"> <li>● <b>Capacity</b> <ul style="list-style-type: none"> <li>■ 480GB, 960GB, 1920GB, 3840GB</li> </ul> </li> <li>● <b>Form Factor</b> <ul style="list-style-type: none"> <li>■ 2.5" SSD</li> </ul> </li> <li>● <b>SATA Interface &amp; Compliance</b> <ul style="list-style-type: none"> <li>■ SATA Gen3</li> <li>■ SATA Revision 3.2</li> </ul> </li> <li>● <b>Flash Interface</b> <ul style="list-style-type: none"> <li>■ Transfer rate up to 533MBps</li> <li>■ Up to 16pcs of BGA132/152 flash</li> </ul> </li> <li>● <b>Sustained Performance<sup>1</sup></b> <ul style="list-style-type: none"> <li>■ Sequential Read: up to 530 MB/s</li> <li>■ Sequential Write: up to 500 MB/s</li> <li>■ Random Read: up to 98K IOPS</li> <li>■ Random Write: up to 34K IOPS</li> </ul> </li> <li>● <b>Temperature Range<sup>2</sup></b> <ul style="list-style-type: none"> <li>■ Operation: 0°C ~ 70°C</li> <li>■ Storage: -40°C ~ 85°C</li> </ul> </li> <li>● <b>Reliability</b> <ul style="list-style-type: none"> <li>■ MTBF: 1.5million hrs</li> <li>■ UBER: &lt; 1 sector per 10<sup>17</sup> bits read</li> <li>■ Power On/Off Cycles: 24 times per day within warranty period</li> <li>■ DWPD 0.8</li> <li>■ TBW: 673TB - 480GB 1347TB - 960GB 2694TB - 1920GB 5389TB - 3840GB</li> </ul> </li> <li>● <b>Power<sup>3</sup></b> <ul style="list-style-type: none"> <li>■ Power supply of 2.5" SSD: 5V±10%</li> <li>■ Active Write (Typ.) &lt; 4.5 W</li> <li>■ Active Read (Typ.) &lt; 3.0 W</li> <li>■ Idle &lt; 1.6 W</li> </ul> </li> <li>● <b>Environment Specifications</b> <ul style="list-style-type: none"> <li>■ Shock: 1500G/0.5ms</li> <li>■ Vibration: 20Hz~80Hz/1.52mm 80Hz~2000Hz/20G</li> <li>■ Drop: 80cm height/each face</li> <li>■ Bending: ≥ 20N force</li> </ul> </li> <li>● <b>RoHS compliant</b></li> <li>● <b>HW Pfail : Support Tantalum</b></li> </ul>	<ul style="list-style-type: none"> <li>● <b>Capacity</b> <ul style="list-style-type: none"> <li>■ 480GB, 960GB, 1920GB, 3840GB</li> </ul> </li> <li>● <b>Form Factor</b> <ul style="list-style-type: none"> <li>■ 2.5" SSD</li> </ul> </li> <li>● <b>SATA Interface &amp; Compliance</b> <ul style="list-style-type: none"> <li>■ SATA Gen3</li> <li>■ SATA Revision 3.2</li> </ul> </li> <li>● <b>Flash Interface</b> <ul style="list-style-type: none"> <li>■ Transfer rate up to 533MBps</li> <li>■ Up to 16pcs of BGA132/152 flash</li> </ul> </li> <li>● <b>Sustained Performance<sup>1</sup></b> <ul style="list-style-type: none"> <li>■ Sequential Read: up to 530 MB/s</li> <li>■ Sequential Write: up to 500 MB/s</li> <li>■ Random Read: up to 95K IOPS</li> <li>■ Random Write: up to 65K IOPS</li> </ul> </li> <li>● <b>Temperature Range<sup>2</sup></b> <ul style="list-style-type: none"> <li>■ Operation: 0°C ~ 70°C</li> <li>■ Storage: -40°C ~ 85°C</li> </ul> </li> <li>● <b>Reliability</b> <ul style="list-style-type: none"> <li>■ MTBF: 1.5million hrs</li> <li>■ UBER: &lt; 1 sector per 10<sup>17</sup> bits read</li> <li>■ Power On/Off Cycles: 24 times per day within warranty period</li> <li>■ DWPD &gt; 1</li> <li>■ TBW: 1066TB - 480GB 2133TB - 960GB 4266TB - 1920GB 8533TB - 3840GB</li> </ul> </li> <li>● <b>Power<sup>3</sup></b> <ul style="list-style-type: none"> <li>■ Power supply of 2.5" SSD: 5V±10%</li> <li>■ Active Write (Typ.) &lt; 5.1 W</li> <li>■ Active Read (Typ.) &lt; 3.5 W</li> <li>■ Idle &lt; 1.8 W</li> </ul> </li> <li>● <b>Environment Specifications</b> <ul style="list-style-type: none"> <li>■ Shock: 1500G/0.5ms</li> <li>■ Vibration: 20Hz~80Hz/1.52mm 80Hz~2000Hz/20G</li> <li>■ Drop: 80cm height/each face</li> <li>■ Bending: ≥ 20N force</li> </ul> </li> <li>● <b>RoHS compliant</b></li> <li>● <b>HW Pfail : Support Tantalum</b></li> </ul>

**NOTES:**

1. Refer to Chapter 2 for more details.
2. Operation temperature is measured by device temperature sensor. Airflow is suggested and it will allow device to be operated at appropriate temperature for each component during heavy workloads environment.
3. Refer to Chapter 4, Section 4.2 Power Consumption for more details.

## Product Overview

SME100 Series	SRE120 Series
<ul style="list-style-type: none"> <li>● <b>Capacity</b> <ul style="list-style-type: none"> <li>■ 480GB, 960GB, 1920GBGB</li> </ul> </li> <li>● <b>Form Factor</b> <ul style="list-style-type: none"> <li>■ 2.5" SSD</li> </ul> </li> <li>● <b>SATA Interface &amp; Compliance</b> <ul style="list-style-type: none"> <li>■ SATA Gen3</li> <li>■ SATA Revision 3.2</li> </ul> </li> <li>● <b>Flash Interface</b> <ul style="list-style-type: none"> <li>■ Transfer rate up to 533MBps</li> <li>■ Up to 16pcs of BGA132/152 flash</li> </ul> </li> <li>● <b>Sustained Performance<sup>1</sup></b> <ul style="list-style-type: none"> <li>■ Sequential Read: up to 530 MB/s</li> <li>■ Sequential Write: up to 500 MB/s</li> <li>■ Random Read: up to 98K IOPS</li> <li>■ Random Write: up to 34K IOPS</li> </ul> </li> <li>● <b>Temperature Range<sup>2</sup></b> <ul style="list-style-type: none"> <li>■ Operation: 0°C ~ 70°C</li> <li>■ Storage: -40°C ~ 85°C</li> </ul> </li> <li>● <b>Reliability</b> <ul style="list-style-type: none"> <li>■ MTBF: 1.5million hrs</li> <li>■ UBER: &lt; 1 sector per 10<sup>17</sup> bits read</li> <li>■ Power On/Off Cycles: 24 times per day within warranty period</li> <li>■ DWPD &gt; 1</li> <li>■ TBW: 1571 TB - 480GB 3143 TB - 960GB 6287 TB - 1920GB</li> </ul> </li> <li>● <b>Power<sup>3</sup></b> <ul style="list-style-type: none"> <li>■ Power supply of 2.5" SSD: 5V±10%</li> <li>■ Active Write (Typ.) &lt; 4.5 W</li> <li>■ Active Read (Typ.) &lt; 3.0 W</li> <li>■ Idle &lt; 1.6 W</li> </ul> </li> <li>● <b>Environment Specifications</b> <ul style="list-style-type: none"> <li>■ Shock: 1500G/0.5ms</li> <li>■ Vibration: 20Hz~80Hz/1.52mm 80Hz~2000Hz/20G</li> <li>■ Drop: 80cm height/each face</li> <li>■ Bending: ≥ 20N force</li> </ul> </li> <li>● <b>RoHS compliant</b></li> <li>● <b>HW Pfail : Support Tantalum</b></li> </ul>	<ul style="list-style-type: none"> <li>● <b>Capacity</b> <ul style="list-style-type: none"> <li>■ 240GB, 480GB, 960GB, 1920GB</li> </ul> </li> <li>● <b>Form Factor</b> <ul style="list-style-type: none"> <li>■ 2.5" SSD</li> </ul> </li> <li>● <b>SATA Interface &amp; Compliance</b> <ul style="list-style-type: none"> <li>■ SATA Gen3</li> <li>■ SATA Revision 3.2</li> </ul> </li> <li>● <b>Flash Interface</b> <ul style="list-style-type: none"> <li>■ Transfer rate up to 533MBps</li> <li>■ Up to 10pcs of BGA132/152 flash</li> </ul> </li> <li>● <b>Sustained Performance<sup>1</sup></b> <ul style="list-style-type: none"> <li>■ Sequential Read: up to 530 MB/s</li> <li>■ Sequential Write: up to 500 MB/s</li> <li>■ Random Read: up to 96K IOPS</li> <li>■ Random Write: up to 65K IOPS</li> </ul> </li> <li>● <b>Temperature Range<sup>2</sup></b> <ul style="list-style-type: none"> <li>■ Operation: 0°C ~ 70°C</li> <li>■ Storage: -40°C ~ 85°C</li> </ul> </li> <li>● <b>Reliability</b> <ul style="list-style-type: none"> <li>■ MTBF: 1.5million hrs</li> <li>■ UBER: &lt; 1 sector per 10<sup>17</sup> bits read</li> <li>■ Power On/Off Cycles: 24 times per day within warranty period</li> <li>■ DWPD 0.8</li> <li>■ TBW: 336 TB – 240GB 673 TB - 480GB 1347 TB - 960GB 2694 TB - 1920GB</li> </ul> </li> <li>● <b>Power<sup>3</sup></b> <ul style="list-style-type: none"> <li>■ Power supply of 2.5" SSD: 5V±10%</li> <li>■ Active Write (Typ.) &lt; 4.0 W</li> <li>■ Active Read (Typ.) &lt; 3.5 W</li> <li>■ Idle &lt; 1.6 W</li> </ul> </li> <li>● <b>Environment Specifications</b> <ul style="list-style-type: none"> <li>■ Shock: 1500G/0.5ms</li> <li>■ Vibration: 20Hz~80Hz/1.52mm 80Hz~2000Hz/20G</li> <li>■ Drop: 80cm height/each face</li> <li>■ Bending: ≥ 20N force</li> </ul> </li> <li>● <b>RoHS compliant</b></li> <li>● <b>HW Pfail : Support Aluminum Capacitor</b></li> </ul>

**NOTES:**

1. Refer to Chapter 2 for more details.
2. Operation temperature is measured by device temperature sensor. Airflow is suggested and it will allow device to be operated at appropriate temperature for each component during heavy workloads environment.
3. Refer to Chapter 4, Section 4.2 Power Consumption for more details.

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# 1. INTRODUCTION



## 1.1. General Description

This document describes the specifications of Phison Enterprise SATA Gen3 Solid State Drive. Applying to SATA interface, Phison SSD are ideal storage solution for outstanding performance, low latency and Quality of Service.

For enterprise-class, the types of form factors are 2.5-inch SSD and the capacities are 480GB, 960GB, 1920GB, and 3840GB.

## 1.2. SSD List

Form Factor	Capacity	Product Series	DWPD
2.5" SSD	480GB	SRE100 + TMC 3D cTLC	0.8
	960GB	SRE100 + TMC 3D cTLC	0.8
	1920GB	SRE100 + TMC 3D cTLC	0.8
	3840GB	SRE100 + TMC 3D cTLC	0.8
	240GB	SRE120 + TMC 3D cTLC	0.8
	480GB	SRE120 + TMC 3D cTLC	0.8
	960GB	SRE120 + TMC 3D cTLC	0.8
	1920GB	SRE120 + TMC 3D cTLC	0.8
	480GB	SME110 + Intel 3D NAND	1.3
	960GB	SME110 + Intel 3D NAND	1.3
	1920GB	SME110 + Intel 3D NAND	1.3
	3840GB	SME110 + Intel 3D NAND	1.3
	480GB	SME100 + TMC 3D eTLC	1.9
	960GB	SME100 + TMC 3D eTLC	1.9
	1920GB	SME100 + TMC 3D eTLC	1.9

## 2. PRODUCT SPECIFICATIONS



### 2.1. Electrical/Physical Interface

- SATA Interface
- Compliant with SATA Revision 3.2
- Compatible with SATA Gen3/ Gen2/ Gen1

### 2.2. Device Capacity

**Table 2-1 User Capacity and Addressable Sectors**

	User Addressable Sectors	Bytes per Sector
<b>240GB</b>	468,862,128	512Byte
<b>480GB</b>	937,703,088	
<b>960GB</b>	1,875,385,008	
<b>1920GB</b>	3,750,748,848	
<b>3840GB</b>	7,501,476,528	

NOTES:

1. 1 Gigabyte (GB) is equal to 1,000,000,000 bytes; 1 sector is equal to 512 bytes.
2. The total actual usable capacity of the SSD may be less than the total physical capacity because internal NAND management, SSD format, SSD partition, operating system and so on.

## 2.3. Performance

### ■ Sequential Read/Write Performance

**Table 2-2 SRE100/SRE120/SME110: Sequential Read / Write Performance**

	Product Series	Flash Structure	Flash Type	Sequential Read (128KB)	Sequential Write (128KB)
				Unit: MB/s	Unit: MB/s
<b>480GB</b>	SRE100 + TMC 3D cTLC	256Gb QDPx5	TSB 3D cTLC	530	480
<b>960GB</b>	SRE100 + TMC 3D cTLC	256Gb QDPx10	TSB 3D cTLC	530	500
<b>1920GB</b>	SRE100 + TMC 3D cTLC	512Gb QDPx10	TSB 3D cTLC	530	500
<b>3840GB</b>	SRE100 + TMC 3D cTLC	512Gb ODPx10	TSB 3D cTLC	530	500
<b>240GB</b>	SRE120 + TMC 3D cTLC	256Gb DDPx5	TSB 3D cTLC	530	370
<b>480GB</b>	SRE120 + TMC 3D cTLC	256Gb QDPx5	TSB 3D cTLC	530	500
<b>960GB</b>	SRE120 + TMC 3D cTLC	256Gb QDPx10	TSB 3D cTLC	530	500
<b>1920GB</b>	SRE120 + TMC 3D cTLC	512Gb QDPx10	TSB 3D cTLC	530	500
<b>480GB</b>	SME110 + Intel 3D NAND	256Gb QDPx5	Intel 3D NAND	530	500
<b>960GB</b>	SME110 + Intel 3D NAND	256Gb QDPx10	Intel 3D NAND	530	500
<b>1920GB</b>	SME110 + Intel 3D NAND	512Gb QDPx10	Intel 3D NAND	530	500
<b>3840GB</b>	SME110 + Intel 3D NAND	512Gb ODPx10	Intel 3D NAND	530	500
<b>480GB</b>	SME100 + TMC 3D eTLC	256Gb QDPx5	TSB 3D eTLC	530	480
<b>960GB</b>	SME100 + TMC 3D eTLC	256Gb QDPx10	TSB 3D eTLC	530	500
<b>1920GB</b>	SME100 + TMC 3D eTLC	256Gb ODPx10	TSB 3D eTLC	530	500

NOTES:

- Performance is measured with the following conditions
  - FIO on Linux: 128K sequential write with QD32 and 1 worker for full drive
  - SSD is unformatted drive.
- Performance may differ according to flash configuration and platform.
- The tables are for reference only. Any criteria for accepting goods shall be further discussed based on different flash configurations.

■ Sustained Random Read / Write Performance

**Table 2-3 SRE100/SRE120/SME110: Sustained Random Read / Write Performance**

	Product Series	Flash Structure	Flash Type	4KB Random Read/Write	8KB Random Read/Write
				Unit: IOPS	Unit: IOPS
<b>480GB</b>	SRE100 + TMC 3D cTLC	256Gb QDPx5	TSB 3D cTLC	98K/24K	58K/13K
<b>960GB</b>	SRE100 + TMC 3D cTLC	256Gb QDPx10	TSB 3D cTLC	98K/34K	58K/17K
<b>1920GB</b>	SRE100 + TMC 3D cTLC	512Gb QDPx10	TSB 3D cTLC	98K/34K	58K/17K
<b>3840GB</b>	SRE100 + TMC 3D cTLC	512Gb ODPx10	TSB 3D cTLC	94K/26K	57K/13K
<b>240GB</b>	SRE120 + TMC 3D cTLC	256Gb DDPx5	TSB 3D cTLC	90K/30K	50K/15K
<b>480GB</b>	SRE120 + TMC 3D cTLC	256Gb QDPx5	TSB 3D cTLC	96K/52K	58K/25K
<b>960GB</b>	SRE120 + TMC 3D cTLC	256Gb QDPx10	TSB 3D cTLC	96K/65K	58K/35K
<b>1920GB</b>	SRE120 + TMC 3D cTLC	512Gb QDPx10	TSB 3D cTLC	96K/65K	58K/35K
<b>480GB</b>	SME110 + Intel 3D NAND	256Gb QDPx5	Intel 3D NAND	95K/55K	56K/29K
<b>960GB</b>	SME110 + Intel 3D NAND	256Gb QDPx10	Intel 3D NAND	95K/65K	57K/35K
<b>1920GB</b>	SME110 + Intel 3D NAND	512Gb QDPx10	Intel 3D NAND	95K/60K	57K/30K
<b>3840GB</b>	SME110 + Intel 3D NAND	512Gb ODPx10	Intel 3D NAND	95K/54K	56K/28K
<b>480GB</b>	SME100 + TMC 3D eTLC	256Gb QDPx5	TSB 3D eTLC	98K/24K	58K/13K
<b>960GB</b>	SME100 + TMC 3D eTLC	256Gb QDPx10	TSB 3D eTLC	98K/34K	58K/17K
<b>1920GB</b>	SME100 + TMC 3D eTLC	256Gb ODPx10	TSB 3D eTLC	98K/34K	58K/17K

NOTES:

- Performance is measured with the following conditions
  - FIO on Linux: 4KB random read/write with QD32 and 1 worker for full drive.
  - SSD is unformatted drive.
- 4KB is 4,096 bytes; 8KB is 8,192 bytes.
- Performance may differ according to flash configuration and platform.
- The tables are for reference only. Any criteria for accepting goods shall be further discussed based on different flash configurations.

■ IOPS Consistency

**Table 2-4 SRE100/SRE120/SME110 IOPS Consistency**

	Product Series	Flash Structure	Flash Type	Random Read (4KB)	Random Write (4KB)
				Unit: %	Unit: %
<b>480GB</b>	SRE100 + TMC 3D cTLC	256Gb QDPx5	TSB 3D cTLC	99	99
<b>960GB</b>	SRE100 + TMC 3D cTLC	256Gb QDPx10	TSB 3D cTLC	99	99
<b>1920GB</b>	SRE100 + TMC 3D cTLC	512Gb QDPx10	TSB 3D cTLC	99	99
<b>3840GB</b>	SRE100 + TMC 3D cTLC	512Gb ODPx10	TSB 3D cTLC	99	86
<b>240GB</b>	SRE120 + TMC 3D cTLC	256Gb DDPx5	TSB 3D cTLC	98	97
<b>480GB</b>	SRE120 + TMC 3D cTLC	256Gb QDPx5	TSB 3D cTLC	98	95
<b>960GB</b>	SRE120 + TMC 3D cTLC	256Gb QDPx10	TSB 3D cTLC	98	90
<b>1920GB</b>	SRE120 + TMC 3D cTLC	512Gb QDPx10	TSB 3D cTLC	98	90
<b>480GB</b>	SME110 + Intel 3D NAND	256Gb QDPx5	Intel 3D NAND	98	97
<b>960GB</b>	SME110 + Intel 3D NAND	256Gb QDPx10	Intel 3D NAND	98	94
<b>1920GB</b>	SME110 + Intel 3D NAND	512Gb QDPx10	Intel 3D NAND	98	94
<b>3840GB</b>	SME110 + Intel 3D NAND	512Gb ODPx10	Intel 3D NAND	98	94
<b>480GB</b>	SME100 + TMC 3D eTLC	256Gb QDPx5	TSB 3D eTLC	99	99
<b>960GB</b>	SME100 + TMC 3D eTLC	256Gb QDPx10	TSB 3D eTLC	99	99
<b>1920GB</b>	SME100 + TMC 3D eTLC	256Gb ODPx10	TSB 3D eTLC	99	99

NOTES:

1. Performance is measured with the following conditions
  - (a) FIO on Linux: 4KB random read/write with QD32 and 1 worker for full drive.
  - (b) SSD is unformatted drive.
2. IOPS Consistency (%) = (99.9% IOPS) / (Average IOPS) x 100
3. 4KB is 4,096 bytes; 8KB is 8,192 bytes.
4. Performance may differ according to flash configuration and platform.
5. The tables are for reference only. Any criteria for accepting goods shall be further discussed based on different flash configurations.

■ **Latency**

**Table 2-5 SRE100/SRE120/SME110 Average Latency**

	Product Series	Flash Structure	Flash Type	Read (4KB)	Write (4KB)
				Unit: us	Unit: us
<b>480GB</b>	SRE100 + TMC 3D cTLC	256Gb QDPx5	TSB 3D cTLC	138	36
<b>960GB</b>	SRE100 + TMC 3D cTLC	256Gb QDPx10	TSB 3D cTLC	135	28
<b>1920GB</b>	SRE100 + TMC 3D cTLC	512Gb QDPx10	TSB 3D cTLC	138	28
<b>3840GB</b>	SRE100 + TMC 3D cTLC	512Gb ODPx10	TSB 3D cTLC	192	36
<b>240GB</b>	SRE120 + TMC 3D cTLC	256Gb DDPx5	TSB 3D cTLC	116	32
<b>480GB</b>	SRE120 + TMC 3D cTLC	256Gb QDPx5	TSB 3D cTLC	115	23
<b>960GB</b>	SRE120 + TMC 3D cTLC	256Gb QDPx10	TSB 3D cTLC	117	22
<b>1920GB</b>	SRE120 + TMC 3D cTLC	512Gb QDPx10	TSB 3D cTLC	118	24
<b>480GB</b>	SME110 + Intel 3D NAND	256Gb QDPx5	Intel 3D NAND	116	22
<b>960GB</b>	SME110 + Intel 3D NAND	256Gb QDPx10	Intel 3D NAND	117	24
<b>1920GB</b>	SME110 + Intel 3D NAND	512Gb QDPx10	Intel 3D NAND	118	23
<b>3840GB</b>	SME110 + Intel 3D NAND	512Gb ODPx10	Intel 3D NAND	128	23
<b>480GB</b>	SME100 + TMC 3D eTLC	256Gb QDPx5	TSB 3D eTLC	138	36
<b>960GB</b>	SME100 + TMC 3D eTLC	256Gb QDPx10	TSB 3D eTLC	135	28
<b>1920GB</b>	SME100 + TMC 3D eTLC	256Gb ODPx10	TSB 3D eTLC	138	28

NOTES:

1. Performance is measured with the following conditions
  - (a) FIO on Linux with QD1 with 1 worker.
  - (b) SSD is unformatted drive.
2. Performance may differ according to flash configuration and platform.
3. The tables are for reference only. Any criteria for accepting goods shall be further discussed based on different flash configurations.

■ **Quality of Service (QoS)**

**Table 2-6 SRE100/SRE120/SME110 Qualify of Service (QoS)**

	Product Series	Flash Structure	Flash Type	Quality of Service (99%)			
				Read 4KB, QD=1	Write 4KB, QD=1	Read 4KB, QD=32	Write 4KB, QD=32
				Unit: us	Unit: us	Unit: us	Unit: us
<b>480GB</b>	SRE100 + TMC 3D cTLC	256Gb QDPx5	TSB 3D cTLC	189	37	577	1,335
<b>960GB</b>	SRE100 + TMC 3D cTLC	256Gb QDPx10	TSB 3D cTLC	185	22	464	872
<b>1920GB</b>	SRE100 + TMC 3D cTLC	512Gb QDPx10	TSB 3D cTLC	193	26	522	929
<b>3840GB</b>	SRE100 + TMC 3D cTLC	512Gb ODPx10	TSB 3D cTLC	272	37	626	1,335
<b>240GB</b>	SRE120 + TMC 3D cTLC	256Gb DDPx5	TSB 3D cTLC	136	128	708	4,358
<b>480GB</b>	SRE120 + TMC 3D cTLC	256Gb QDPx5	TSB 3D cTLC	134	67	485	618
<b>960GB</b>	SRE120 + TMC 3D cTLC	256Gb QDPx10	TSB 3D cTLC	136	36	415	634
<b>1920GB</b>	SRE120 + TMC 3D cTLC	512Gb QDPx10	TSB 3D cTLC	136	36	415	634
<b>480GB</b>	SME110 + Intel 3D NAND	256Gb QDPx5	Intel 3D NAND	187	30	872	1,171
<b>960GB</b>	SME110 + Intel 3D NAND	256Gb QDPx10	Intel 3D NAND	185	30	577	1,089
<b>1920GB</b>	SME110 + Intel 3D NAND	512Gb QDPx10	Intel 3D NAND	189	30	634	1,073
<b>3840GB</b>	SME110 + Intel 3D NAND	512Gb ODPx10	Intel 3D NAND	211	25	423	1,028
<b>480GB</b>	SME100 + TMC 3D eTLC	256Gb QDPx5	TSB 3D eTLC	189	37	577	1,335
<b>960GB</b>	SME100 + TMC 3D eTLC	256Gb QDPx10	TSB 3D eTLC	185	22	464	872
<b>1920GB</b>	SME100 + TMC 3D eTLC	256Gb ODPx10	TSB 3D eTLC	193	26	522	929

	Product Series	Flash Structure	Flash Type	Quality of Service (99.99%)			
				Read 4KB, QD=1	Write 4KB, QD=1	Read 4KB, QD=32	Write 4KB, QD=32
				Unit: us	Unit: us	Unit: us	Unit: us
<b>480GB</b>	SRE100 + TMC 3D cTLC	256Gb QDPx5	TSB 3D cTLC	234	120	1,286	1,630
<b>960GB</b>	SRE100 + TMC 3D cTLC	256Gb QDPx10	TSB 3D cTLC	230	118	741	1,220
<b>1920GB</b>	SRE100 + TMC 3D cTLC	512Gb QDPx10	TSB 3D cTLC	236	75	790	1,236
<b>3840GB</b>	SRE100 + TMC 3D cTLC	512Gb ODPx10	TSB 3D cTLC	333	86	1,204	1,564
<b>240GB</b>	SRE120 + TMC 3D cTLC	256Gb DDPx5	TSB 3D cTLC	254	168	1,122	4,816
<b>480GB</b>	SRE120 + TMC 3D cTLC	256Gb QDPx5	TSB 3D cTLC	382	203	782	1,662
<b>960GB</b>	SRE120 + TMC 3D cTLC	256Gb QDPx10	TSB 3D cTLC	403	179	831	2572
<b>1920GB</b>	SRE120 + TMC 3D cTLC	512Gb QDPx10	TSB 3D cTLC	403	179	831	2572
<b>480GB</b>	SME110 + Intel 3D NAND	256Gb QDPx5	Intel 3D NAND	946	856	1,662	2,375
<b>960GB</b>	SME110 + Intel 3D NAND	256Gb QDPx10	Intel 3D NAND	872	757	1,466	2,342
<b>1920GB</b>	SME110 + Intel 3D NAND	512Gb QDPx10	Intel 3D NAND	1,777	782	1,368	2,179
<b>3840GB</b>	SME110 + Intel 3D NAND	512Gb ODPx10	Intel 3D NAND	2,244	774	1,122	7,176
<b>480GB</b>	SME100 + TMC 3D eTLC	256Gb QDPx5	TSB 3D eTLC	234	120	1,286	1,630
<b>960GB</b>	SME100 + TMC 3D eTLC	256Gb QDPx10	TSB 3D eTLC	230	118	741	1,220
<b>1920GB</b>	SME100 + TMC 3D eTLC	256Gb ODPx10	TSB 3D eTLC	236	75	790	1,236

NOTES:

- Quality of Service (QoS) is measured with the following conditions
  - FIO test: 4KB transfer size, QD=1, 32 on 4KB random read and write workload on whole LBA range of drive once the performance performs on steady state and all background operations run normally.
- According to random 4KB QD=1 and 32 workloads, the result of QoS is the maximum round-trip time which is taken for 99.0 % and 99.99% of commands to host.
- QoS may differ according to flash configuration and platform.
- The tables are for reference only. Any criteria for accepting goods shall be further discussed based on different flash configurations.

### 3. ENVIRONMENTAL SPECIFICATIONS



#### 3.1. Environmental Conditions

##### 3.1.1. Temperature and Humidity

**Table 3-1 High Temperature Test Condition**

		Temperature	Humidity
<b>High Temperature Test</b>	Operation	70°C	0% RH
	Storage	85°C	0% RH
<b>Low Temperature Test</b>	Operation	0°C	0% RH
	Storage	-40°C	0% RH
<b>High Humidity Test</b>	Operation	40°C	90% RH
	Storage	40°C	93% RH
<b>Temperature Cycle Test</b>	Operation	0°C - 70°C	—
	Storage	-40°C - 85°C	—

NOTES:

1. Operation temperature is measured by device temperature sensor. Airflow is suggested and it will allow device to be operated at appropriate temperature for each component during heavy workloads environment.

**Table 3-2 Mechanical Test Condition**

Items			2.5 inch SATA SSD
<b>Shock</b>	Non-operational	Acceleration Force	1500G
<b>Vibration</b>	Non-operational	Frequency/Displacement	20Hz~80Hz/1.52mm
		Frequency/Acceleration	80Hz~2000Hz/20G
<b>Drop</b>	Non-operational	Height of Drop	80cm free fall
		Number of Drop	6 face of each unit
<b>Bending</b>	Non-operational	Force	≥ 20N
		Action	Hold 1min/5times

**Table 3-3 Electrostatic Discharge (ESD)**

Specification	+/- 4KV
EN 55024, CISPR 24 EN 61000-4-2 and IEC 61000-4-2	Device functions are affected, but EUT will be back to its normal or operational state automatically.

**Table 3-4 EMI Compliance**

Specification
EN 55032, CISPR 32(CE)
AS/NZS CISPR 32(CE)
ANSI C63.4 (FCC)
CNS 13438 (BSMI)
VCCI-CISPR 32 (VCCI)

### 3.2. TBW (TeraBytes Written) and DDPD (Drive Write Per Day)

**Table 3-5 TBW & DDPD**

	Product Series	Flash Structure	Flash Type	TBW	DDPD
<b>480GB</b>	SRE100 + TMC 3D cTLC	256Gb QDPx5	TSB 3D cTLC	673	0.8
<b>960GB</b>	SRE100 + TMC 3D cTLC	256Gb QDPx10	TSB 3D cTLC	1,347	0.8
<b>1920GB</b>	SRE100 + TMC 3D cTLC	512Gb QDPx10	TSB 3D cTLC	2,694	0.8
<b>3840GB</b>	SRE100 + TMC 3D cTLC	512Gb ODPx10	TSB 3D cTLC	5,389	0.8
<b>240GB</b>	SRE120 + TMC 3D cTLC	256Gb DDPx5	TSB 3D cTLC	336	0.8
<b>480GB</b>	SRE120 + TMC 3D cTLC	256Gb QDPx5	TSB 3D cTLC	673	0.8
<b>960GB</b>	SRE120 + TMC 3D cTLC	256Gb QDPx10	TSB 3D cTLC	1,347	0.8
<b>1920GB</b>	SRE120 + TMC 3D cTLC	512Gb QDPx10	TSB 3D cTLC	2,694	0.8
<b>480GB</b>	SME110 + Intel 3D NAND	256Gb QDPx5	Intel 3D NAND	1,066	1.3
<b>960GB</b>	SME110 + Intel 3D NAND	256Gb QDPx10	Intel 3D NAND	2,133	1.3
<b>1920GB</b>	SME110 + Intel 3D NAND	512Gb QDPx10	Intel 3D NAND	4,266	1.3
<b>3840GB</b>	SME110 + Intel 3D NAND	512Gb ODPx10	Intel 3D NAND	8,533	1.3
<b>480GB</b>	SME100 + TMC 3D eTLC	256Gb QDPx5	TSB 3D eTLC	1,571	1.9
<b>960GB</b>	SME100 + TMC 3D eTLC	256Gb QDPx10	TSB 3D eTLC	3,143	1.9
<b>1920GB</b>	SME100 + TMC 3D eTLC	256Gb ODPx10	TSB 3D eTLC	6,287	1.9

NOTES:

1. The JEDEC Enterprise 219A workload.
2. Based on 5 years.
3. DDPD = TBW / (365 x 5years x User capacity)  
= TBW (TB\*10<sup>3</sup>) / [365 x 5years x User capacity(=GB\*1000<sup>3</sup>/1024<sup>3</sup>)]

### 3.3. Power On/Off Cycles

The definition of power on/off cycles is that the power is withdrawn from the SSD device, and then restored. The test is to simulate the behavior that SSD still can be restored and active normally when host platforms go into suspend and shutdown.

During the Power On/Off cycles test, the SSD can be protective if 24 times of power on/off per day within warranty period

### 3.4. UBER

**Table 3-6 UBER**

	Flash Type	UBER
<b>240GB</b>	3D NAND	< 1 sector per 10 <sup>17</sup> bits read
<b>480GB</b>		
<b>960GB</b>		
<b>1920GB</b>		
<b>3840GB</b>		

NOTES:

1. UBER (Uncorrectable Bit Error Rates) means the uncorrectable error per bits read.

### 3.5. MTBF

MTBF, Mean Time Between Failures, is a measure of reliability of a device. Its value represents the average time between a repair and the next failure. The unit of MTBF is in hours. The higher the MTBF value, the higher the reliability of the device.

Our MTBF result is based on simulation software (Brand/Model). Please note that a lower MTBF should be expected for higher capacity drives, and we apply the lowest MTBF for all capacities.

**Table 3-7 MTBF**

	MTBF
<b>240GB</b>	1.5 million Hours
<b>480GB</b>	
<b>960GB</b>	
<b>1920GB</b>	
<b>3840GB</b>	

## 4. ELECTRICAL SPECIFICATIONS



### 4.1. Supply Voltage

Table 4-1 Supply Voltage

	2.5" SSD
Parameter	Rating
Operating Voltage	5V, + / - 5%
Rise Time (Max/Min)	100 ms / 0.1 ms
Fall Time (Max/Min)	5 s / 1 ms
Min. Off Time <sup>1</sup>	1 s

NOTE:

1. Minimum time between power removed from SSD ( $V_{cc} < 100 \text{ mW}$ ) and power re-applied to the drive.

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## 4.2. Power Consumption

**Table 4-2 SRE100/SRE120/SME110 Power Consumption**

				2.5" SSD		
	Product Series	Flash Structure	Flash Type	Active Write (Typ.)	Active Read (Typ.)	Idle
				Unit: W	Unit: W	Unit: W
<b>480GB</b>	SRE100 + TMC 3D cTLC	256Gb QDPx5	TSB 3D cTLC	2.8	2.1	1.3
<b>960GB</b>	SRE100 + TMC 3D cTLC	256Gb QDPx10	TSB 3D cTLC	3.2	2.5	1.4
<b>1920GB</b>	SRE100 + TMC 3D cTLC	512Gb QDPx10	TSB 3D cTLC	3.8	2.7	1.5
<b>3840GB</b>	SRE100 + TMC 3D cTLC	512Gb ODPx10	TSB 3D cTLC	4.5	3.0	1.6
<b>240GB</b>	SRE120 + TMC 3D cTLC	256Gb DDPx5	TSB 3D cTLC	2.5	2	1.2
<b>480GB</b>	SRE120 + TMC 3D cTLC	256Gb QDPx5	TSB 3D cTLC	2.8	2.1	1.3
<b>960GB</b>	SRE120 + TMC 3D cTLC	256Gb QDPx10	TSB 3D cTLC	3.2	2.5	1.4
<b>1920GB</b>	SRE120 + TMC 3D cTLC	512Gb QDPx10	TSB 3D cTLC	3.8	2.7	1.5
<b>480GB</b>	SME110 + Intel 3D NAND	256Gb QDPx5	Intel 3D NAND	4.1	2.4	1.4
<b>960GB</b>	SME110 + Intel 3D NAND	256Gb QDPx10	Intel 3D NAND	4.3	2.8	1.5
<b>1920GB</b>	SME110 + Intel 3D NAND	512Gb QDPx10	Intel 3D NAND	4.6	3.0	1.6
<b>3840GB</b>	SME110 + Intel 3D NAND	512Gb ODPx10	Intel 3D NAND	5.1	3.5	1.8
<b>480GB</b>	SME100 + TMC 3D eTLC	256Gb QDPx5	TSB 3D eTLC	3.2	2.5	1.4
<b>960GB</b>	SME100 + TMC 3D eTLC	256Gb QDPx10	TSB 3D eTLC	3.8	2.7	1.5
<b>1920GB</b>	SME100 + TMC 3D eTLC	256Gb ODPx10	TSB 3D eTLC	4.5	3.0	1.6

**NOTES:**

1. Use iometer with QD32 and worker 1 for 128KB sequential write test to measure the power of active write.
2. Use iometer with QD32 and worker 1 for 4KB random read test to measure the power of active read.
3. The power of idle is measured with DIPM off.
4. Power Consumption may differ according to flash configuration and platform.
5. The average value of power consumption is achieved based on 100% conversion efficiency.
6. The measured power voltage of 2.5" SSD is 5V.

## 5. INTERFACE



### 5.1. Pin Assignment and Descriptions

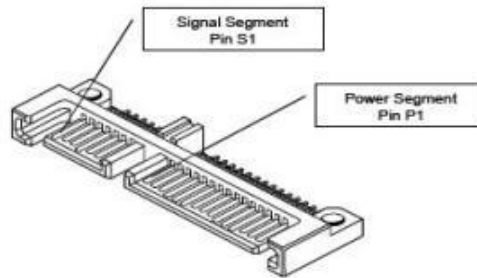


Figure 5-1 2.5" SATA SSD Pin Assignment

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 Signal Segment Pin Assignment and Description

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	Support	Description	Op Code	Support	Description	
00h	Y	NOP	B6h	12h	-	NV Cache: QUERY NV CACHE PINNED SET DMA EXT
03h	-	CFA REQUEST EXTENDED ERROR	B6h	13h	-	NV Cache: QUERY NV CACHE MISSES DMA EXT
06h	Y	DATA SET MANAGEMENT	B6h	14h	-	NV Cache: FLUSH NV CACHE
08h	-	DEVICE RESET	C4h	Y	READ MULTIPLE	
0Bh	-	REQUEST SENSE DATA EXT	C5h	Y	WRITE MULTIPLE	
10h	Y	RECALIBRATE	C6h	Y	SET MULTIPLE MODE	
11h-1Fh	-	RECALIBRATE	C7h	-	READ DMA QUEUED	
20h	Y	READ SECTOR(S)	C8h	Y	READ DMA	
21h	Y	READ SECTOR(S) WITHOUT RETRY	C9h	Y	READ DMA WITHOUT RETRY	
22h	-	READ LONG	CAh	Y	WRITE DMA	
23h	-	READ LONG WITHOUT RETRY	CBh	Y	WRITE DMA WITHOUT RETRY	
24h	Y	READ SECTOR(S) EXT	CCh	-	WRITE DMA QUEUED	
25h	Y	READ DMA EXT	CDh	-	CFA WRITE MULTIPLE WITHOUT ERASE	
26h	-	READ DMA QUEUED EXT	CEh	Y	WRITE MULTIPLE FUA EXT	
27h	Y	READ NATIVE MAX ADDRESS EXT	D1h	-	CHECK MEDIA CARD TYPE	
29h	Y	READ MULTIPLE EXT	DAh	-	GET MEDIA STATUS	
2Ah	-	READ STREAM DMA EXT	DEh	-	MEDIA LOCK	
2Bh	-	READ STREAM EXT	DFh	-	MEDIA UNLOCK	
2Fh	Y	READ LOG EXT	E0h	Y	STANDBY IMMEDIATE	
30h	Y	WRITE SECTOR(S)	E1h	Y	IDLE IMMEDIATE	
31h	Y	WRITE SECTOR(S) WITHOUT RETRY	E2h	Y	STANDBY	
32h	-	WRITE LONG	E3h	Y	IDLE	
33h	-	WRITE LONG WITHOUT RETRY	E4h	Y	READ BUFFER	
34h	Y	WRITE SECTOR(S) EXT	E5h	Y	CHECK POWER MODE	
35h	Y	WRITE DMA EXT	E6h	Y	SLEEP	
36h	-	WRITE DMA QUEUED EXT	E7h	Y	FLUSH CACHE	
37h	Y	SET MAX ADDRESS EXT	E8h	Y	WRITE BUFFER	
38h	-	CFA WRITE SECTORS WITHOUT ERASE	E9h	Y	READ BUFFER DMA	
39h	Y	WRITE MULTIPLE EXT	EAh	Y	FLUSH CACHE EXT	

Op Code	Support	Description	Op Code	Support	Description		
3Ah	-	WRITE STREAM DMA EXT	EBh	Y	WRITE BUFFER DMA		
3Bh	-	WRITE STREAM EXT	ECh	Y	IDENTIFY DEVICE		
3Ch	-	WRITE VERIFY	EDh	-	MEDIA EJECT		
3Dh	Y	WRITE DMA FUA EXT	EEh	-	IDENTIFY DEVICE DMA		
3Eh	-	WRITE DMA QUEUED FUA EXT	EFh	01h	-	SET FEATURES: Enable 8-bit PIO transfer mode (CFA feature set only)	
3Fh	Y	WRITE LOG EXT	EFh	02h	Y	SET FEATURES: Enable write cache	
40h	Y	READ VERIFY SECTOR(S)	EFh	03h	Y	SET FEATURES: Set transfer mode based on value in Count field	
41h	Y	READ VERIFY SECTOR(S) WITHOUT RETRY	EFh	05h	Y	SET FEATURES: Enable advanced power management	
42h	Y	READ VERIFY SECTOR(S) EXT	EFh	06h	-	SET FEATURES: Enable Power-Up In Standby feature set	
44h	-	Reserved	EFh	07h	-	SET FEATURES: Power-Up In Standby feature set device spin-up	
45h	O	WRITE UNCORRECTABLE EXT	EFh	0Ah	-	SET FEATURES: Enable CFA power mode 1	
47h	Y	READ LOG DMA EXT	EFh	0Bh	-	SET FEATURES: Enable Write-Read-Verify feature set	
50h	-	FORMAT TRACK	EFh	10h	01h	-	SET FEATURES: Enable use of Serial ATA feature
51h	-	CONFIGURE STREAM	EFh	10h	02h	Y	SET FEATURES: Enable DMA Setup FIS Auto-Activate optimization
57h	Y	WRITE LOG DMA EXT	EFh	10h	03h	Y	SET FEATURES: Enable Device-initiated interface power state (DIPM) transitions
60h	Y	READ FPDMA QUEUED	EFh	10h	04h	-	SET FEATURES: Enable use of Serial ATA feature
61h	Y	WRITE FPDMA QUEUED	EFh	10h	05h	-	SET FEATURES: Enable use of Serial ATA feature
70h	Y	SEEK	EFh	10h	06h	O	SET FEATURES: Enable Software Settings Preservation (SSP)
71-76h	-	SEEK	EFh	10h	07h	Y	SET FEATURES: Enable Device Automatic Partial to Slumber transitions
77h	Y	SET DATE AND TIME EXT	EFh	10h	09h	O	SET FEATURES: Enable Device Sleep

Op Code		Support	Description	Op Code		Support	Description	
78h		Y	ACCESSIBLE MAX ADDRESS CONFIGURATION	EFh	42h	-	SET FEATURES: Enable Automatic Acoustic Management feature set	
79-7Fh		-	SEEK	EFh	43h	-	SET FEATURES: Set Maximum Host Interface Sector Times	
87h		-	CFA TRANSLATE SECTOR	EFh	44h	-	SET FEATURES: Vendor Specific ECC byte	
90h		Y	EXECUTE DEVICE DIAGNOSTIC	EFh	55h	Y	SET FEATURES: Disable read look-ahead feature	
91h		Y	INITIALIZE DEVICE PARAMETERS	EFh	5Dh	-	SET FEATURES: Enable release interrupt	
92h		Y	DOWNLOAD MICROCODE	EFh	5Eh	-	SET FEATURES: Enable service interrupt	
93h		Y	DOWNLOAD MICROCODE DMA	EFh	5Fh	-	SET FEATURES: Enable NDRQ Feature	
94h		-	STANDBY IMMEDIATE	EFh	66h	Y	SET FEATURES: Disable reverting to power-on defaults	
95h		-	IDLE IMMEDIATE	EFh	81h	-	SET FEATURES: Disable 8-bit PIO transfer mode (CFA feature set only)	
96h		-	STANDBY	EFh	82h	Y	SET FEATURES: Disable write cache	
97h		-	IDLE	EFh	85h	Y	SET FEATURES: Disable advanced power management	
98h		-	CHECK POWER MODE	EFh	86h	-	SET FEATURES: Disable Power-Up In Standby feature set	
99h		-	SLEEP	EFh	8Ah	-	SET FEATURES: Disable CFA power mode	
A0h		-	PACKET	EFh	8Bh	-	SET FEATURES: Disable Write-Read-Verify feature set	
A1h		-	IDENTIFY PACKET DEVICE	EFh	90h	01h	-	SET FEATURES: Disable use of Serial ATA feature
A2h		-	SERVICE	EFh	90h	02h	Y	SET FEATURES: Disable DMA Setup FIS Auto-Activate optimization
B0h	D0h	Y	SMART: READ DATA	EFh	90h	03h	Y	SET FEATURES: Disable Device-initiated interface power state (DIPM) transitions
B0h	D1h	Y	SMART: READ ATTRIBUTE THRESHOLDS	EFh	90h	04h	-	SET FEATURES: Disable use of Serial ATA feature

Op Code		Support	Description	Op Code			Support	Description
B0h	D2h	Y	SMART: ENABLE/DISABLE AUTOSAVE	EFh	90h	05h	-	SET FEATURES: Disable use of Serial ATA feature
B0h	D3h	Y	SMART: SAVE ATTRIBUTE VALUES	EFh	90h	06h	Y	SET FEATURES: Disable Software Settings Preservation (SSP)
B0h	D4h	Y	SMART: EXECUTE OFF-LINE IMMEDIATE	EFh	90h	07h	Y	SET FEATURES: Disable Device Automatic Partial to Slumber transitions
B0h	D5h	Y	SMART: READ LOG	EFh	90h	09h	O	SET FEATURES: Disable Device Sleep
B0h	D6h	Y	SMART: WRITE LOG	EFh	AAh		Y	SET FEATURES: Enable read look-ahead feature
B0h	D8h	Y	SMART: ENABLE OPERATIONS	EFh	BBh		-	SET FEATURES: Default ECC byte
B0h	D9h	Y	SMART: DISABLE OPERATIONS	EFh	C2h		-	SET FEATURES: Disable Automatic Acoustic Management feature set
B0h	DAh	Y	SMART: RETURN STATUS	EFh	C3h		-	SET FEATURES: Enable/Disable the Sense Data Reporting feature set
B0h	DBh	Y	SMART: ENABLE/DISABLE AUTOMATIC OFF-LINE	EFh	CCh		Y	SET FEATURES: Enable reverting to power-on defaults
B0h	E0h	-	SMART: Vendor specific	EFh	DDh		-	SET FEATURES: Disable release interrupt
B1h	C0h	Y	DEVICE CONFIGURATION: RESTORE	EFh	DEh		-	SET FEATURES: Disable SERVICE interrupt
B1h	C1h	Y	DEVICE CONFIGURATION: FREEZE LOCK	EFh	DFh		-	SET FEATURES: Disable NDRQ Feature
B1h	C2h	Y	DEVICE CONFIGURATION: IDENTIFY	F1h			Y	SECURITY SET PASSWORD
B1h	C3h	Y	DEVICE CONFIGURATION: SET	F2h			Y	SECURITY UNLOCK
B1h	C4h	Y	DEVICE CONFIGURATION: IDENTIFY DMA	F3h			Y	SECURITY ERASE PREPARE
B1h	C5h	Y	DEVICE CONFIGURATION: SET DMA	F4h			Y	SECURITY ERASE UNIT
B4h	0000h	O	SANITIZE DEVICE: SANITIZE STATUS EXT	F5h			Y	SECURITY FREEZE LOCK
B4h	0011h	O	SANITIZE DEVICE: CRYPTO SCRAMBLE EXT	F6h			Y	SECURITY DISABLE PASSWORD
B4h	0012h	O	SANITIZE DEVICE: BLOCK ERASE EXT	F8h			Y	READ NATIVE MAX ADDRESS
B4h	0014h	O	SANITIZE DEVICE: OVERWRITE EXT	F9h	00h		Y	SET MAX: SET MAX ADDRESS

Op Code		Support	Description	Op Code		Support	Description
B4h	0020h	O	SANITIZE DEVICE: SANITIZE FREEZE LOCK EXT	F9h	01h	Y	SET MAX: SET MAX PASSWORD
B4h	0040h	O	SANITIZE DEVICE: SANITIZE ANTIFREEZE LOCK EXT	F9h	02h	Y	SET MAX: SET MAX LOCK
B6h	00h	-	NV Cache: SET NV CACHE POWER MODE EXT	F9h	03h	Y	SET MAX: SET MAX UNLOCK
B6h	01h	-	NV Cache: RETURN FROM NV CACHE POWER MODE EXT	F9h	04h	Y	SET MAX: SET MAX FREEZE LOCK
B6h	10h	-	NV Cache: ADD LBA(S) TO NV CACHE PINNED SET DMA EXT	F9h	05h	Y	SET MAX: SET MAX SET PASSWORD DMA
B6h	11h	-	NV Cache: REMOVE LBA(S) FROM NV CACHE PINNED SET DMA EXT	F9h	06h	Y	SET MAX: SET MAX UNLOCK DMA

NOTE: "Y" means "Support".

"O" means "Option, default No support".

"-" means "No support".

## 6.2. Identify Device Command

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	ATA Identify Parameter
0	F	0040h	General configuration
1	X	*1	Number of cylinders in the default CHS translation
2	F	C837h	Specific configuration
3	X	0010h	Number of heads in the default CHS translation
4..5	X	0000h	Retired
6	X	003Fh	Number of sectors per track in the default CHS translation
7..8	X	0000h	Reserved for CFA
9	X	0000h	Retired
10..19	V	ASCII	Serial number
20..21	X	0000h	Retired
22	X	0000h	Obsolete
23..26	V	ASCII	Firmware revision
27..46	V	ASCII	Model number
47	X	8010h	READ/WRITE MULTIPLE commands function
48	F	4000h	Trusted Computing feature set options
49	F	2F00h	Capabilities
50	F	4000h	Capabilities
51..52	X	0000h	Obsolete
53	F	0007h	Field validity
54	X	*1	Number of current logical cylinders
55	X	0010h	Number of current logical heads
56	X	003Fh	Number of current sectors per track
57..58	X	*2	Current capacity in sectors
59	V	0110h	Multiple sector setting
60..61	V	*3	Total number of user addressable logical sectors for 28-bit commands
62	X	0000h	Obsolete
63	V	0407h	Multiword DMA transfer modes

Word	F: Fixed V: Variable X: retired/obsolete /reserved	Default Value	ATA Identify Parameter
64	F	0003h	Advanced PIO modes modes
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	5D20h	Additional Supported
70..74	X	0000h	Reserved
75	F	001Fh	Queue depth
76	V	E50Eh	Serial SATA capabilities
77	V	0006/0004/0002 h	Serial ATA Additional Capabilities
78	V	004Ch	Serial ATA features supported
79	F	0040h	Serial ATA features enabled
80	F	07F8h	Major version number
81	F	0000h	Minor version number
82	F	746Bh	Commands and feature sets supported
83	F	7D09h	Commands and feature sets supported
84	F	4163h	Commands and feature sets supported
85	F	7469h	Commands and feature sets supported or enabled
86	F	BC09h	Commands and feature sets supported or enabled
87	F	4163h	Commands and feature sets supported or enabled
88	F	007Fh	Ultra DMA Modes
89	F	0001h	Time required for Normal Erase mode SECURITY ERASE UNIT command
90	F	0001h	Time required for Enhanced Erase mode SECURITY ERASE UNIT command
91	F	00FEh	Current APM (advanced power management) level value
92	F	FFFEh	Master password identifier
93	F	0000h	Hardware reset result.

Word	F: Fixed V: Variable X: retired/obsolete /reserved	Default Value	ATA Identify Parameter
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	0000h	Streaming Performance Granularity
100..103	V	<b>*4</b>	Number of User Addressable Logical Sectors
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/IEC 7779 standard acoustic testing
108..111	V	0000h	World Wide Name
112..115	X	0000h	Reserved
116	X	0000h	Obsolete
117..118	F	0000h	Logical sector size
119	V	4019h	Commands and feature sets supported
120	V	4019h	Commands and feature sets supported or enabled
121..126	X	0000h	Reserved for expanded supported and enabled settings
127	X	0000h	Obsolete
128	F	0021h	Security status
129..159	V	0000h	Vendor specific
160..167	X	0000h	Reserved for CFA
168	V	Varies	Device Nominal Form Factor shows as below: Nominal Form Factor not reported: 0000h 1.25 inch: 0001h 1.5 inch: 0002h 2.5 inch: 0003h 1.8 inch: 0004h mSATA and others: 0005h
169	F	0001h	DATA SET MANAGEMENT command is support
170..173	F	0000h	Additional Product Identifier
174..175	X	0000h	Reserved

Word	F: Fixed V: Variable X: retired/obsolete /reserved	Default Value	ATA Identify Parameter
176..205	F	0000h	Current media serial number
206	V	0000h	SCT Command Transport
207..208	X	0000h	Reserved
209	F	4000h	Alignment of logical sectors within a physical sector
210..211	F	0000h	Write-Read-Verify Sector Mode 3 Count
212..213	F	0000h	Write-Read-Verify Sector Mode 2 Count
214..216	X	0000h	Obsolete
217	F	0001h	Nominal media rotation rate
218	X	0000h	Reserved
219	X	0000h	Obsolete
220	V	0000h	Current mode of the Write-Read-Verify feature set
221	X	0000h	Reserved
222	V	107Fh	Transport major version number
223	F	0000h	Transport minor version number
224..229	X	0000h	Reserved
230..233	F	0000h	Extend Number of User Addressable Sectors
234	F	0001h	Minimum number of 512-byte data blocks per Download Microcode operation
235	F	1000h	Maximum number of 512-byte data blocks per Download Microcode operation
236..242	X	0000h	Reserved
243	F	4000h	Security feature 4000 : Self Encrypting Drive
244..254	F	0000h	Reserved
255	V	XXA5h XX is variable	Integrity word (Checksum and Signature)

**Table 6-3 List of Device Identification for Each Capacity**

Capacity (GB)	*1 (Word 1/Word 54)	*2 (Word 57 – 58)	*3 (Word 60 – 61)	*4 (Word 100 – 103)
240	3FFFh	FBFC10h	FFFFFFFh	1BF244B0h
480	3FFFh	FBFC10h	FFFFFFFh	37E436B0
960	3FFFh	FBFC10h	FFFFFFFh	6FC81AB0
1920	3FFFh	FBFC10h	FFFFFFFh	DF8FE2B0
3840	3FFFh	FBFC10h	FFFFFFFh	1BF1F72B0

### 6.3. SMART Attributes

**Table 6-4 SMART Attributes**

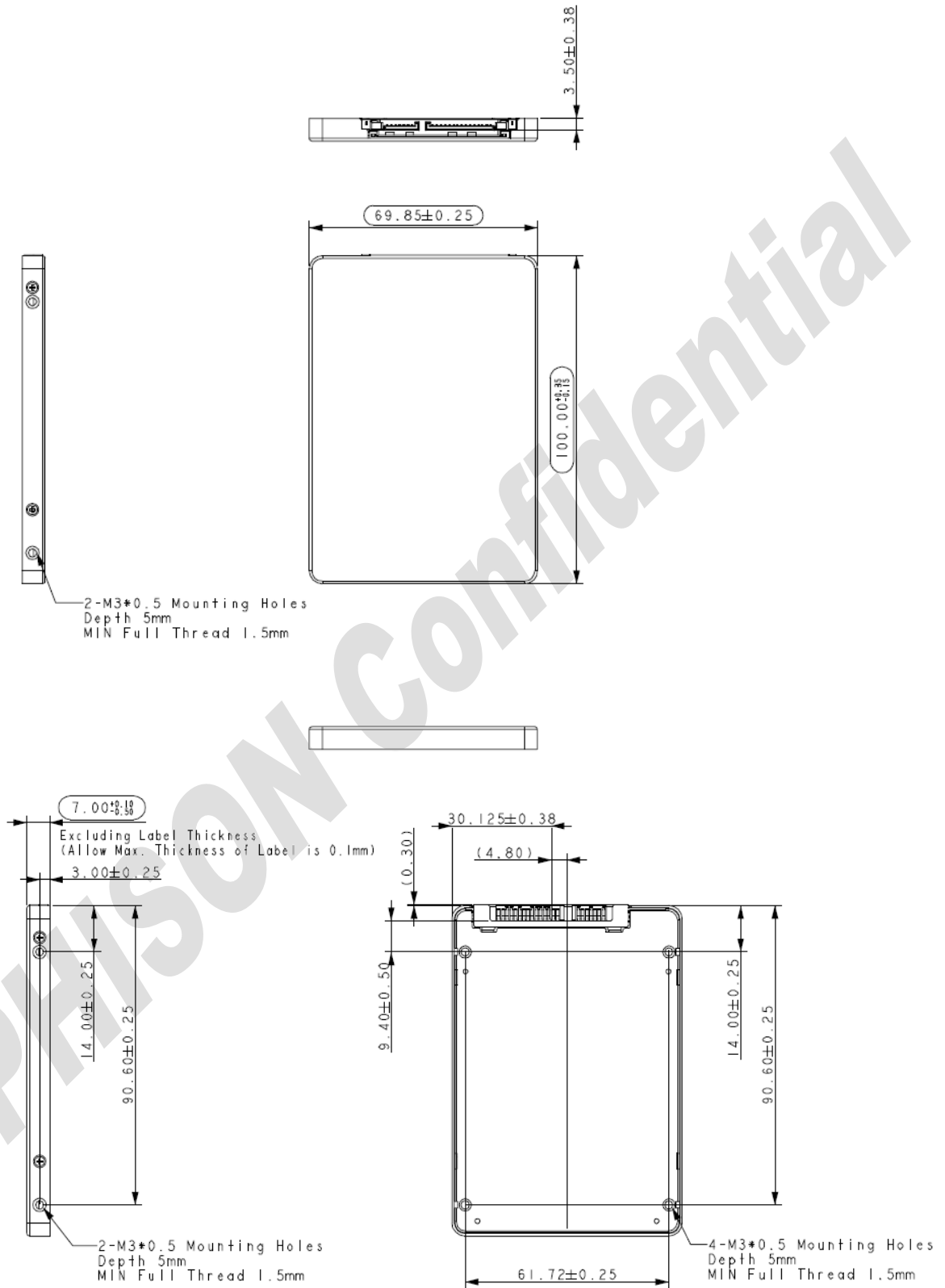
Attribute ID	Description
01h	Number of Accumulation of Uncorrectable Error.
09h	Power on Hours Count.
0Ch	Drive Power Cycle Count (number of accumulation of power on/off cycles)
A8h	SATA PHY Error Count (Only record from power on, when power off this value will clear to zero. These values include all PHY error count, ex data FIS CRC, code error, disparity error, command FIS CRC.....)
AAh	Bad Block Count (early bad count and later bad count)
ADh	Erase Count (max. erase count and average erase count)
C0h	Number of Unexpected Power Loss
C2h	Temperature (show 33C if no thermal sensor)
DAh	Number of Accumulation CRC Error (read/write data FIS CRC error)
E7h	SSD Life Remaining
F1h	Host Write (GB)

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## 7. PHYSICAL DIMENSION



- ❖ 2.5" SSD: 100.00mm (L) x 69.85mm (W) x 7.00mm (H)



## 8. PRODUCT WARRANTY POLICY

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In the event the Product does not conform to the specification within Phison agreed warranty period and such inconformity is solely attributable to Phison's cause, Phison 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) alteration, modification, improper use, misuse or excessive use of the Product;
- (2) failure to comply with Phison's instructions;
- (3) Phison'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 Phison; or
- (5) other error or failure not solely attributable to Phison's cause (including without limitation, normal wear or tear, manufacturing or assembly wastage, improper operation, virus, unauthorized maintenance or repair).

EXCEPT FOR THE ABOVE EXPRESS LIMITED WARRANTY, THE PRODUCT IS PROVIDED "AS IS," AND PHISON MAKES NO OTHER WARRANTIES (WHETHER EXPRESS, IMPLIED, STATUTORY OR OTHERWISE) REGARDING THE PRODUCT OR ANY PORTION OF IT. PHISON SPECIFICALLY DISCLAIMS ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NONINFRINGEMENT. UNLESS OTHERWISE PHISON AGREED IN WRITING, PHISON DOES NOT RECOMMEND NOR WARRANT PRODUCTS FOR USE IN LIFE SUPPORT, NUCLEAR, MEDICAL, MILITARY, TRANSPORTATION, AUTOMOTIVE, AVIATION, AEROSPACE INDUSTRY OR OTHER APPLICATIONS WHEREIN A FAILURE OR DEFECT OF THE PRODUCT MAY THREATEN LIFE, INJURY, HEALTH, LOSS OF SIGNIFICANT AMOUNT OF MONEY ("CRITICAL USE"), AND CUSTOMER AND USER HEREBY ASSUMES ALL RISK OF ANY CRITICAL USE OF THE PRODUCT.

## 9. REFERENCE

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

**Table 9-1 List of References**

Title	Acronym/Source
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>

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## 10. TERMINOLOGY

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

**Table 10-1 List of Terminology**

<b>Term</b>	<b>Definitions</b>
LBA	Logical block addressing
MB	Mega-byte
GB	Giga-byte
TB	Tera-byte
MTBF	Mean time between failures
S.M.A.R.T.	Self-monitoring, analysis and reporting technology
SSD	Solid state disk

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