

MZ7KH3T8HALS-00005
MZ7KH1T9HAJR-00005
MZ7KH960HAJR-00005
MZ7KH480HAHQ-00005
MZ7KH240HAHQ-00005

2.5" SATA 6Gbps SM883

SAMSUNG Solid State Drive

datasheet

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SAMSUNG Solid State Drive SM883 Features

| Part Number | Capacity ¹⁾ |
|--------------------|------------------------|
| MZ7KH3T8HALS-00005 | 3,840GB |
| MZ7KH1T9HAJR-00005 | 1,920GB |
| MZ7KH960HAJR-00005 | 960GB |
| MZ7KH480HAHQ-00005 | 480GB |
| MZ7KH240HAHQ-00005 | 240GB |

FEATURES

- SATA 6Gbps
- 2.5" 7mmT
- Fully Complies with ATA/ATAPI-7 Standard
- Fully Complies with Serial ATA 3.2 Standard
- Hardware based AES 256-bit Encryption Engine (optional)
- Support NCQ (up to 32 depth) Command Set
- Support TRIM Command
- RoHS Compliant

PERFORMANCE

- Data Transfer Rate
 - Sequential Read Up to 540 MB/s²⁾
 - Sequential Write Up to 520 MB/s²⁾
 - Random Read (8KB) Up to 57 KIOPS³⁾
 - Random Write (8KB) Up to 14 KIOPS³⁾
 - Random Read (4KB) Up to 97 KIOPS³⁾
 - Random Write (4KB) Up to 29 KIOPS³⁾
- IOPS Consistency (Read/Write @4KB) 99 / 97%
- Latency (Read/Write @4KB, QD1) 85 / 35us
- Quality of Service(99.99%)
 - Read (4KB, QD=1) 0.2 ms
 - Write (4KB, QD=1) 0.1 ms
 - Read (4KB, QD=32) 0.6 ms
 - Write (4KB, QD=32) 1.9 ms

RELIABILITY

- Non-recoverable Read Error 1 sector per 10¹⁷ bits read
- MTBF 2,000,000 hours
- TBW
 - (3840GB) 21,024 TB
 - (1920GB) 10,512 TB
 - (960GB) 5,256 TB
 - (480GB) 2,628 TB
 - (240GB) 1,314 TB

ENVIRONMENTAL SPECIFICATIONS⁴⁾

- Temperature
 - Operating 0 ~ 70 °C
 - Non-operating -40 ~ 85 °C
- Humidity (non-condensing) 5 ~ 95%
- Shock (1/2 sine pulse) 1,500 G (0.5ms)
- Vibration (non-operating)
 - 20 ~ 2,000 Hz (Sinusoidal) 20 Gpeak
 - 7~800Hz (Random) 2.17Grms

POWER REQUIREMENTS^{5) 6)}

- Supply Voltage +5V ± 5%
- Voltage Ripple/Noise (max.) 100mV p-p
- Active (Read) (Typ.) 2.8 W RMS
- Active (Write) (Typ.) 3.7 W RMS
- Idle (Typ.) 1.4 W

PHYSICAL DIMENSION

- Width 100.20 ± 0.25 mm
- Depth 69.85 ± 0.25 mm
- Height 6.80 ± 0.20 mm
- Weight Up to 60 g

NOTE: Specifications are subject to change without notice.

1) 1MB = 1,000,000 Bytes, 1GB = 1,000,000,000 Bytes, Unformatted Capacity.

User accessible capacity may vary depending on operating environment and formatting.

2) Sequential performance was measured by using FIO 2.7 in Linux CentOS 7.4 with 128KB (131,072 bytes) of data transfer size in Queue Depth=32 by 1 worker.

3) Random performance was measured by using FIO 2.7 in Linux CentOS 7.4 with 4KB (4,096 bytes), 8KB (8,192 bytes) of data transfer size in Queue Depth=32 by 1 workers. Measurements were performed on a full Logical Block Address (LBA) span of the drive in sustained state. The actual performance may vary depending on use conditions and environment.

4) Operating Temperature (0 ~ 70°C / Tc) is measured at the hottest point on the case. Sufficient airflow is recommended to be operated properly on heavier workloads within device operating temperature.

5) Active Read power is measured on 4 KB random read.

Active Write power is measured on 128 KB sequential write.

6) Idle power is measured with DIPM off.

IF THERE IS ANY OTHER OPERATION TO IMPLEMENT IN ADDITION TO SPECIFICATION IN THE DATASHEET OR JEDEC STANDARD, PLEASE CONTACT EACH BRANCH OFFICE OR HEADQUARTERS OF SAMSUNG ELECTRONICS.

datasheet

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1.0 Introduction

1.1 General Description

This document describes the specification of the SM883 SSD which use SATA 6Gb/s interface. SM883 are fully consist of semiconductor device and using NAND Flash Memory which has a high reliability and a high technology for a storage media. As the SSD doesn't have a moving parts such as platter(disk) and head media, it gives a good solution for a storage device with a high performance, high capacity. SM883 delivers 540GB/s for sequential read and 520GB/s for sequential write speed under up to 3.7W power.

1.2 Product List

| Form factor | Density | Part Number |
|-------------|---------|--------------------|
| 2.5" 7mmT | 3,840GB | MZ7KH3T8HALS-00005 |
| | 1,920GB | MZ7KH1T9HAJR-00005 |
| | 960GB | MZ7KH960HAJR-00005 |
| | 480GB | MZ7KH480HAHQ-00005 |
| | 240GB | MZ7KH240HAHQ-00005 |

1.3 Ordering Information

M Z X X X X X X X X X X - X X X X X
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

1. Memory (M)

2. Module Classification

Z: SSD

3. Form Factor

7: 2.5" 7mmT SATA

4. Line-Up

K: VM: Client/SV (VNAND 2bit MLC)

5. SSD CTRL

H: Maru,S.LSI

6~8. SSD Density

3T8: 3.84TB

1T9: 1.92TB

960: 960 GB

480: 480GB

240: 240GB

9. NAND PKG

H: BGA

10. Flash Generation

A : 2nd Generation

11~12. NAND Density

LS: 4T HDP 2CE(FBI)

JR: 2T ODP 2CE

HQ: 1T QDP 4CE

13. " - "

14. Default

"0"

15. HW revision

0: No revision

16. Packing type

0: Bulk

17~18. Customer

05: General SED

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2.0 Product Specifications

2.1 Interface and Compliance

- SATA 6.0Gbps
- Fully compatible with ATA/ATAPI-7 Standard
- Compatible with ATA/ATAPI-8 ACS4 Mandatory Command
- Native Command Queuing (NCQ) Command Set
- Support Data Set Management Command

2.2 Drive Capacity

[Table 1] User Capacity and Addressable Sectors

| | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB |
|---------------------------------|-------------|-------------|---------------|---------------|---------------|
| User-Addressable Sectors | 468,862,128 | 937,703,088 | 1,875,385,008 | 3,750,748,848 | 7,501,476,528 |
| Bytes per Sector | 512 Bytes | | | | |

NOTE:

- 1) Gigabyte (GB) = 1,000,000,000 Bytes, 1 Sector = 512Bytes.
- 2) Capacity shown in Table 1 represents the total usable capacity of the SSD which may be less than the total physical capacity. A certain area in physical capacity, not in the area shown to the user, might be used for the purpose of NAND flash management.
- 3) Max. LBA shown in Table 1 represents the total user addressable sectors in LBA mode and calculated by IDEMA rule.

2.3 System Performance

[Table 2] Sequential Read / Write Performance

| Read / Write | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB |
|---------------------------|---------|---------|---------|----------|----------|
| Sequential Read (128 KB) | 540MB/s | 540MB/s | 540MB/s | 540MB/s | 540MB/s |
| Sequential Write (128 KB) | 480MB/s | 520MB/s | 520MB/s | 520MB/s | 520MB/s |

NOTE:

- 1) Actual performance may vary depending on use conditions and environment.
- 2) Sequential performance was measured by using FIO 2.7 in Linux CentOS 7.4 (Kernel 3.10.0) with 128KB (131,072 bytes) of data transfer size in Queue Depth=32 by 1 worker.
- 3) 1 MB/sec = 1,048,576 bytes/sec was used in sequential performance.

[Table 3] Sustained Random Read / Write Performance

| Read / Write | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB |
|--------------------------|-------|-------|-------|----------|----------|
| Random Read IOPS (8 KB) | 57K | 57K | 57K | 57K | 57K |
| Random Write IOPS (8 KB) | 11K | 13K | 14K | 14K | 14K |
| Random Read IOPS (4 KB) | 97K | 97K | 97K | 97K | 97K |
| Random Write IOPS (4 KB) | 22K | 27K | 29K | 29K | 29K |

NOTE:

- 1) Actual performance may vary depending on use conditions and environment.
- 2) Random performance was measured by using FIO 2.7 in Linux CentOS 7.4 (Kernel 3.10.0) with 4KB(4,096 bytes) / 8KB(8,192 bytes) of data transfer size in Queue Depth=32 by 1 worker. Measurements were performed on a full Logical Block Address (LBA) span of the drive in sustained state. The actual performance may vary depending on use conditions and environment.

2.4 IOPS Consistency

| IOPS Consistency | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB |
|---------------------|-------|-------|-------|----------|----------|
| Random Read (4 KB) | 98% | 99% | 99% | 99% | 99% |
| Random Write (4 KB) | 93% | 97% | 97% | 97% | 97% |

NOTE:

- 1) IOPS consistency measured using FIO 2.7 in Linux CentOS 7.4 (Kernel 3.10.0) with 4KB (4,096 bytes) of data transfer size in Queue Depth=32 by worker 1.
- 2) IOPS Consistency (%) = (99.9% IOPS) / (Average IOPS) x 100.

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2.5 Latency

| Latency | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB |
|--------------|-------|-------|-------|----------|----------|
| Read (4 KB) | 85us | 85us | 85us | 85us | 85us |
| Write (4 KB) | 45us | 35us | 35us | 35us | 35us |

NOTE:
1) Random Latency is measured using FIO 2.7 in Linux CentOS 7.4 (Kernel 3.10.0) with 4KB (4,096 bytes) of data transfer size in Queue Depth=1 by worker 1.

2.6 Quality of Service (QoS)

| Quality of Service (99%) | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB |
|------------------------------|---------|---------|---------|----------|----------|
| Read (4 KB, QD=1) | 0.18 ms | 0.18 ms | 0.18 ms | 0.18 ms | 0.18 ms |
| Write (4 KB, QD=1) | 0.1 ms | 0.1 ms | 0.1 ms | 0.1 ms | 0.1 ms |
| Read (4 KB, QD=32) | 0.5 ms | 0.5 ms | 0.4 ms | 0.4 ms | 0.4 ms |
| Write (4 KB, QD=32) | 1.9 ms | 1.9 ms | 1.5 ms | 1.5 ms | 1.5 ms |
| Quality of Service (99.99 %) | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB |
| Read (4 KB, QD=1) | 0.25 ms | 0.2 ms | 0.2 ms | 0.2 ms | 0.2 ms |
| Write (4 KB, QD=1) | 0.1 ms | 0.1 ms | 0.1 ms | 0.1 ms | 0.1 ms |
| Read (4 KB, QD=32) | 0.7 ms | 0.6 ms | 0.6 ms | 0.6 ms | 0.6 ms |
| Write (4 KB, QD=32) | 2.4 ms | 1.9 ms | 1.9 ms | 1.8 ms | 1.9 ms |

NOTE:
1) QoS is measured using Fio 2.7 (99 and 99.99%) in CentOS 7.4 (Kernel 3.10.0) with 4KB(4,096 bytes) of data transfer size in Queue Depth 1, 32.
2) QoS is measured as the maximum round-trip time taken for 99 and 99.99% of commands to host.

2.7 Supply Voltage

[Table 4] Supply Voltage

| Item | Requirements |
|--------------------------|--------------------|
| Allowable voltage | 5.0 V ± 5% |
| Allowable noise / ripple | 100 mV p-p or less |

2.8 System Power Consumption

[Table 5] Power Consumption

| Read/Write | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB |
|----------------------------------|-------|-------|-------|----------|----------|
| Active Write ¹ (Typ.) | 2.5W | 2.8W | 2.9W | 3.0 W | 3.7 W |
| Active Read ² (Typ.) | 2.0W | 2.3W | 2.4W | 2.5 W | 2.8 W |
| Idle ³ | 1.3W | 1.3W | 1.3W | 1.4 W | 1.4 W |

NOTE:
1) Active Write power is measured on 128 KB sequential write (QD32, Worker1)
2) Active Read power is measured on 4 KB random read (QD4, Worker4)
3) Idle power is measured with DIPM off.
4)The Active and Idle power is defined as the highest averaged power value, which is the max RMS average value over 100ms duration.

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2.9 Inrush Current

[Table 6] Inrush Current

| Parameter | Requirements |
|----------------|--------------|
| Inrush Current | 1.2A, <1sec |

NOTE:

1) The measurement value of inrush current is also compatible with the standard specification of "Enterprise SSD Form Factor Version 1.0a" released by SSD Form Factor Working Group.

2.10 Environmental Specifications

[Table 7] Environmental Specifications

| Features | Operating | Non-Operating |
|--------------------------|---|-----------------|
| Temperature ¹ | 0 °C to 70 °C | -40 °C to 85 °C |
| Temperature Gradient | 30 °C /Hr | 30 °C /Hr |
| Humidity | 5% to 95%, non-condensing | |
| Shock | 1500 G, duration 0.5 ms, Half Sine Wave | |
| Vibration | 20G, 20 ~ 2,000 Hz, Sinusoidal 2.17Grms, 7~800Hz, Random | |

NOTE:

1) Operating Temperature (0 ~ 70°C / Tc) is measured at the hottest point on the case. Sufficient airflow is recommended to be operated properly on heavier workloads within device operating temperature.

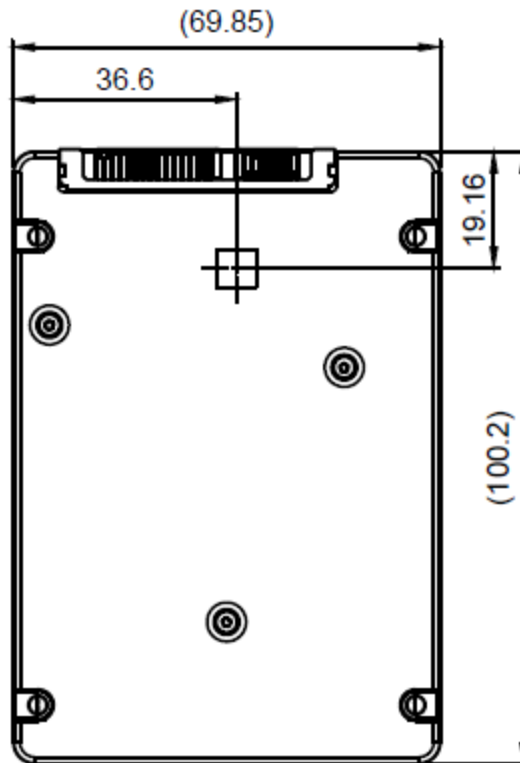


Figure 1. Standard Tcase point

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2.11 System Reliability

[Table 8] MTBF Specifications

| Parameter | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB |
|-----------|-----------------|-------|-------|----------|----------|
| MTBF | 2,000,000 Hours | | | | |

NOTE:

- 1) Mean Time between Failures (MTBF) is the estimated time between failures occurring during SSD operation.
- 2) Uncorrectable Bit Error Rate (UBER) is a metric for the rate of occurrence of data errors, equal to the number of data errors per bits read as specified in the JESD218 document of JEDEC standard.
- 3) MTBF is Mean Time Between Failure. As same word, annual failure ratio is 0.438%.

[Table 9] UBER Specifications

| Parameter | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB |
|-----------|----------------------------------|-------|-------|----------|----------|
| UBER | 1 sector per 10^{17} bits read | | | | |

NOTE:

- 1) Uncorrectable Bit Error Rate (UBER) is a metric for the rate of occurrence of data errors, equal to the number of data errors per bits read as specified in the JESD218 document of JEDEC standard. For the enterprise application, JEDEC recommends that UBER shall be below 10^{-16} .

[Table 10] TBW (TeraBytes Written) Specifications

| Parameter | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB |
|-----------|----------|----------|----------|-----------|-----------|
| TBW | 1,314 TB | 2,628 TB | 5,256 TB | 10,512 TB | 21,024 TB |

NOTE:

- 1) TBW is measured while running 100 % random 4 KB writes across the entire SSD.(TBW = DWPD x 365 x 5years x User capacity)

[Table 11] Drive Write Per Day (DWPD) Specifications

| Parameter | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB |
|-----------|--------------|-------|-------|----------|----------|
| DWPD | 3.0 (5Years) | | | | |

NOTE:

- 1) Data retention was measured by assuming that SSD reaches the maximum rated endurance at 40C in power-off state.

[Table 12] Data Retention Specifications

| Parameter | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB |
|----------------|---------|-------|-------|----------|----------|
| Data Retention | 3months | | | | |

NOTE:

- 1) Data retention was measured by assuming that SSD reaches the maximum rated endurance at 40°C in power-off state.

3.0 Mechanical Specification

[Table 13] Physical Dimensions and Weight

| Model | Height (mm) | Width (mm) | Length (mm) | Weight (gram) |
|---------------------------|-------------|--------------|---------------|---------------|
| 240/480/960/1,920/3,840GB | 6.80 ± 0.20 | 69.85 ± 0.25 | 100.20 ± 0.25 | Max 60g |

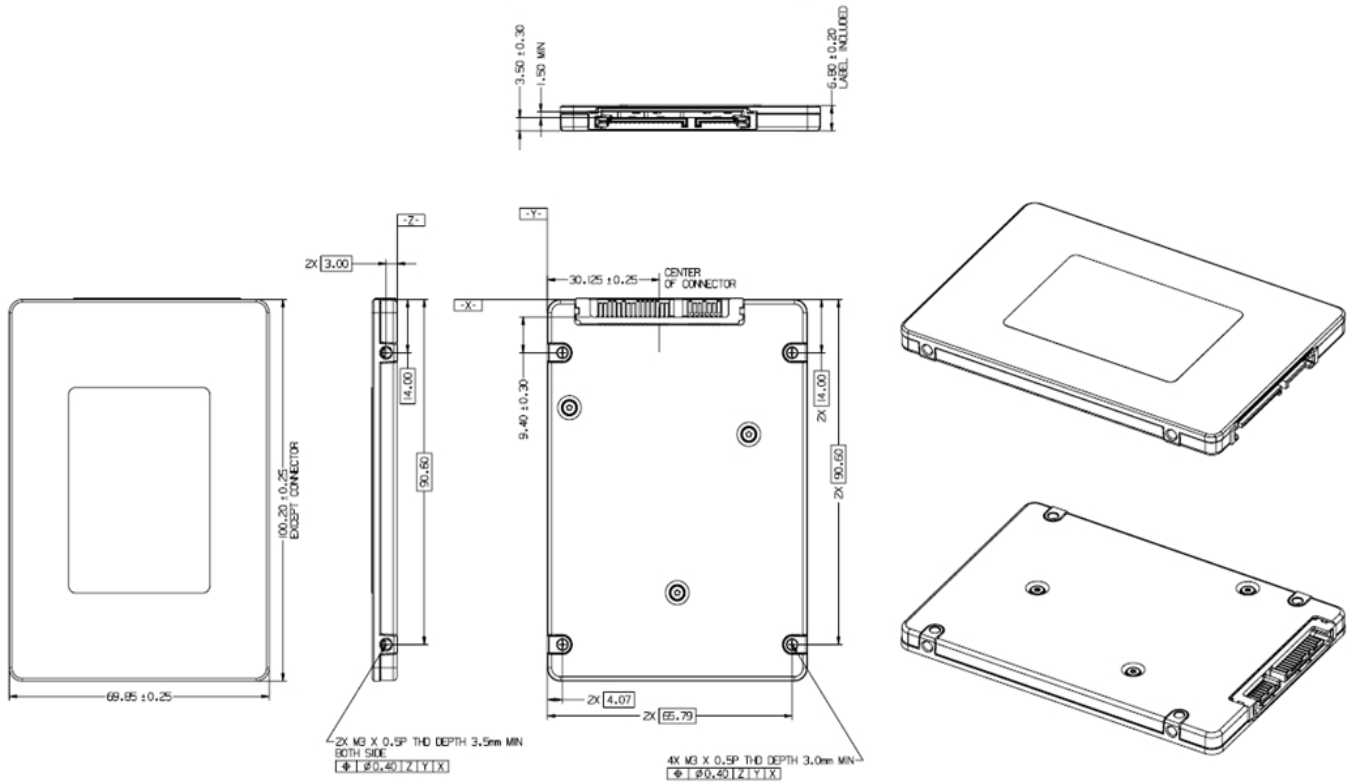


Figure 2. Physical Dimension

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4.0 Electrical Interface Specification

4.1 Serial ATA Interface Connector

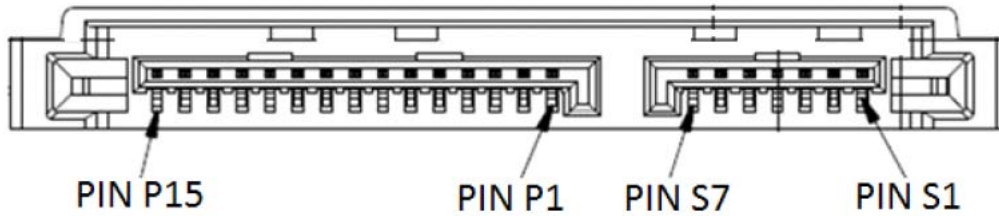


Figure 3. Drive Plug Connector

4.2 Pin Assignments

[Table 14] Pin Assignments

| Word | No. | Plug Connector pin definition | |
|--|-----|-------------------------------|---|
| Signal | S1 | GND | 2 nd mate |
| | S2 | A + | Differential signal A from Phy |
| | S3 | A - | |
| | S4 | GND | 2 nd mate |
| | S5 | B - | Differential signal B from Phy |
| | S6 | B + | |
| | S7 | GND | 2 nd mate |
| Key and spacing separate signal and power segments | | | |
| Power | P1 | Retired | 3rd Mate |
| | P2 | Retired | 3rd Mate |
| | P3 | DEVSLP/PWDIS | 2 nd mate (Not Support DEVSLP) |
| | P4 | GND | 1 st mate |
| | P5 | GND | 2 nd mate |
| | P6 | GND | 2 nd mate |
| | P7 | V5 | 5 V power, pre-charge, 2 nd mate |
| | P8 | V5 | 5 V power |
| | P9 | V5 | 5 V power |
| | P10 | GND | 2 nd mate |
| | P11 | DAS / DSS | Device Activity Signal |
| | P12 | GND | 1 st mate |
| | P13 | V12 | 12 V power, pre-charge, 2 nd mate (Unused) |
| | P14 | V12 | 12 V power (Unused) |
| | P15 | V12 | 12 V power (Unused) |

NOTE:

1. Uses 5 V power only. 3.3 V and 12 V power are not used

4.3 P3 Electrical Specification

| Parameter | Value | Parameter | Value |
|--------------------------------|-------|-------------------------------|-------|
| Absolute Maximum Input Voltage | 3.6V | VIH(HIGH Level Input Voltage) | 2.03V |
| VIL(LOW Level Input Voltage) | 1.98V | Deglintch Time | 5us |

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5.0 Command Descriptions

5.1 Supported ATA Commands

[Table 15] Supported ATA Commands Summary

| Command Name | Command Code (Hex) | Command Name | Command Code (Hex) |
|---------------------------------|--------------------|---------------------------|--------------------|
| CHECK POWER MODE | E5h / 98h | SEND FPDMA QUEUED | 64h |
| DEVICE CONFIGURATION | B1h | SET DATE N TIME | 77h |
| DOWNLOAD MICROCODE | 92h | SET FEATURES | EFh |
| DOWNLOAD MICROCODE DMA | 93h | SET MAX ADDRESS | F9h |
| EXECUTE DEVICE DIAGNOSTIC | 90h | SET MAX ADDRESS EXT | 37h |
| FLUSH CACHE | E7h | SET MULTIPLE MODE | C6h |
| FLUSH CACHE EXT | EAh | SLEEP | E6h / 99h |
| IDENTIFY DEVICE | ECh | S.M.A.R.T. | B0h |
| IDLE | E3h / 97h | STANDBY | E2h / 96h |
| IDLE IMMEDIATE | E1h / 95h | STANDBY IMMEDIATE | E0h / 94h |
| INITIALIZE DEVICE PARMETERS | 91h | TRIM | 06h |
| READ BUFFER | E4h | WRITE BUFFER | E8h |
| READ BUFFER DMA | E9h | WRITE BUFFER DMA | EBh |
| READ DMA | C8h | WRITE DMA | CAh |
| READ DMA (w/o retry) | C9h | WRITE DMA (w/o retry) | CBh |
| READ DMA EXT | 25h | WRITE DMA EXT | 35h |
| READ FPDMA QUEUED | 60h | WRITE DMA FUA EXT | 3Dh |
| READ LOG DMA EXT | 47h | WRITE FPDMA QUEUED | 61h |
| READ LOG EXT | 2Fh | WRITE LOG DMA EXT | 57h |
| READ MULTIPLE | C4h | WRITE LOG EXT | 3Fh |
| READ MULTIPLE EXT | 29h | WRITE MULTIPLE | C5h |
| READ NATIVE MAX ADDRESS | F8h | WRITE MULTIPLE EXT | 39h |
| READ NATIVE MAX ADDRESS EXT | 27h | WRITE MULTIPLE FUA EXT | CEh |
| READ SECTORS | 20h | WRITE SECTORS | 30h |
| READ SECTORS (w/o retry) | 21h | WRITE SECTORS (w/o retry) | 31h |
| READ SECTORS EXT | 24h | WRITE SECTORS EXT | 34h |
| READ VERIFY SECTORS | 40h | WRITE UNCORRECTABLE EXT | 45h |
| READ VERIFY SECTORS (w/o retry) | 41h | | |
| READ VERIFY SECTORS EXT | 42h | | |
| RECALIBRATE | 10h | | |
| NCQ NONDATA | 63h | | |
| SANITIZE DEVICE | B4h | | |
| SECURITY DISABLE PASSWORD | F6h | | |
| SECURITY ERASE PREPARE | F3h | | |
| SECURITY ERASE UNIT | F4h | | |
| SECURITY FREEZE LOCK | F5h | | |
| SECURITY SET PASSWORD | F1h | | |
| SECURITY UNLOCK | F2h | | |
| SEEK | 70h | | |

5.2 Individual Attribute Data Structure

The following defines the 12 bytes that make up the information for each Attribute entry in the Device Attribute Data Structure.

[Table 16] Attribute Entry in Device Attribute Data Structure

| Byte | Descriptions |
|--------|--|
| 0 | Attribute ID number 01-FFh |
| 1 - 2 | Status flag bit 0 (pre-failure / advisory bit) bit 0 = 0: If attribute value is less than the threshold, the drive is in advisory condition. Product life period may expired. bit 0 = 1: If attribute value is less than the threshold, the drive is in pre-failure condition. The drive may have failure. bit 1 (on-line data collection bit) bit 1 = 0: Attribute value will be changed during off-line data collection operation. bit 1 = 1: Attribute value will be changed during normal operation. bit 2 (Performance Attribute bit) bit 3 (Error rate Attribute bit) bit 4 (Event Count Attribute bit) bit 5 (Self-Preserving Attribute bit) bit 6 - 15 Reserved |
| 3 | Attribute value 01h - FDh *1 00h, FEh, FFh = Not in use 01h = Minimum value 64h = Initial value Fdh = Maximum value |
| 4 | Worst Ever normalized Attribute Value (valid values from 01h - FEh) |
| 5 - 10 | Raw Attribute Value Attribute specific raw data (FFFFFFh - reserved as saturated value) |
| 11 | Reserved (00h) |

*1 For ID = 199 CRC Error Count

The device supports following Attribute ID Numbers.

[Table 17] SMART Attributes

| ID (Word) | Attribute Name | Status Flag | Threshold (%) |
|-----------|--|-------------|---------------|
| 5 | Reallocated Sector Count | 110011 | 10 |
| 9 | Power-on Hours | 110010 | - |
| 12 | Power-on Count | 110010 | - |
| 177 | Wear Leveling Count | 010011 | 5 |
| 179 | Used Reserved Block Count (total) | 010011 | 10 |
| 180 | Unused Reserved Block Count (total) | 010011 | 10 |
| 181 | Program Fail Count (total) | 110010 | 10 |
| 182 | Erase Fail Count (total) | 110010 | 10 |
| 183 | Runtime Bad Count (total) | 010011 | 10 |
| 184 | End to End Error data path Error Count | 110011 | 97 |
| 187 | Uncorrectable Error Count | 110010 | - |
| 190 | Air Flow Temperature | 110010 | - |
| 194 | Temperature | 100010 | - |
| 195 | ECC Error Rate | 011010 | - |
| 197 | Pending Sector Count | 110010 | - |
| 199 | CRC Error Count | 111110 | - |
| 202 | SSD Mode Status | 110011 | 10 |
| 235 | Power Recovery Count | 010010 | - |
| 241 | Total LBA Written | 110010 | - |
| 242 | Total LBA Read | 110010 | - |
| 243 | SATA Downshift Control | 110010 | - |
| 244 | Thermal Throttle Status | 110010 | - |
| 245 | Timed Workload Media Wear | 110010 | - |
| 246 | Timed Workload Host Read / Write Ratio | 110010 | - |
| 247 | Timed Workload Timer | 110010 | - |
| 251 | NAND Writes | 110010 | - |

6.0 Identify Device Data

[Table 18] Identify Device Data

| Word | 240GB | 480GB | 960 GB | 1,920 GB | 3,840GB | General Information |
|---------|-------|-------|--------|----------|---------|---|
| 0 | 0040h | 0040h | 0040h | 0040h | 0040h | Obsolete |
| 1 | 3FFFh | 3FFFh | 3FFFh | 3FFFh | 3FFFh | Obsolete |
| 2 | C837h | C837h | C837h | C837h | C837h | Obsolete |
| 3 | 0010h | 0010h | 0010h | 0010h | 0010h | Retired |
| 4 - 5 | 0000h | 0000h | 0000h | 0000h | 0000h | Obsolete |
| 6 | 003Fh | 003Fh | 003Fh | 003Fh | 003Fh | Obsolete |
| 7 - 8 | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved for the Compact Flash Association |
| 9 | 0000h | 0000h | 0000h | 0000h | 0000h | Retired |
| 10 - 19 | XXXXh | XXXXh | XXXXh | XXXXh | XXXXh | Serial Number (ATA string) |
| 20-21 | 0000h | 0000h | 0000h | 0000h | 0000h | Obsolete |
| 22 | 0000h | 0000h | 0000h | 0000h | 0000h | Obsolete |
| 23-26 | XXXXh | XXXXh | XXXXh | XXXXh | XXXXh | Firmware Revision (ATA string) |
| 27-46 | XXXXh | XXXXh | XXXXh | XXXXh | XXXXh | Model Number |
| 47 | 8010h | 8010h | 8010h | 8010h | 8010h | Read / Write Multiple Support |
| 48 | 4000h | 4000h | 4000h | 4000h | 4000h | Trusted Computing Feature Set Options |
| 49 | 2F00h | 2F00h | 2F00h | 2F00h | 2F00h | Capabilities |
| 50 | 4000h | 4000h | 4000h | 4000h | 4000h | Capabilities |
| 51-52 | 0200h | 0200h | 0200h | 0200h | 0200h | Obsolete |
| 53 | 0007h | 0007h | 0007h | 0007h | 0007h | Obsolete |
| 54 | 3FFFh | 3FFFh | 3FFFh | 3FFFh | 3FFFh | Obsolete |
| 55 | 0010h | 0010h | 0010h | 0010h | 0010h | Obsolete |
| 56 | 003Fh | 003Fh | 003Fh | 003Fh | 003Fh | Obsolete |
| 57 | FC10h | FC10h | FC10h | FC10h | FC10h | Obsolete |
| 58 | 00FBh | 00FBh | 00FBh | 00FBh | 00FBh | Obsolete |
| 59 | BD10h | BD10h | BD10h | BD10h | BD10h | Multiple Logical Setting |
| 60 | FFFFh | FFFFh | FFFFh | FFFFh | FFFFh | Obsolete |
| 61 | 0FFFh | 0FFFh | 0FFFh | 0FFFh | 0FFFh | Obsolete |
| 62 | 0000h | 0000h | 0000h | 0000h | 0000h | Obsolete |
| 63 | 0007h | 0007h | 0007h | 0007h | 0007h | Multi-word DMA Transfer |
| 64 | 0003h | 0003h | 0003h | 0003h | 0003h | PIO Transfer Modes Supported |
| 65 | 0078h | 0078h | 0078h | 0078h | 0078h | Minimum Multiword DMA Transfer Cycle Time per Word (ns) |
| 66 | 0078h | 0078h | 0078h | 0078h | 0078h | Manufacturer's Recommended Multiword DMA Cycle Time (ns) |
| 67 | 0078h | 0078h | 0078h | 0078h | 0078h | Minimum PIO Transfer Cycle Time without IORDY Flow Control (ns) |
| 68 | 0078h | 0078h | 0078h | 0078h | 0078h | Minimum PIO Transfer Cycle Time with IORDY Flow Control (ns) |
| 69 | 4E30h | 4E30h | 4E30h | 4E30h | 4E30h | Additional Supported |
| 70-74 | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved |
| 75 | 001Fh | 001Fh | 001Fh | 001Fh | 001Fh | Queue Dept |
| 76 | 850Eh | 850Eh | 850Eh | 850Eh | 850Eh | Serial ATA Capabilities |
| 77 | 0066h | 0066h | 0066h | 0066h | 0066h | Serial ATA Additional Capabilities |
| 78 | 0064h | 0064h | 0064h | 0064h | 0064h | Serial ATA Features Supported |
| 79 | 0060h | 0060h | 0060h | 0060h | 0060h | Serial ATA Features Enabled |
| 80 | 0FFCh | 0FFCh | 0FFCh | 0FFCh | 0FFCh | Major Version Number |
| 81 | 005Eh | 005Eh | 005Eh | 005Eh | 005Eh | Minor Version Number |
| 82 | 746Bh | 746Bh | 746Bh | 746Bh | 746Bh | Commands and Feature Sets Supported |
| 83 | 7D01h | 7D01h | 7D01h | 7D01h | 7D01h | Commands and Feature Sets Supported |
| 84 | 4163h | 4163h | 4163h | 4163h | 4163h | Commands and Feature Sets Supported or Enabled |

IF THERE IS ANY OTHER OPERATION TO IMPLEMENT IN ADDITION TO SPECIFICATION IN THE DATASHEET OR JEDEC STANDARD, PLEASE CONTACT EACH BRANCH OFFICE OR HEADQUARTERS OF SAMSUNG ELECTRONICS.

datasheet

| | | | | | | |
|---------|-------|-------|-------|-------|-------|---|
| 85 | 7469h | 7469h | 7469h | 7469h | 7469h | Commands and Feature Sets Supported or Enabled |
| 86 | BC01h | BC01h | BC01h | BC01h | BC01h | Commands and Feature Sets Supported or Enabled |
| 87 | 4163h | 4163h | 4163h | 4163h | 4163h | Commands and Feature Sets Supported or Enabled |
| 88 | 407Fh | 407Fh | 407Fh | 407Fh | 407Fh | Ultra DMA Modes |
| 89 | 0010h | 0010h | 0010h | 0010h | 0010h | Normal Security Erase Unit Time |
| 90 | 0001h | 0001h | 0001h | 0001h | 0001h | Enhanced Security Erase Unit Time |
| 91 | 0000h | 0000h | 0000h | 0000h | 0000h | Advanced Power Management Level |
| 92 | FFFEh | FFFEh | FFFEh | FFFEh | FFFEh | Master Password Revision Code |
| 93 | 0000h | 0000h | 0000h | 0000h | 0000h | Hardware Reset Result |
| 94 | 0000h | 0000h | 0000h | 0000h | 0000h | Obsolete |
| 95 | 0000h | 0000h | 0000h | 0000h | 0000h | Stream Minimum Request Size |
| 96 | 0000h | 0000h | 0000h | 0000h | 0000h | Streaming Transfer Time - DMA |
| 97 | 0000h | 0000h | 0000h | 0000h | 0000h | Streaming Access Latency - DMA and PIO |
| 98-99 | 0000h | 0000h | 0000h | 0000h | 0000h | Streaming Performance Granularity (DWord) |
| 100-103 | XXXXh | XXXXh | XXXXh | XXXXh | XXXXh | Total Number of User 48-Bit LBA |
| 104 | 0000h | 0000h | 0000h | 0000h | 0000h | Streaming Transfer Time - PIO |
| 105 | 0008h | 0008h | 0008h | 0008h | 0008h | Maximum Number of 512-byte Data Blocks of LBA Range Entries per DATA SET MANAGEMENT Command |
| 106 | 6003h | 6003h | 6003h | 6003h | 6003h | Physical Sector Size / Logical Sector Size |
| 107 | 0000h | 0000h | 0000h | 0000h | 0000h | Inter-seek Delay for ISO 7779 Standard Acoustic Testing |
| 108 | 5002h | 5002h | 5002h | 5002h | 5002h | World Wide Name |
| 109 | 538Ch | 538Ch | 538Ch | 538Ch | 538Ch | World Wide Name |
| 110-111 | XXXXh | XXXXh | XXXXh | XXXXh | XXXXh | World Wide Name |
| 112-115 | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved |
| 116 | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved for TLC |
| 117-118 | 0000h | 0000h | 0000h | 0000h | 0000h | Logical Sector Size (Dword) |
| 119 | 401Eh | 401Eh | 401Eh | 401Eh | 401Eh | Commands and Feature Sets Supported |
| 120 | 401Ch | 401Ch | 401Ch | 401Ch | 401Ch | Commands and Feature Sets Supported or Enabled |
| 121-126 | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved for Expanded Supported and Enabled Settings |
| 127 | 0000h | 0000h | 0000h | 0000h | 0000h | Obsolete |
| 128 | 0021h | 0021h | 0021h | 0021h | 0021h | Security Status |
| 129-159 | 0000h | 0000h | 0000h | 0000h | 0000h | Vendor Specific |
| 160 | 0000h | 0000h | 0000h | 0000h | 0000h | CFA Power Mode |
| 161-167 | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved for the Compact Flash Association |
| 168 | 0003h | 0003h | 0003h | 0003h | 0003h | Device Nominal Form Factor |
| 169 | 0001h | 0001h | 0001h | 0001h | 0001h | DATA SET MANAGEMENT is Supported |
| 170-173 | 2020h | 2020h | 2020h | 2020h | 2020h | Additional Product Identifier (ATA string) |
| 174-175 | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved |
| 176-205 | 0000h | 0000h | 0000h | 0000h | 0000h | Current Media Serial Number |
| 206 | 003Dh | 003Dh | 003Dh | 003Dh | 003Dh | SCT Command Transport |
| 207-208 | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved for CE-ATA |
| 209 | 4000h | 4000h | 4000h | 4000h | 4000h | Alignment of Logical Blocks within a Physical Block |
| 210-211 | 0000h | 0000h | 0000h | 0000h | 0000h | Write-Read-Verify Sector Count Mode 3 |
| 212-213 | 0000h | 0000h | 0000h | 0000h | 0000h | Write-Read-Verify Sector Count Mode 2 |
| 214 | 0000h | 0000h | 0000h | 0000h | 0000h | Obsolete |
| 215-216 | 0000h | 0000h | 0000h | 0000h | 0000h | Obsolete |
| 217 | 0001h | 0001h | 0001h | 0001h | 0001h | Nominal Media Rotation Rate |
| 218 | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved |
| 219 | 0000h | 0000h | 0000h | 0000h | 0000h | Obsolete |
| 220 | 0000h | 0000h | 0000h | 0000h | 0000h | Write Read Verify Mode |

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| | | | | | | |
|---------|----------------|----------------|----------------|----------------|-------|--|
| 221 | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved |
| 222 | 10FFh | 10FFh | 10FFh | 10FFh | 10FFh | Transport Major Version Number |
| 223 | 0000h | 0000h | 0000h | 0000h | 0000h | Transport Minor Version Number |
| 224-229 | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved |
| 230-233 | 0000h | 0000h | 0000h | 0000h | 0000h | Extended Number of User Addressable Sectors |
| 234 | 0000h | 0000h | 0000h | 0000h | 0000h | Minimum Number of 512-byte Data Blocks per DOWNLOAD MICROCODE Command for Mode 03h |
| 235 | 1400h | 1400h | 1400h | 1400h | 1400h | Maximum Number of 512-byte Data Blocks per DOWNLOAD MICROCODE Command for Mode 03h |
| 236-242 | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved |
| 243 | 4000h or 0000h | 4000h or 0000h | 4000h or 0000h | 4000h or 0000h | 4000h | FDE Security Features ** SED(4000h), Non-SED(0000h) ** |
| 244-254 | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved |
| 255 | XXA5h | XXA5h | XXA5h | XXA5h | XXA5h | Integrity Word |

7.0 SPOR Specification (Sudden Power Off and Recovery)

7.1 Data Recovery in Sudden Power Off

If power interruption is detected, SSD dumps all cached user data and meta data to NAND Flash. SSD could protect even the user data in DRAM from sudden power off while SSD is used with cache on. Commonly, data is protected all of the operation period.

7.2 Time to Ready Sequence

In normal power-off recovery status, SSD needs less than 10 seconds to reach operating mode where SSD works perfectly with cache-on state. SSD is ready to respond Identify Device command during FTL OPEN. When the sudden power-off occurs, the user data in DRAM will be dumped into to NAND Flash using the stored power in the capacitor. In sudden power-off recovery condition, mapping data will be loaded or the FTL meta data be rebuilt perfectly for initial max. 10 seconds. During this period, Identify Device command is still supported. It is called SPOR (Sudden Power Off and Recovery).

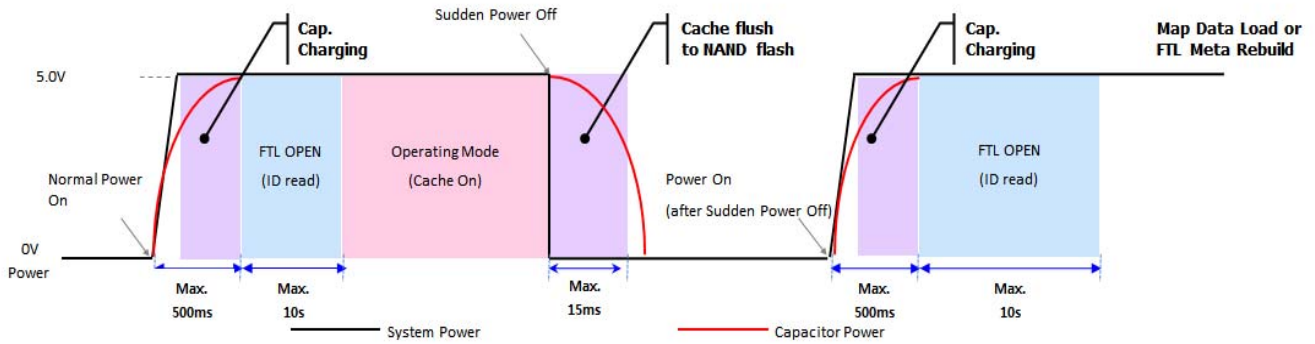


Figure 4. Time to Ready Sequence

[Table 19] Device Ready Time for Normal Read / Write Operation after Sudden Power Off

| | 240GB | 480GB | 960GB | 1,920 GB | 3,840GB |
|----------------------|-------|-------|-------|----------|---------|
| Max. Open Time (sec) | 10s | | | | |

8.0 Product Compliance

[Table 20] Certifications and Declarations

| Category | Certifications |
|----------|-------------------|
| Safety | c-UL-us |
| | CE |
| | TUV |
| | CB |
| EMC | CE (EU) |
| | BSMI (Taiwan) |
| | KCC (South Korea) |
| | VCCI (Japan) |
| | RCM (Australia)* |
| | Morocco |
| | FCC (USA) |
| | IC (CANADA) |

* The three existing compliance marks (C-Tick, A-Tick and RCM) are consolidated into a single compliance mark - the RCM



Caution: Any changes or modifications in construction of this device which are not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio / TV technician for help.

Modifications not expressly approved by the manufacturer could void the user's authority to operated the equipment under FCC rules.



1. 기자재 명칭 : SSD (Solid State Drive)
2. 모델명(Model): 라벨 별도 표기
3. 제조연월 : 라벨 별도 표기
4. 제조자 : 삼성전자(주)
5. 제조국가 : 대한민국
6. 상호명 : 삼성전자(주)

Industry Canada ICES-003 Compliance Label:

CAN ICES-3 (B)/NMB-3(B)

IF THERE IS ANY OTHER OPERATION TO IMPLEMENT IN ADDITION TO SPECIFICATION IN THE DATASHEET OR JEDEC STANDARD, PLEASE CONTACT EACH BRANCH OFFICE OR HEADQUARTERS OF SAMSUNG ELECTRONICS.

9.0 References

[Table 21] Standards References

| Item | Website |
|---|---|
| Serial ATA Revision 3.3 | http://www.sata-io.org |
| ATA/ATAPI Command Set - 4 (ACS-4) | http://www.t13.org |
| SFF-8223, 2.5-inch Drive with Serial Attachment Connector | http://www.sffcommittee.org |
| SFF-8201, 2.5-inch drive form factor | http://www.sffcommittee.org |
| Solid-State Drive Requirements and Endurance Test Method (JESD218A) | http://www.jedec.org/standards-documents/docs/jesd218a |
| Solid-State Drive Requirements and Endurance Test Method (JESD219A) | http://www.jedec.org/standards-documents/docs/jesd219a |