

MZ7LH240HAHQ-00005
MZ7LH480HAHQ-00005
MZ7LH960HAJR-00005
MZ7LH1T9HMLT-00005
MZ7LH3T8HMLT-00005
MZ7LH7T6HMLA-00005

2.5" SATA 6Gbps PM883

SAMSUNG Solid State Drive

datasheet

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SAMSUNG Solid State Drive PM883 Features

| Part Number | Capacity ¹⁾ |
|--------------------|------------------------|
| MZ7LH240HAHQ-00005 | 240GB |
| MZ7LH480HAHQ-00005 | 480GB |
| MZ7LH960HAJR-00005 | 960GB |
| MZ7LH1T9HMLT-00005 | 1,920GB |
| MZ7LH3T8HMLT-00005 | 3,840GB |
| MZ7LH7T6HMLA-00005 | 7,680GB |

FEATURES

- SATA 3.3 Compliant
- 2.5" 7mmT
- Fully Complies with ATA/ATAPI-7 Standard
- Hardware based AES 256-bit Encryption Engine
- Support NCQ (up to 32 depth) Command Set
- Support TRIM Command
- RoHS Compliant

PERFORMANCE ²⁾

- Data Transfer Rate
 - Sequential Read Up to 550 MB/s³⁾
 - Sequential Write Up to 520 MB/s³⁾
 - Random Read (4KB) Up to 98 KIOPS
 - Random Write (4KB) Up to 28 KIOPS
- IOPS Consistency (Read/Write @4KB) 99 / 90%
- Latency (Read @4KB, QD1) (240/480/960GB) 120 us
(1920/3840/7680GB) 140 us
(Write @4KB, QD1) (240GB) 70 us
(480/960/1920/3840G/7680B) 40 us
- Quality of Service(99.99%)
 - Read (4KB, QD=1) 0.5 ms
 - Write (4KB, QD=1) 0.3 ms
 - Read (4KB, QD=32) 0.9 ms
 - Write (4KB, QD=32) 3.2 ms

RELIABILITY

- Non-recoverable Read Error 1 sector per 10¹⁷ bits read
- MTBF 2,000,000 hours
- TBW
 - (7680GB) 10,932 TB
 - (3840GB) 5,466 TB
 - (1920GB) 2,733 TB
 - (960GB) 1,366 TB
 - (480GB) 683 TB
 - (240GB) 341 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 (20min /axis on 3 axes)
 - Non-operating (20 ~ 2,000 Hz, Sweep Sine) 20 G

POWER REQUIREMENTS ^{5) 6)}

- Supply Voltage +5V ± 5%
- Voltage Ripple/Noise (max.) 100mV p-p
- Active (Read) (Typ.) 2.3 W
- Active (Write) (Typ.) 3.6 W
- Idle (Typ.) 1.3 W

PHYSICAL DIMENSION

- Width 100.20 ± 0.25 mm
- Depth 69.85 ± 0.25 mm
- Height 6.80 ± 0.20 mm
- Weight Up to 58 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) Performance measured using FIO 2.7 with queue depth 32, Z170 Intel SATA 6G port. Measurements are performed on whole LBA range. Write cache enabled. Performance vary depending on capacity

3) 1 MB/sec = 1,048,576 bytes/sec was used in sequential performance.

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.

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1.0 Introduction

1.1 General Description

This document describes the specification of the PM883 SSD which use SATA 6Gb/s interface. PM883 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. PM883 delivers 550MB/s for sequential read and 520MB/s for sequential write speed under up to 3.6W power.

1.2 Product List

| Form factor | Density | Part Number |
|-------------|---------|--------------------|
| 2.5" 7mmT | 240GB | MZ7LH240HAHQ-00005 |
| | 480GB | MZ7LH480HAHQ-00005 |
| | 960GB | MZ7LH960HAJR-00005 |
| | 1,920GB | MZ7LH1T9HMLT-00005 |
| | 3,840GB | MZ7LH3T8HMLT-00005 |
| | 7,680GB | MZ7LH7T6HMLA-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

L: V-NAND 3bit

5. SSD CTRL

H: Maru

6~8. SSD Density

7T6: 7,680 GB

3T8: 3,840 GB

1T9: 1,920 GB

960: 960 GB

480: 480GB

240: 240GB

9. NAND PKG

H: BGA

10. Flash Generation

M: 1st Generation

A: 2nd Generation

11~12. NAND Density

HQ: 1T QDP 4CE

JR: 2T ODP 2CE

LT: 4T ODP 2CE (FBI)

LA: 8T HDP 2CE (FBI)

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 3.3 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 | 7,680 GB |
|---------------------------------|-------------|-------------|---------------|---------------|---------------|----------------|
| User-Addressable Sectors | 468,862,128 | 937,703,088 | 1,875,385,008 | 3,750,748,848 | 7,501,476,528 | 15,002,931,888 |
| Bytes per Sector | 512 Bytes | | | | | |

NOTE:

1. Megabyte (MB) = 1 Million bytes; 1 Gigabyte (GB) = 1 Billion bytes
2. Actual usable capacity may be less (due to formatting, partitioning, operating system, applications or otherwise).

2.3 Performance

[Table 2] Sequential Read / Write Performance

| Read / Write | unit | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB | 7,680 GB |
|---------------------------|------|-------|-------|-------|----------|----------|----------|
| Sequential Read (128 KB) | MB/s | 550 | 550 | 550 | 550 | 550 | 550 |
| Sequential Write (128 KB) | MB/s | 320 | 520 | 520 | 520 | 520 | 520 |

[Table 3] Sustained Random Read / Write Performance

| Read / Write | unit | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB | 7,680 GB |
|--------------------------|------|-------|-------|-------|----------|----------|----------|
| Random Read IOPS (4 KB) | IOPS | 98K | 98K | 98K | 98K | 98K | 98K |
| Random Write IOPS (4 KB) | IOPS | 14K | 24K | 25K | 25K | 28K | 27K |

NOTE:

- 1) Actual performance may vary depending on use conditions and environment.
- 2) Performance measured using FIO 2.7 with queue depth 32, Z170 Intel SATA 6G port.
- 3) Measurements are performed on whole LBA range.
- 4) Write cache enabled.
- 5) 1 MB/sec = 1,048,576 bytes/sec was used in sequential performance.

[Table 4] IOPS Consistency

| IOPS Consistency | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB | 7,680 GB |
|---------------------|-------|-------|-------|----------|----------|----------|
| Random Read (4 KB) | 99% | | | | | |
| Random Write (4 KB) | 90% | | | | | |

NOTE:

- 1) IOPS consistency measured using FIO with queue depth 32.
- 2) IOPS Consistency (%) = (99.9% IOPS) / (Average IOPS) x 100.

[Table 5] Latency

| Latency | unit | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB | 7,680 GB |
|--------------|------|-------|-------|-------|----------|----------|----------|
| Read (4 KB) | us | 120 | 120 | 120 | 140 | 140 | 140 |
| Write (4 KB) | us | 70 | 40 | 40 | 40 | 40 | 40 |

NOTE:

- 1) Latency is measured using FIO with queue depth 1 on 4KB random and write.

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[Table 6] Quality of Service (QoS)

| Quality of Service (99%) | unit | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB | 7,680 GB |
|-----------------------------|------|-------|-------|-------|----------|----------|----------|
| Read (4 KB, QD=1) | ms | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Write (4 KB, QD=1) | ms | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 |
| Read (4 KB, QD=32) | ms | 1.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Write (4 KB, QD=32) | ms | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 |
| Quality of Service (99.99%) | unit | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB | 7,680 GB |
| Read (4 KB, QD=1) | ms | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Write (4 KB, QD=1) | ms | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| Read (4 KB, QD=32) | ms | 2 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |
| Write (4 KB, QD=32) | ms | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 |

NOTE:

- 1) QoS is measured using FIO 2.7 (99 and 99.99%) in Linux RHEL 6.5 (Kernel 2.6.32) with queue depth 1, 32 on 4KB random read and write.
- 2) QoS is measured as the maximum round-trip time taken for 99 and 99.99% of commands to host.

2.4 Electrical Characteristics

[Table 7] Operating Voltage

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

NOTE:

- 1) The measurement value of inrush current is also compatible with the standard specification of "Enterprise SSD Form Factor Version 1.0a"

[Table 8] Power Consumption

| Read/Write | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB | 7,680 GB |
|----------------------------------|-------|-------|-------|----------|----------|----------|
| Active Write ¹ (Typ.) | 2.6W | 2.9W | 3.1W | 3.4W | 3.6W | 3.6W |
| Active Read ² (Typ.) | 2.3W | 2.3W | 2.3W | 2.3W | 2.3W | 2.3W |
| Idle ³ | 1.3W | 1.3W | 1.3W | 1.3W | 1.3W | 1.4W |

NOTE:

- 1) Active Write power is measured on 128 KB sequential write.
- 2) Active Read power is measured on 4 KB random read.
- 3) Idle power is measured with DIPM off.

[Table 9] 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.

2.5 Environmental Specifications

[Table 10] 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 | |

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| | |
|------------------|---|
| Shock | 1500 G, duration 0.5 ms, Half Sine Wave |
| Vibration | 20G, 20 ~ 2,000 Hz, Sinusoidal |

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.

2.6 Reliability

[Table 11] MTBF Specifications

| Parameter | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB | 7,680 GB |
|-----------|-----------------|-------|-------|----------|----------|----------|
| MTBF | 2,000,000 Hours | | | | | |

NOTE:

1) MTBF is Mean Time Between Failure. As same word, annual failure ratio is 0.438%.

[Table 12] UBER Specifications

| Parameter | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB | 7,680 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 13] TBW (TeraBytes Written) Specifications

| Parameter | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB | 7,680 GB |
|-----------|--------|--------|---------|----------|----------|----------|
| TBW | 341 TB | 683 TB | 1366 TB | 2733 TB | 5466 TB | 10932 TB |

NOTE:

1) TBW is measured while running 100 % random 4 KB writes across the entire SSD.(TBW = DWPD x 365 x 3 x User capacity).

[Table 14] Drive Write Per Day (DWPD) Specifications

| Parameter | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB | 7,680 GB |
|-----------|--------------|-------|-------|----------|----------|----------|
| DWPD | 1.3 (3Years) | | | | | |

[Table 15] Data Retention Specifications

| Parameter | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB | 7,680 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.

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3.0 Mechanical Specification

[Table 16] Physical Dimensions and Weight

| Model | Height (mm) | Width (mm) | Length (mm) | Weight (gram) |
|------------------------------------|-------------|--------------|---------------|---------------|
| 240/480/960/1,920 /3,840 / 7,680GB | 6.80 ± 0.20 | 69.85 ± 0.25 | 100.20 ± 0.25 | Max 58g |

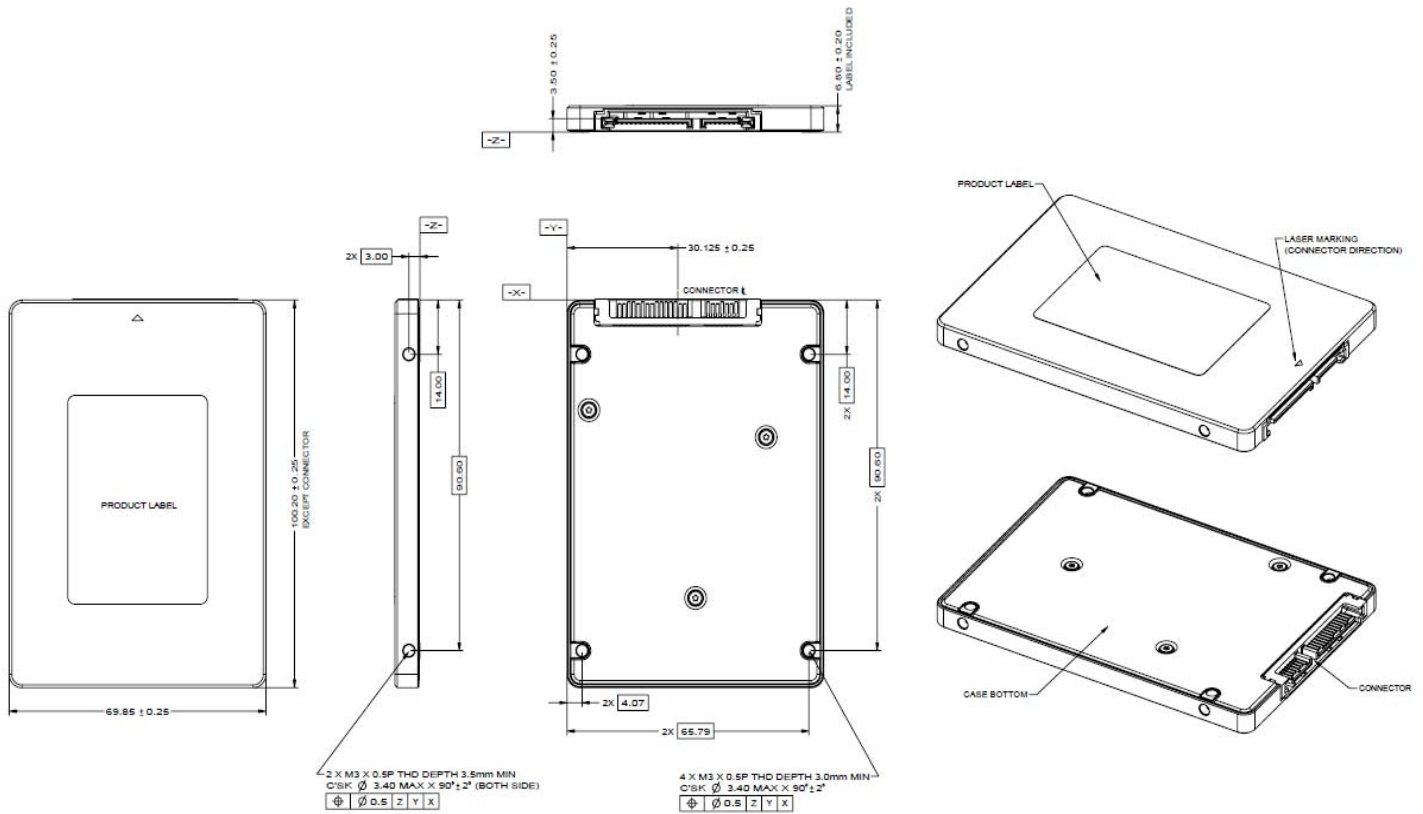


Figure 1. Physical Dimension

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4.0 Electrical Interface Specification

4.1 Serial ATA Interface Connector

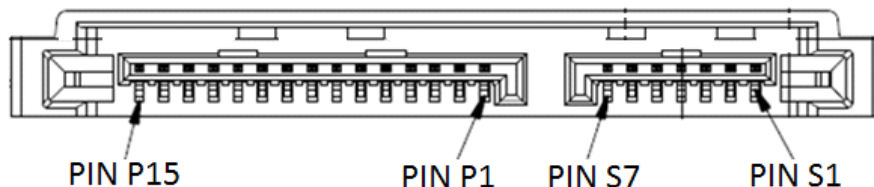


Figure 2. Drive Plug Connector

4.2 Pin Assignments

[Table 17] 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 | 3 rd Mate |
| | P2 | Retired | 3 rd 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 18] Supported ATA Commands Summary

| Command Name | Command Code (Hex) | Command Name | Command Code (Hex) |
|---------------------------------|--------------------|---------------------------|--------------------|
| CHECK POWER MODE | E5h / 98h | SEEK | 70h |
| DEVICE CONFIGURATION | B1h | SEND FPDMA QUEUED | 64h |
| DOWNLOAD MICROCODE | 92h | SET DATE N TIME | 77h |
| DOWNLOAD MICROCODE DMA | 93h | SET FEATURES | EFh |
| EXECUTE DEVICE DIAGNOSTIC | 90h | SET MAX ADDRESS | F9h |
| FLUSH CACHE | E7h | SET MAX ADDRESS EXT | 37h |
| FLUSH CACHE EXT | EAh | SET MULTIPLE MODE | C6h |
| IDENTIFY DEVICE | ECh | SLEEP | E6h / 99h |
| IDLE | E3h / 97h | S.M.A.R.T. | B0h |
| IDLE IMMEDIATE | E1h / 95h | STANDBY | E2h / 96h |
| INITIALIZE DEVICE PARMETERS | 91h | STANDBY IMMEDIATE | E0h / 94h |
| NOP | 00h | 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 | | |

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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 19] 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 20] 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 | - |

NOTE:

1. Any nonzero value in the Attribute ID Number indicates an active attribute.

6.0 Identify Device Data

Identify Device Data

| Word | 240 GB | 480 GB | 960 GB | 1,920 GB | 3,840 GB | 7,680 GB | General Information |
|---------|--------|--------|--------|----------|----------|----------|---|
| 0 | 0040h | 0040h | 0040h | 0040h | 0040h | 0040h | Obsolete |
| 1 | 3FFFh | 3FFFh | 3FFFh | 3FFFh | 3FFFh | 3FFFh | Obsolete |
| 2 | C837h | C837h | C837h | C837h | C837h | C837h | Obsolete |
| 3 | 0010h | 0010h | 0010h | 0010h | 0010h | 0010h | Retired |
| 4 - 5 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Obsolete |
| 6 | 003Fh | 003Fh | 003Fh | 003Fh | 003Fh | 003Fh | Obsolete |
| 7 - 8 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved for the Compact Flash Association |
| 9 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Retired |
| 10 - 19 | XXXXh | XXXXh | XXXXh | XXXXh | XXXXh | XXXXh | Serial Number (ATA string) |
| 20-21 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Obsolete |
| 22 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Obsolete |
| 23-26 | XXXXh | XXXXh | XXXXh | XXXXh | XXXXh | XXXXh | Firmware Revision (ATA string) |
| 27-46 | XXXXh | XXXXh | XXXXh | XXXXh | XXXXh | XXXXh | Model Number |
| 47 | 8010h | 8010h | 8010h | 8010h | 8010h | 8010h | Read / Write Multiple Support |
| 48 | 4000h | 4000h | 4000h | 4000h | 4000h | 4000h | Trusted Computing Feature Set Options |
| 49 | 2F00h | 2F00h | 2F00h | 2F00h | 2F00h | 2F00h | Capabilities |
| 50 | 4000h | 4000h | 4000h | 4000h | 4000h | 4000h | Capabilities |
| 51-52 | 0200h | 0200h | 0200h | 0200h | 0200h | 0200h | Obsolete |
| 53 | 0007h | 0007h | 0007h | 0007h | 0007h | 0007h | Obsolete |
| 54 | 3FFFh | 3FFFh | 3FFFh | 3FFFh | 3FFFh | 3FFFh | Obsolete |
| 55 | 0010h | 0010h | 0010h | 0010h | 0010h | 0010h | Obsolete |
| 56 | 003Fh | 003Fh | 003Fh | 003Fh | 003Fh | 003Fh | Obsolete |
| 57 | FC10h | FC10h | FC10h | FC10h | FC10h | FC10h | Obsolete |
| 58 | 00FBh | 00FBh | 00FBh | 00FBh | 00FBh | 00FBh | Obsolete |
| 59 | BD10h | BD10h | BD10h | BD10h | BD10h | BD10h | Multiple Logical Setting |
| 60 | FFFFh | FFFFh | FFFFh | FFFFh | FFFFh | FFFFh | Obsolete |
| 61 | 0FFFh | 0FFFh | 0FFFh | 0FFFh | 0FFFh | 0FFFh | Obsolete |
| 62 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Obsolete |
| 63 | 0007h | 0007h | 0007h | 0007h | 0007h | 0007h | Multi-word DMA Transfer |
| 64 | 0003h | 0003h | 0003h | 0003h | 0003h | 0003h | PIO Transfer Modes Supported |
| 65 | 0078h | 0078h | 0078h | 0078h | 0078h | 0078h | Minimum Multiword DMA Transfer Cycle Time per Word (ns) |
| 66 | 0078h | 0078h | 0078h | 0078h | 0078h | 0078h | Manufacturer's Recommended Multiword DMA Cycle Time (ns) |
| 67 | 0078h | 0078h | 0078h | 0078h | 0078h | 0078h | Minimum PIO Transfer Cycle Time without IORDY Flow Control (ns) |
| 68 | 0078h | 0078h | 0078h | 0078h | 0078h | 0078h | Minimum PIO Transfer Cycle Time with IORDY Flow Control (ns) |
| 69 | 4F30h | 4F30h | 4F30h | 4F30h | 4F30h | 4F30h | Additional Supported |
| 70-74 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved |
| 75 | 001Fh | 001Fh | 001Fh | 001Fh | 001Fh | 001Fh | Queue Dept |
| 76 | 850Eh | 850Eh | 850Eh | 850Eh | 850Eh | 850Eh | Serial ATA Capabilities |
| 77 | 0066h | 0066h | 0066h | 0066h | 0066h | 0066h | Serial ATA Additional Capabilities |
| 78 | 0064h | 0064h | 0064h | 0064h | 0064h | 0064h | Serial ATA Features Supported |
| 79 | 0060h | 0060h | 0060h | 0060h | 0060h | 0060h | Serial ATA Features 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.

| | | | | | | | |
|---------|-------|-------|-------|-------|-------|-------|---|
| 80 | 0FFCh | 0FFCh | 0FFCh | 0FFCh | 0FFCh | 0FFCh | Major Version Number |
| 81 | 005Eh | 005Eh | 005Eh | 005Eh | 005Eh | 005Eh | Minor Version Number |
| 82 | 746Bh | 746Bh | 746Bh | 746Bh | 746Bh | 746Bh | Commands and Feature Sets Supported |
| 83 | 7D01h | 7D01h | 7D01h | 7D01h | 7D01h | 7D01h | Commands and Feature Sets Supported |
| 84 | 4163h | 4163h | 4163h | 4163h | 4163h | 4163h | Commands and Feature Sets Supported or Enabled |
| 85 | 7469h | 7469h | 7469h | 7469h | 7469h | 7469h | Commands and Feature Sets Supported or Enabled |
| 86 | BC01h | BC01h | BC01h | BC01h | BC01h | BC01h | Commands and Feature Sets Supported or Enabled |
| 87 | 4163h | 4163h | 4163h | 4163h | 4163h | 4163h | Commands and Feature Sets Supported or Enabled |
| 88 | 407Fh | 407Fh | 407Fh | 407Fh | 407Fh | 407Fh | Ultra DMA Modes |
| 89 | 0010h | 0010h | 0010h | 0010h | 0010h | 0010h | Normal Security Erase Unit Time |
| 90 | 0010h | 0010h | 0010h | 0010h | 0010h | 0010h | Enhanced Security Erase Unit Time |
| 91 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Advanced Power Management Level |
| 92 | FFFEh | FFFEh | FFFEh | FFFEh | FFFEh | FFFEh | Master Password Revision Code |
| 93 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Hardware Reset Result |
| 94 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Obsolete |
| 95 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Stream Minimum Request Size |
| 96 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Streaming Transfer Time - DMA |
| 97 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Streaming Access Latency - DMA and PIO |
| 98-99 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Streaming Performance Granularity (DWord) |
| 100-103 | XXXXh | XXXXh | XXXXh | XXXXh | XXXXh | XXXXh | Total Number of User 48-Bit LBA |
| 104 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Streaming Transfer Time - PIO |
| 105 | 0008h | 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 | 6003h | Physical Sector Size / Logical Sector Size |
| 107 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Inter-seek Delay for ISO 7779 Standard Acoustic Testing |
| 108 | 5002h | 5002h | 5002h | 5002h | 5002h | 5002h | World Wide Name |
| 109 | 538Ch | 538Ch | 538Ch | 538Ch | 538Ch | 538Ch | World Wide Name |
| 110-111 | XXXXh | XXXXh | XXXXh | XXXXh | XXXXh | XXXXh | World Wide Name |
| 112-115 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved |
| 116 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved for TLC |
| 117-118 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Logical Sector Size (Dword) |
| 119 | 401Eh | 401Eh | 401Eh | 401Eh | 401Eh | 401Eh | Commands and Feature Sets Supported |
| 120 | 401Ch | 401Ch | 401Ch | 401Ch | 401Ch | 401Ch | Commands and Feature Sets Supported or Enabled |
| 121-126 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved for Expanded Supported and Enabled Settings |
| 127 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Obsolete |
| 128 | 0021h | 0021h | 0021h | 0021h | 0021h | 0021h | Security Status |
| 129-159 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Vendor Specific |
| 160 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | CFA Power Mode |
| 161-167 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved for the Compact Flash Association |
| 168 | 0003h | 0003h | 0003h | 0003h | 0003h | 0003h | Device Nominal Form Factor |
| 169 | 0001h | 0001h | 0001h | 0001h | 0001h | 0001h | DATA SET MANAGEMENT is Supported |
| 170-173 | 2020h | 2020h | 2020h | 2020h | 2020h | 2020h | Additional Product Identifier (ATA string) |
| 174-175 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved |
| 176-205 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Current Media Serial Number |
| 206 | 003Dh | 003Dh | 003Dh | 003Dh | 003Dh | 003Dh | SCT Command Transport |
| 207-208 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved for CE-ATA |
| 209 | 4000h | 4000h | 4000h | 4000h | 4000h | 4000h | Alignment of Logical Blocks within a Physical Block |

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

| | | | | | | | |
|---------|-------|-------|-------|-------|-------|-------|--|
| 210-211 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Write-Read-Verify Sector Count Mode 3 |
| 212-213 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Write-Read-Verify Sector Count Mode 2 |
| 214 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Obsolete |
| 215-216 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Obsolete |
| 217 | 0001h | 0001h | 0001h | 0001h | 0001h | 0001h | Nominal Media Rotation Rate |
| 218 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved |
| 219 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Obsolete |
| 220 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Write Read Verify Mode |
| 221 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved |
| 222 | 10FFh | 10FFh | 10FFh | 10FFh | 10FFh | 10FFh | Transport Major Version Number |
| 223 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Transport Minor Version Number |
| 224-229 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved |
| 230-233 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Extended Number of User Addressable Sectors |
| 234 | 0000h | 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 | 1400h | Maximum Number of 512-byte Data Blocks per DOWNLOAD MICROCODE Command for Mode 03h |
| 236-242 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved |
| 243 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | FDE Security Features |
| 244-254 | 0000h | 0000h | 0000h | 0000h | 0000h | 0000h | Reserved |
| 255 | XXA5h | XXA5h | XXA5h | XXA5h | XXA5h | XXA5h | Integrity Word |

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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 20 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. 20 seconds. During this period, Identify Device command is still supported. It is called SPOR (Sudden Power Off and Recovery).

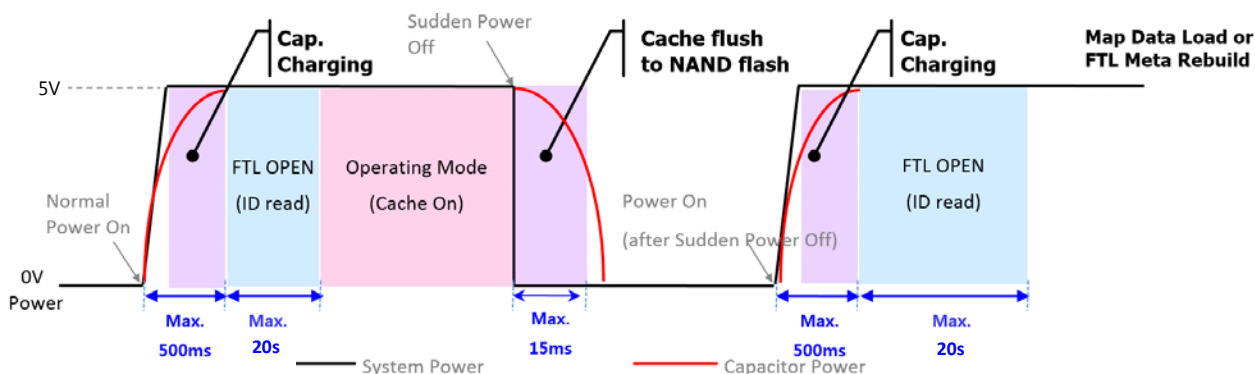


Figure 3. Time to Ready Sequence

[Table 21] Device Ready Time for Normal Read / Write Operation after Sudden Power Off

| | 240GB | 480GB | 960GB | 1,920 GB | 3,840 GB | 7,680 GB |
|----------------------|-------|-------|-------|----------|----------|----------|
| Max. Open Time (sec) | | | 10 | | | 20 |

8.0 Product Compliance

[Table 22] Certifications and Declarations

| Category | Certification |
|----------|--|
| CE | Comunaute Europeenne |
| BSMI | Bureau of Standards, Metrology and Inspection |
| KCC | Korea Communications commission |
| VCCI | Voluntary Control Council for Interference |
| C-Tick | Radio Telecommunication Labeling |
| FCC | Federal Communications Commission |
| IC | Industry Canada |
| UL | Underwriters Laboratories, Inc. |
| TUV | Technischer Uberwachungs Verine e.V |
| CB | Scheme of the IECEE for Mutual Recognition of Test Certificates for Electrical Equipment |
| Morocco | Morocco Certification |




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 23] 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 (JESD219A) | http://www.jedec.org/standards-documents/docs/jesd219a |