MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

SM825 2.5"SATA 3.0Gb/s E-MLC SSD

(NAND based Solid State Drive)

datasheet

SAMSUNG ELECTRONICS RESERVES THE RIGHT TO CHANGE PRODUCTS, INFORMATION AND SPECIFICATIONS WITHOUT NOTICE.

Products and specifications discussed herein are for reference purposes only. All information discussed herein is provided on an "AS IS" basis, without warranties of any kind.

This document and all information discussed herein remain the sole and exclusive property of Samsung Electronics. No license of any patent, copyright, mask work, trademark or any other intellectual property right is granted by one party to the other party under this document, by implication, estoppel or other-wise.

Samsung products are not intended for use in life support, critical care, medical, safety equipment, or similar applications where product failure could result in loss of life or personal or physical harm, or any military or defense application, or any governmental procurement to which special terms or provisions may apply.

For updates or additional information about Samsung products, contact your nearest Samsung office.

All brand names, trademarks and registered trademarks belong to their respective owners.

SAMSUNG ELECTRONICS

SAMSUNG

Revision History

Revision No.	History	Draft Date	Remark	Editor
1.0	Final version	Oct.20.2011	Final	Ryder Kim

- 2 -

SAMSUNG ELECTRONICS

SAMSUNG

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD

Table Of Contents

SAMSUNG ELECTRONICS

SAMSUNG

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD

SAMSUNG ELECTRONICS

SAMSUNG

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD

1.0 Introduction

The SSD(Solid State Drive) of Samsung Electronics is fully consist of semiconductor device and using Enterprise MLC 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 in a Enterprise server and Storage for a storage device with a high performance, high capacity, a low power consumption and a small form factor. For an easy adoption, the SSD has the same host interface as Hard Disk Drive and has the same physical dimension.

1.1 General Description

- **Capacity**
  - 100GB, 200GB, 400GB is available

- **Form Factor**
  - 2.5" Type (100.00 x 69.85 x 14.8 mm)

- **Host interface**
  - Serial ATA interface of 3.0Gbps
  - Fully complies with ATA/ATAPI-7 Standard
    (Partially Complies with ATA/ATAPI-8)
  - Asynchronous Signal Recovery(Hot-Plug)
  - Activity LED indication (Pin11)
  - Native Command Queuing (NCQ, 32 Depth) Supported

- **Component**
  - Samsung Enteprise MLC NAND with high endurance

- **Performance**
  - Host transfer rate: 300 MB/s
  - Sustained Data Read : 250MB/s
  - Sustained Data Write : 220MB/s (110MB/s for 100GB)
  - Random Read IOPS : 43K IOPS
  - Random Write IOPS : 11K IOPS (5.5K IOPS for 100GB)

- **Power Consumption (Watt)**
  - Read/Write : 1.8/3.4 Watt
  - Idle : 1.3 Watt

- **Mean Time Between Failure(MTBF)**
  - 2,000,000 hours

- **Data amount written for entire life time (TBW)**
  - 100GB : 1,700 Terabyte(TB)
  - 200GB : 3,500 Terabyte(TB)
  - 400GB : 7,000 Terabyte(TB)

- **Temperature**
  - Operating : 0°C to 55°C

- **Altitude**
  - Operating : -1,000fts to 15,000fts

- **Shock and Vibration**
  - Shock : 1500G (0.5ms duration with sine wave)
  - Vibration : 20G (10Hz to 2,000Hz, 15min/axis on 3axis)

- **Weight**
  - 100GB : 140g
  - 200GB : 143g
  - 400GB : 146g

- **Sudden Power Off and data Recovery**
  - Meta data and User data in cache is fully protected on sudden power off situation with additional power source

1.2 Block Diagram

- **SSD Functional Block Diagram**

SAMSUNG

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD
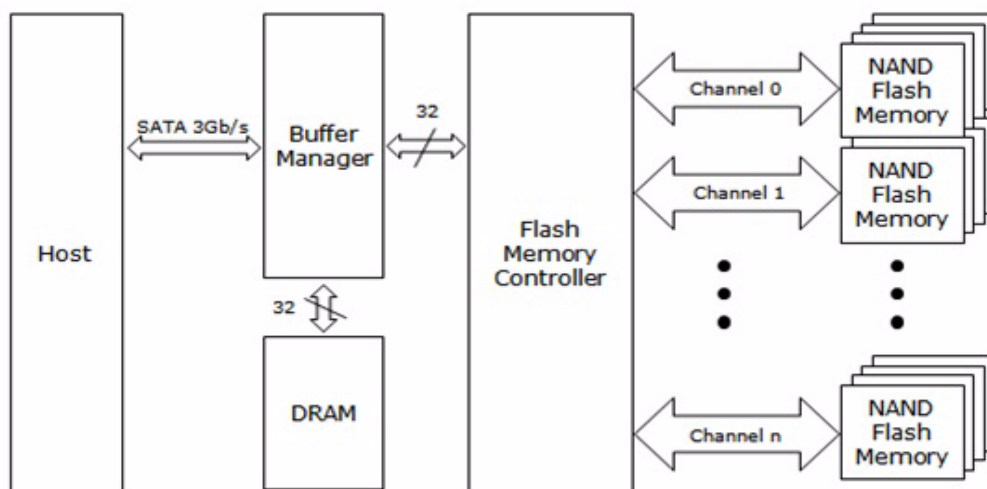
2.0 Product Specification

2.1 Interface and Configuration

- Maximum Bandwidth : 300 MB/sec (3.0 Gb/sec).
- PIO 0 to 4 mode
- UDMA 0 to 6 mode (Ultra DMA133)
- Fully compatible with ATA-7 Standard (Serial ATA Revision 2.6)
  (Partially Complies with ATA/ATAPI-8)

2.2 System Performance

2.2.1 Sequential Read and Write Bandwidth

Bandwidth Type	Performance
Sustained Sequential Read Bandwidth	Up to 250 MB/s
Sustained Sequential Write Bandwidth	Up to 220 MB/s

NOTE :
1. Measured performance on IOMeter
2. Data transfer size is 128KB and Queue depth is 32

2.2.2 Random Read and Write IOPS (Input and Output operation Per Second)

IOPS Type	Performance
Sustained Random Read IOPS	Up to 43,000 IOPS
Sustained Random Write IOPS	Up to 11,000 IOPS

NOTE :
1. Measured performance on IOMETER
2. Data transfer size is 4KB and Queue depth is 32

2.3 Drive Capacity

	MZ5EA100HMDR	MZ5EA200HMDR	MZ5EA400HMFP
Unformatted Capacity	100 GB	200 GB	400 GB
User-Addressable Sectors	195,371,568	390,721,968	781,422,768

NOTE :
1. 1 Gigabyte(GB) = 1,000,000,000 Bytes
2. 1 Sector = 512 Bytes

2.4 Supply Voltage

Item	Requirements
Allowable voltage	5V ± 5% 12V ± 5%

SAMSUNG ELECTRONICS

SAMSUNG

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD

2.5 Power Consumption

Power	Typical(W)
Active Read	1.8
Active Write	3.4
Idle	1.3

NOTE :
1. Measured power consumption under 100% 4KB random read/write operation

2.6 Reliability

	MZ5EA100HMDR	MZ5EA200HMDR	MZ5EA400HMFP
TBW*	1,700 TB	3,500 TB	7,000 TB
Data Retention*	3 months		
MTBF*	2,000,000 hours		
UBER*	1 bit error in 10E17bits		

NOTE :
1. TBW is TeraByte Written, that is, total data amount written for entire life time. 1 Terabyte = 1,000,000,000 Byte
2. Above TBW is considered under data aligned condition to 8KB
3. Data retention is not under consideration on power-on state because SSD manages data retention by SSD itself
4. MTBF is Mean Time Between Failure. As same word, annual failure ratio is 0.4%
5. UBER is Uncorrectable Bit Error Ratio

2.7 Environmental Specification

2.7.1 Temperature

	MZ5EA100HMDR	MZ5EA200HMDR	MZ5EA400HMFP
Temperature (Operating)	0'C to 55'C		
Temperature (Non-operating)	-40'C to 85'C		
Humidity	5% to 90%		

NOTE :
1. Temperature specification is following JEDEC standard; Expressed temperature must be measured right on the case
2. Humidity is measured in non-condensing

2.7.2 Shock and Vibration

	MZ5EA100HMDR	MZ5EA200HMDR	MZ5EA400HMFP
Shock (Operating, Non-operating)	1500G		
Vibration (Operating, Non-operating)	20G peak		

NOTE :
1. Test condition for shock : 0.5ms duration with sine wave
2. Test condition for vibration : 10Hz to 2,000Hz, 15min/axis on 3axis

SAMSUNG ELECTRONICS

SAMSUNG

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD

2.7.3 Altitude

	MZ5EA100HMDR	MZ5EA200HMDR	MZ5EA400HMFP
Altitude (Operating)	-1,000 fts to 15,000 fts		
Altitude (Non-operating)	-1,000 fts to 40,000 fts		

NOTE :
1. Test condition for altitude : recurring sequential read and write for 6hours in each 5'C and 55'C at 15,000 fts

3.0 Physical Specification

3.1 Physical Dimension and Weight

Part No.	Density	Height(mm)	Width(mm)	Length(mm)	Weight(gram)
MZ5EA100HMDR	100GB	14.80 ± 0.2	69.85 ± 0.25	100.00 ± 0.25	140g
MZ5EA200HMDR	200GB	14.80 ± 0.2	69.85 ± 0.25	100.00 ± 0.25	143g
MZ5EA400HMFP	400GB	14.80 ± 0.2	69.85 ± 0.25	100.00 ± 0.25	146g

3.2 Case Outline

<BOTTOM VIEW>   <SIDE VIEW>   <TOP VIEW>

SAMSUNG

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD
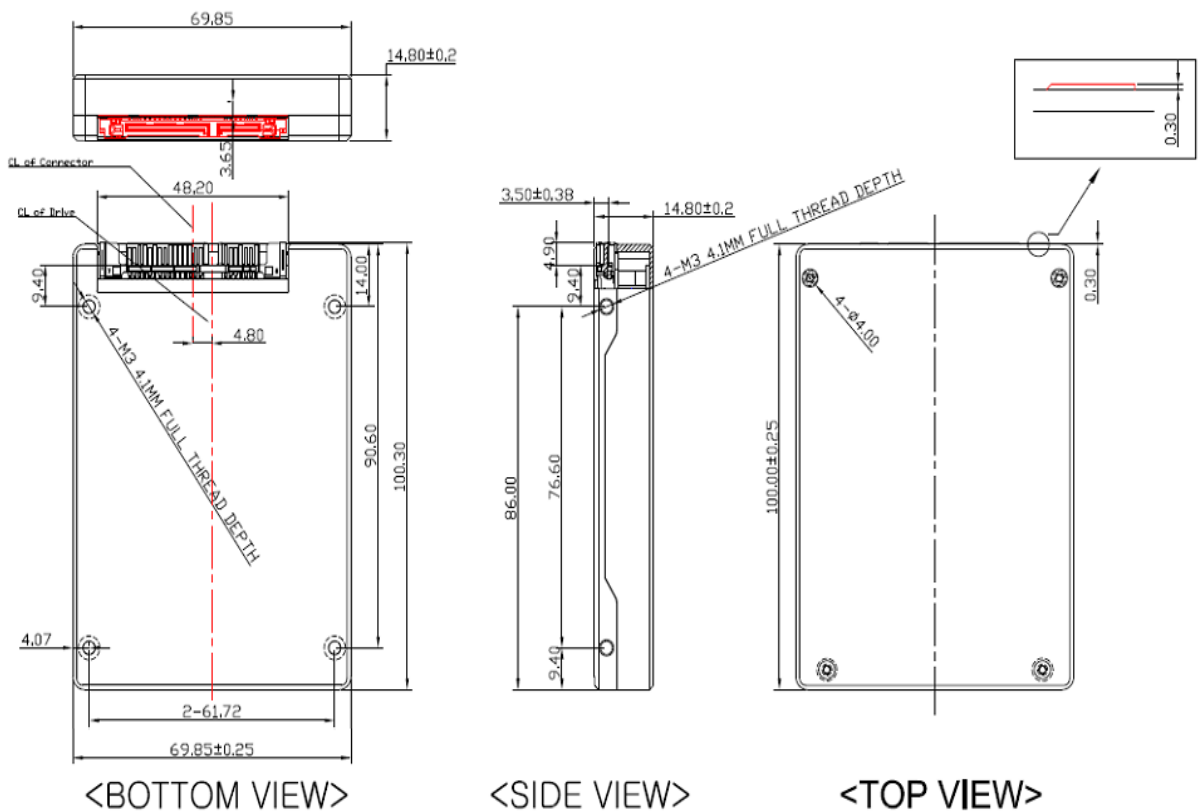
4.0 Electrical Interface Specification

4.1 Serial ATA Interface Connector

4.1.1 Drive Connector Model : Amphenol, SATA00 100941T

4.1.2 Connector Dimension and Pin Location

SAMSUNG ELECTRONICS

SAMSUNG

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD
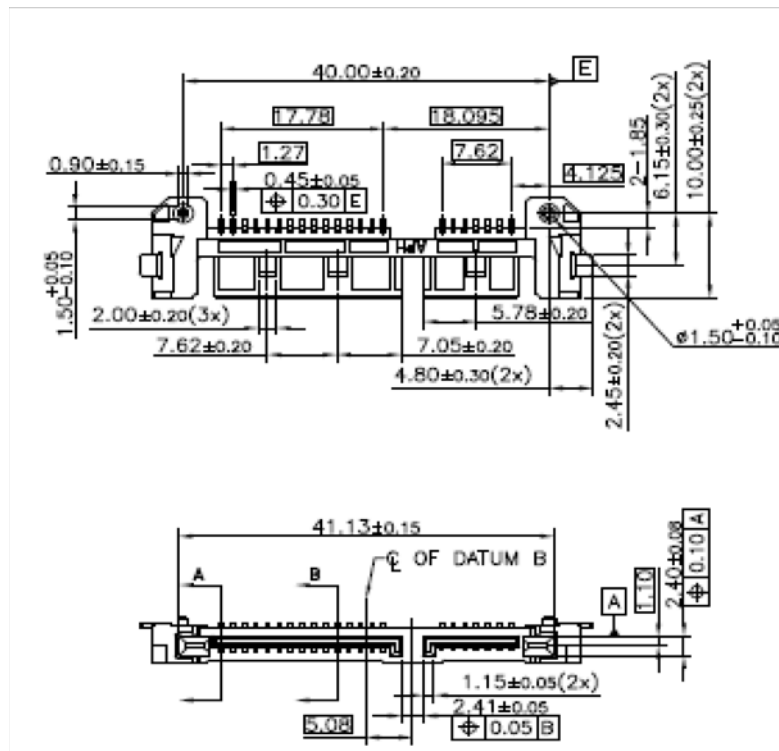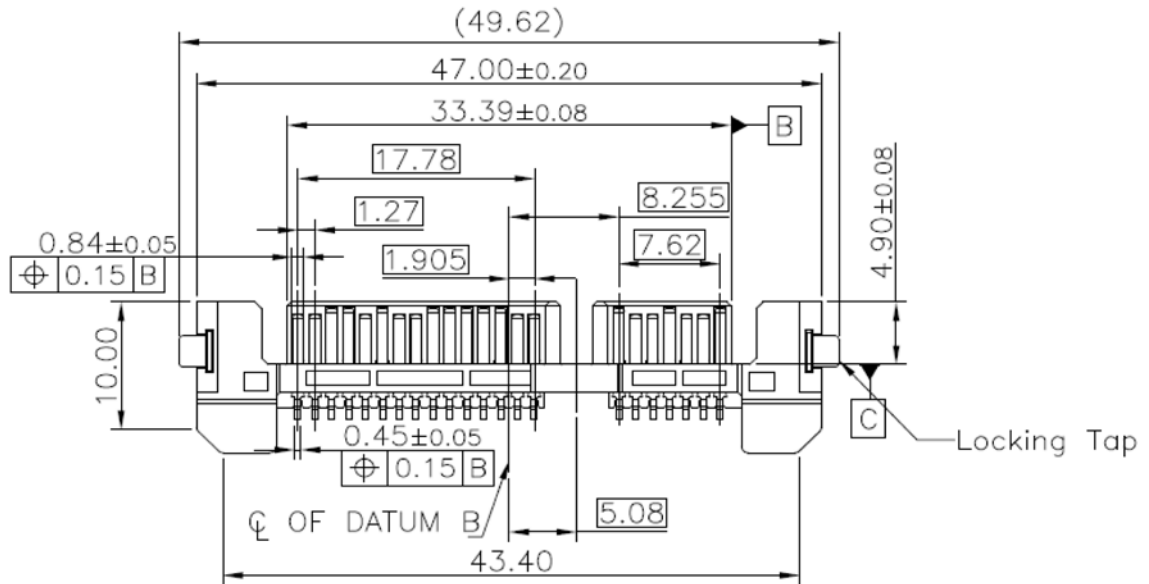
4.2 Pin Assignments and Definition

	No.		Plug Connector pin definition
Signal	S1	GND	2nd mate
	S2	A+	Differential signal A from Phy
	S3	A-	
	S4	GND	2nd mate
	S5	B-	Differential signal B from Phy
	S6	B+	
	S7	GND	2nd mate
Key and spacing spearate signal and power segments			
Power	P1	V33	3.3V power (Unused)
	P2	V33	3.3V power (Unused)
	P3	V33	3.3V power, pre-charge, 2nd mate (Unused)
	P4	GND	1st mate
	P5	GND	2nd mate
	P6	GND	2nd mate
	P7	V5	5V power, pre-charge, 2nd mate
	P8	V5	5V power
	P9	V5	5V power
	P10	GND	2nd mate
	P11	DAS/DSS	Device Activity Signal
	P12	GND	1st mate
	P13	V12	12V power, pre-charge, 2nd mate
	P14	V12	12V power
	P15	V12	12V power

NOTE :
1. 5V(P7, P8 and P9) and 12V(P13, P14 and P15) is used to supply power to the SSD. SSD may not work unless host put power to both 5V power pin and 12V power pin.
2. 3.3V(P1, P2 and P3) is not used for this SSD.
3. The usage of power pin P11 is treated on 'SATA Optional Feature Chapter'

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD

5.0 Command Descriptions

5.1 Supported ATA Commands

Command Name	Command Code (Hex)	Command Name	Command Code (Hex)
CHECK POWER MODE	E5h	SECURITY SET PASSWORD	F1h
DATA SET MANAGEMENT	06h	SECURITY UNLOCK	F2h
DEVICE CONFIGURATION FREEZE LOCK	B1h or C1h	SET FEATURES	EFh
DEVICE CONFIGURATION IDENTIFY	B1h or C2h	SET MAX ADDRESS	F9h or 00h
DEVICE CONFIGURATION RESTORE	B1h or C0h	SET MAX ADDRESS EXT	37h
DEVICE CONFIGURATION SET	B1h or C3h	SET MAX FREEZE LOCK	F9h or 04h
DOWNLOAD MICROCODE	92h	SET MAX LOCK	F9h or 02h
EXECUTE DEVICE DIAGNOSTIC	90h	SET MAX SET PASSWORD	F9h or 01h
FLUSH CACHE	E7h	SET MAX UNLOCK	F9h or 03h
FLUSH CACHE EXT	EAh	SET MULTIPLE MODE	C6h
IDENTIFY DEVICE	ECh	SLEEP	E6h
IDLE	E3h	SMART DISABLE OPERATIONS	B0h or D9h
IDLE IMMEDIATE	E1h	SMART ENABLE OPERATIONS	B0h or D8h
NOP	00h	SMART ENABLE/DISABLE ATTRIBUTE AUTOSAVE	B0h or D2h
READ BUFFER	E4h	SMART EXECUTE OFF-LINE IMMEDIATE	B0h or D4h
READ DMA EXT	25h	SMART READ ATTRIBUTE TRESHOLDS	B0h or D1h
READ DMA with Retry	C8h	SMART READ ATTRIBUTE TRESHOLDS	B0h or D3h
READ DMA without Retry	C9h	SMART READ DATA	B0h or D0h
READ FPDMA QUEUED	60h	SMART READ LOG	B0h or D5h
READ LOG EXT	2Fh	SMART RETURN STATUS	B0h or DAh
READ LOG DMA EXT	47h	SMART WRITE LOG	B0h or D6h
READ MULTIPLE	C4h	STANDBY	E2h
READ MULTIPLE EXT	29h	STANDBY IMMEDIATE	E0h
READ NATIVE MAX ADDRESS	B0H	WRITE BUFFER	E8h
READ NATIVE MAX ADDRESS EXT	27h	WRITE DMA EXT	35h
READ SECTORS EXT	24h	WRITE DMA FUA EXT	3Dh
READ SECTORS with Retry	20h	WRITE DMA with Retry	CAh
READ SECTORS without Retry	21h	WRITE DMA without Retry	CBh
READ VERIFY SECTORS EXT	42h	WRITE FPDMA QUEUED	61h
READ VERIFY SECTORS with Retry	40h	WRITE LOG DMA EXT	57h
READ VERIFY SECTORS without Retry	41h	WRITE LOG EXT	3Fh
SCT DATA TABLE		WRITE MULTIPLE	C5h
SCT FEATURE CONTROL		WRITE MULTIPLE EXT	39h
SCT WRITE SAME		WRITE MULTIPLE FUA EXT	CE
SECURITY DISABLE PASSWORD	F6h	WRITE SECTORS EXT	34h
SECURITY ERASE PREPARE	F3h	WRITE SECTORS with Retry	C3h
SECURITY ERASE UNIT	F4h	WRITE SECTORS without Retry	30h
SECURITY FREEZE LOCK	F5h	WRITE UNCORRECTABLE EXT	45h

SAMSUNG

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD

5.2 SECURITY FEATURE Set

The Security mode features allow the host to implement a securtity password system to prevent unauthorized access to the disk drive.

5.2.1 SECURITY mode default setting

The SSD is shipped with master password set to 20h value(ASCII blanks) and the lock function disabled.
The system manufacturer/dealer may set a new master password by using the SECURITY SET PASSWORD command, without enabling the lock function.

5.2.2 Initial setting of the user password

When a user password is set, the drive automatically enters lock mode by the next powered-on

5.2.3 SECURITY mode operation from power-on

In locked mode, the SSD rejects media access commands until a SECURITY UNLOCK command is successfully completed.

5.2.4 Password lost

If the user password is lost and High level security is set, the drive does not allow the user to access any data.
However, the drive can be unlocked using the master password.

If the user password is lost and Maxium security level is set, it is impossible to access data.
However, the drive can be unlocked using the ERASE UNIT command with the master password. The drive will erase all user data and unlock the drive.

5.3 SMART FEATURE Set (B0h)

The SMART Feature Set command provides access to the Attribute Values, the Attribute Thresholds, and other low level subcommands that can be used for logging and reporting purposes and to accommodate special user needs. The SMART Feature Set command has several separate subcommands which are selectable via the device's Features Register when the SMART Feature Set command is issued by the host. In order to select a subcommand, the host must write the subcommand code to the device's Features Register before issuing the SMART Feature Set command.

5.3.1 Sub Command

In order to select a subcommand the host must write the subcommand code to the device's Features Register before issuing the S.M.A.R.T. Function Set command. The subcommands and their respective codes are listed below.

Subcommand	Code	Subcommand	Code
SMART READ DATA	D0h	SMART READ LOG	D5h
SMART READ ATTRIBUTE THRESHOLDS	D1h	SMART WRITE LOG	D6h
SMART ENABLE/DISABLE ATTRIBUTE AUTOSAVE	D2h	SMART ENABLE OPERATIONS	D8h
SMART SAVE ATTRIBUTE VALUES	D3h	SMART DISABLE OPERATIONS	D9h
SMART EXECUTE OFF-LINE IMMIDIATE	D4h	SMART RETURN STATUS	DAh

5.3.1.1 S.M.A.R.T. Read Attribute Values (subcommand D0h)1

This subcommand returns the device's Attribute Values to the host. Upon receipt of the S.M.A.R.T. Read Attribute Values subcommand from the host, the device asserts BSY, saves any updated Attribute Values to the Attribute Data sectors, asserts DRQ, clears BSY, asserts INTRQ, and then waits for the host to transfer the 512 bytes of Attribute Value information from the device via the Data Register.

5.3.1.2 S.M.A.R.T. Read Attribute Thresholds (subcommand D1h)

This subcommand returns the device's Attribute Thresholds to the host. Upon receipt of the S.M.A.R.T. Read Attribute Thresholds subcommand from the host, the device reads the Attribute Thresholds from the Attribute Threshold sectors and then waits for the host to transfer the 512 bytes of Attribute Thresholds information from the device.

SAMSUNG ELECTRONICS

SAMSUNG

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD

5.3.1.3 S.M.A.R.T. Enable/Disable Attribute Autosave (subcommand D2h)

This subcommand enables and disables the attribute auto save feature of the device. The S.M.A.R.T. Enable/Disable Attribute Autosave subcommand allows the device to automatically save its updated Attribute Values to the Attribute Data Sector at the timing of the first transition to Active idle mode and after 15 minutes after the last saving of Attribute Values. This subcommand causes the auto save feature to be disabled. The state of the Attribute Autosave feature—either enabled or disabled—will be preserved by the device across the power cycle.
A value of 00h—written by the host into the device's Sector Count Register before issuing the S.M.A.R.T. Enable/Disable Attribute Autosave subcommand—will cause this feature to be disabled. Disabling this feature does not preclude the device from saving Attribute Values to the Attribute Data sectors during some other normal operation such as during a power-up or a power-down.
A value of F1h—written by the host into the device's Sector Count Register before issuing the S.M.A.R.T. Enable/Disable Attribute Autosave subcommand—will cause this feature to be enabled. Any other nonzero value written by the host into this register before issuing the S.M.A.R.T. Enable/Disable Attribute Autosave subcommand will not change the current Autosave status. The device will respond with the error code specified in Table 7-9: "S.M.A.R.T. Error Codes" on page 30.
The S.M.A.R.T. Disable Operations subcommand disables the auto save feature along with the device's S.M.A.R.T. operations.
Upon the receipt of the subcommand from the host, the device asserts BSY, enables or disables the Autosave feature, clears BSY, and asserts INTRQ.

5.3.1.4 S.M.A.R.T. Save Attribute Values (subcommand D3h)

This subcommand causes the device to immediately save any updated Attribute Values to the device's Attribute Data sector regardless of the state of the Attribute Autosave feature. Upon receipt of the S.M.A.R.T. Save Attribute Values subcommand from the host, the device asserts BSY, writes any updated Attribute Values to the Attribute Data sector, clears BSY, and asserts INTRQ.

5.3.1.5 S.M.A.R.T. Execute Off-line Immediate (subcommand D4h)

This subcommand causes the device to immediately initiate the set of activities that collect Attribute data in an offline mode (off-line routine) or execute a self-test routine in either captive or off-line mode. The LBA Low register shall be set to specify the operation to be executed.

LBA Low	Subcommand
00h	Execute S.M.A.R.T. off-line data collection routine immediately
01h	Execute S.M.A.R.T. Short self-test routine immediately in off-line mode
02h	Execute S.M.A.R.T. Extended self-test routine immediately in off-line mode
03h	Reserved
04h	Execute S.M.A.R.T. Selective self-test routine immediately in off-line mode
40h	Reserved
7Fh	Abort off-line mode self-test routine
81h	Execute S.M.A.R.T. short self-test routine immediately in captive mode
82h	Execute S.M.A.R.T. Extended self-test routine immediately in captive mode
84h	Execute S.M.A.R.T. selective self-test routine immediately in captive mode
C0h	Reserved

Off-line mode: The device executes command completion before executing the specified routine. During execution of the routine the device will not set BSY nor clear DRDY. If the device is in the process of performing its routine and is interrupted by a new command from the host, the device will abort or suspend its routine and service the host within two seconds after receipt of the new command. After servicing the interrupting command, the device will resume its routine automatically or not start its routine depending on the interrupting command.

Captive mode: When executing self-test in captive mode, the device sets BSY to one and executes the specified self-test routine after receipt of the command. At the end of the routine, the device sets the execution result in the Self-test execution status byte (see Table 7-1: "Device Attribute Data Structure" on page 23) and ATA registers and then executes the command completion. See definitions below.

Status	Set ERR to one when the self-test has failed
Error	Set ABRT to one when the self-test has failed
LBA Low	Set to F4h when the self-test has failed
LBA High	Set to 2Ch when the self-test has failed

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD

5.3.1.6 S.M.A.R.T. Read Log Sector (subcommand D5h)

This command returns the indicated log sector contents to the host. Sector count specifies the number of sectors to be read from the specified log. The log transfered by the drive shall start at the first sector in the speicified log, regardless of the sector count requested. Sector nubmer indicates the log sector to be returned as described in the following Table.

Log sector address	Content	
00h	Log directory	RO
01h	SMART error log	RO
02h	Comprehensive SMART error log	RO
04h-05h	Reserved	RO
06h	SMART self-test log	RO
08h	Reserved	RO
09h	Selective self-test log	RW
0Ah-7Fh	Reserved	RO
80h-9Fh	Host vendor specific	R/W
A0h-FFh	Reserved	VS

RO - Log is read only by the host.
R/W - Log is read or written by the host.
VS - Log is vendor specific thus read/write ability is vendor specific.

5.3.1.7 S.M.A.R.T. Write Log Sector (subcommand D6h)

This command writes 512 bytes of data to the specified log sector. The 512 bytes of data are transferred at a command and the LBA Low value shall be set to one. The LBA Low shall be set to specify the log sector address. If a Read Only log sector is specified, the device returns ABRT error.

5.3.1.8 S.M.A.R.T. Enable Operations (subcommand D8h)

This subcommand enables access to all S.M.A.R.T. capabilities within the device. Prior to receipt of a S.M.A.R.T. Enable Operations subcommand, Attribute Values are neither monitored nor saved by the device. The state of S.M.A.R.T.—either enabled or disabled—will be preserved by the device across power cycles. Once enabled, the receipt of subsequent S.M.A.R.T. Enable Operations subcommands will not affect any of the Attribute Values. Upon receipt of the S.M.A.R.T. Enable Operations subcommand from the host, the device asserts BSY, enables S.M.A.R.T. capabilities and functions, clears BSY, and asserts INTRQ.

5.3.1.9 S.M.A.R.T. Disable Operations (subcommand D9h)

This subcommand disables all S.M.A.R.T. capabilities within the device including the device's attribute auto save feature. After receipt of this subcommand the device disables all S.M.A.R.T. operations. Non self-preserved Attribute Values will no longer be monitored. The state of S.M.A.R.T.—either enabled or disabled—is preserved by the device across power cycles. Note that this subcommand does not preclude the device's power mode attribute auto saving.

Upon receipt of the S.M.A.R.T. Disable Operations subcommand from the host, the device asserts BSY, disables S.M.A.R.T. capabilities and functions, clears BSY, and asserts INTRQ.

After receipt of the device of the S.M.A.R.T. Disable Operations subcommand from the host, all other S.M.A.R.T. subcommands—with the exception of S.M.A.R.T. Enable Operations—are disabled, and invalid and will be aborted by the device—including the S.M.A.R.T. Disable Operations subcommand—returning the error code as specified in Table 7-9: "S.M.A.R.T. Error Codes" on page 30.

Any Attribute Values accumulated and saved to volatile memory prior to receipt of the S.M.A.R.T. Disable Operations command will be preserved in the device's Attribute Data Sectors. If the device is re-enabled, these Attribute Values will be updated, as needed, upon receipt of a S.M.A.R.T. Read Attribute Values or a S.M.A.R.T. Save Attribute Values command.

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD

5.3.1.10 S.M.A.R.T. Return Status (subcommand DAh)

This subcommand is used to communicate the reliability status of the device to the host's request. Upon receipt of the S.M.A.R.T. Return Status subcommand the device asserts BSY, saves any updated Attribute Values to the reserved sector, and compares the updated Attribute Values to the Attribute Thresholds.

If the device does not detect a Threshold Exceeded Condition, or detects a Threshold Exceeded Condition but involving attributes are advisory, the device loads 4Fh into the LBA Mid register, C2h into the LBA High register, clears BSY, and asserts INTRQ.

If the device detects a Threshold Exceeded Condition for prefailure attributes, the device loads F4h into the LBA Mid register, 2Ch into the LBA High register, clears BSY, and asserts INTRQ. Advisory attributes never result in a negative reliability condition.

5.3.2 Device Attribute Data Structure

The following defines the 512 bytes that make up the Attribute Value information. This data structure is accessed by the host in its entirety using the

S.M.A.R.T. Read Attribute Values subcommand.

Byte	Descriptions
0~1	Data structure revision number
2~361	1st - 30th Individual attribute data
362	Off-line data collection status
363	Self-test execution status
364~365	Total time in seconds to complete off-line data collection activity
366	Vendor Specific
367	Off-line data collection capability
368-369	SMART capability

370	Error logging capability
	    7-1 Reserved
	        0 1=Device error logging supported

371	Self-test failure check point
372	Short self-test routine recommended polling time(in minutes)
373	Extended self-test routine recommended polling time(in minutes)
374-510	Reserved
511	Data structure checksum

[Table 7-1] Device Attribute Data Structure

5.3.2.1 Data Structure Revision Number

The Data Structure Revision Number identifies which version of this data structure is implemented by the device.
This revision number will be set to 0005h. This revision number identifies both the Attribute Value and Attribute
Threshold Data structures.

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD

5.3.2.2 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.

Byte	Descriptions
0	Attribute ID number 01-FFh

1~2	Status flag
	 bit 0 (pre-failure/advisory bit)
	  bit 0 = 0 : An attribute value less than or equal to its corresponding attribute threshold indicates an advisory condition where the usage or age of the device has exceeded its intended design life period.
	  bit 0 = 1 : An attribute value less than or equal to its corresponding attribute threshold indicates a pre-failure condition where imminent loss of data is being predicted.
	 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	

Attribute ID Numbers: Any nonzero value in the Attribute ID Number indicates an active attribute. The device supports following Attribute ID Numbers.

ID	Attribute Name
9	Power-on Hours Count
12	Power Cycle Count
177	Wear Leveling
179	Used Reserved Block Count
180	Unused Reserved Block Count
181	Program Fail Count
182	Erase Fail Count
194	Drive Case Temperature
195	Uncorrectable Error Count
198	Off-line Scan Uncorrectable Error Count
199	CRC Error Count
202	Exception Mode Status(Read Only Mode)
233	Number of the Write Count

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD

5.3.2.3 Off-Line Data Collection Status

The value of this byte defines the current status of the off-line activities of the device. Bit 7 indicates an Automatic Off-line Data Collection Status.
Bit 7 Automatic Off-line Data Collection Status
0 Automatic Off-line Data Collection is disabled.
1 Automatic Off-line Data Collection is enabled.

Bits 0–6 represent a hexadecimal status value reported by the device.
Value   Definition
  0 Off-line data collection never started.
  2 All segments completed without errors. In this case the current segment pointer is equal to the total segments required.
  3 Off-line activity in progress.
  4 Off-line data collection is suspended by the interrupting command.
  5 Off-line data collecting is aborted by the interrupting command.
  6 Off-line data collection is aborted with a fatal error.

5.3.2.4 Self-test execution status

Bit   Definition
0-3 Percent Self-test remaining. An approximation of the percentage of the self-test routine remaining until completion given in ten percent increments. Valid values are 0 through 9.
4-7 Current Self-test execution status.
  0 The self-test routine completed without error or has never been run.
  1 The self-test routine was aborted by the host.
  2 The self-test routine was interrupted by the host with a hard or soft reset.
  3 The device was unable to complete the self-test routine due to a fatal error or unknown test error.
  4 The self-test routine was completed with an unknown element failure.
  5 The self-test routine was completed with an electrical element failure.
  6 The self-test routine was completed with a servo element failure.
  7 The self-test routine was completed with a read element failure.
  15 The self-test routine is in progress.

5.3.2.5 Total time in seconds to complete off-line data collection activity

This field tells the host how many seconds the device requires to complete the off-line data collection activity.

5.3.2.6 Current segment pointer

This byte is a counter indicating the next segment to execute as an off-line data collection activity. Because the number of segments is 1, 01h is always returned in this field.

5.3.2.7 Off-line data collection capability

Bit   Definition
0 Execute Off-line Immediate implemented bit
  0 S.M.A.R.T. Execute Off-line Immediate subcommand is not implemented
  1 S.M.A.R.T. Execute Off-line Immediate subcommand is implemented
1 Enable/disable Automatic Off-line implemented bit
  0 S.M.A.R.T. Enable/disable Automatic Off-line subcommand is not implemented
  1 S.M.A.R.T. Enable/disable Automatic Off-line subcommand is implemented
2 Abort/restart off-line by host bit
  0 The device will suspend off-line data collection activity after an interrupting command and resume it after a vendor specific event
  1 The device will abort off-line data collection activity upon receipt of a new command Bit Definition
3 Off-line Read Scanning implemented bit
  0 The device does not support Off-line Read Scanning
  1 The device supports Off-line Read Scanning
4 Self-test implemented bit
  0 Self-test routing is not implemented
  1 Self-test routine is implemented
5 Reserved (0)
6 Selective self-test routine is not implemented
  0 Selective self-test routine is not implemented
  1 Selective self-test routine is implemented
7 Reserved (0)

SAMSUNG ELECTRONICS

SAMSUNG

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD

5.3.2.8 S.M.A.R.T. Capability

This word of bit flags describes the S.M.A.R.T. capabilities of the device. The device will return 03h indicating that the device will save its Attribute Values prior to going into a power saving mode and supports the S.M.A.R.T. ENABLE/DISABLE ATTRIBUTE AUTOSAVE command.

Bit   Definition
0   Pre-power mode attribute saving capability. If bit = 1, the device will save its Attribute Values prior to going into a power
               saving mode (Standby or Sleep mode).
1   Attribute auto save capability. If bit = 1, the device supports the S.M.A.R.T. ENABLE/ DISABLE ATTRIBUTE AUTOSAVE
               command.
2-15   Reserved (0)

5.3.2.9 Error logging capability

Bit   Definition
7-1   Reserved (0)
0   The Error Logging support bit. If bit = 1, the device supports the Error Logging

5.3.2.10 Self-test failure check point

This byte indicates the section of self-test where the device detected a failure.100

5.3.2.11 Self-test completion time

These bytes are the minimum time in minutes to complete the self-test.

5.3.2.12 Data Structure Checksum

The Data Structure Checksum is the 2's complement of the result of a simple 8-bit addition of the first 511 bytes in the data structure.

5.3.3 Device Attribute Thresholds data structure

The following defines the 512 bytes that make up the Attribute Threshold information. This data structure is accessed by the host in its entirety using the S.M.A.R.T. Read Attribute Thresholds. All multibyte fields shown in these data structures follow the ATA/ATAPI-6 specification for byte ordering, that is, that the least significant byte occupies the lowest numbered byte address location in the field.

The sequence of active Attribute Thresholds will appear in the same order as their corresponding Attribute Values.

Byte	Descriptions
0~1	Data structure revision number
2~361	1st - 30th Individual attribute data
362 ~ 379	Reserved
380 ~ 510	Vendor specific
511	Data structure checksum

[Table 7-2] Device Attribute Thresholds Data Structure

5.3.3.1 Data Structure Revision Number

This value is the same as the value used in the Device Attributes Values Data Structure.

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD

5.3.3.2 Individual Thresholds Data Structure

The following defines the 12 bytes that make up the information for each Threshold entry in the Device Attribute Thresholds Data Structure. Attribute entries in the Individual Threshold Data Structure are in the same order and correspond to the entries in the Individual Attribute Data Structure.

Byte	Descriptions
0	Attribute ID Number (01h to FFh)
1	Attribute Threshold (for comparison with Attribute Values from 00h to FFh) 00h - "always passing" threshold value to be used for code test purposes 01h - minimum value for normal operation FDh - maximum value for normal operation FEh - invalid for threshold value FFh - "always failing" threshold value to be used for code test purposes
2~11	Reserved (00h)

5.3.3.3 Attribute ID Numbers

Attribute ID Numbers supported by the device are the same as Attribute Values Data Structures.

5.3.3.4 Attribute Threshold

These values are preset at the factory and are not meant to be changeable. However, the host might use the "S.M.A.R.T. Write Attribute Threshold" sub-command to override these preset values in the Threshold sectors.

5.3.3.5 Data Structure Checksum

The Data Structure Checksum is the 2's compliment of the result of a simple 8-bit addition of the first 511 bytes in the data structure.

5.3.4 S.M.A.R.T. Log Directory

The following defines the 512 bytes that make up the S.M.A.R.T. Log Directory. The S.M.A.R.T. Log Directory is on S.M.A.R.T. Log Address zero and is defined as one sector long.

Byte	Descriptions
0~1	S.M.A.R.T. Logging Version
2	Number of sectors in the log at log address 1
3	Reserved
4	Number of sectors in the log at log address 2
5	Reserved
...	
510	Number of sectors in the log at log address 255
511	Reserved

[Table 7-3] S.M.A.R.T. Log Directory

The value of the S.M.A.R.T. Logging Version word shall be 01h. The logs at log addresses 80-9Fh are defined as 16 sectors long.

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD

5.3.5 S.M.A.R.T. error log sector

The following defines the 512 bytes that make up the S.M.A.R.T. error log sector. All multibyte fields shown in these data structures follow the ATA/ATAPI-6 specifications for byte ordering.

Byte	Descriptions
0	S.M.A.R.T. error log version
1	Error log pointer
2-91	1st error log data structure
92-181	2nd error log data structure
182-271	3rd error log data structure
272-361	4th error log data structure
362-451	5th error log data structure
452-453	Device error count
454-510	Reserved
511	Data structure checksum

[Table 7-4] S.M.A.R.T. error log sector

5.3.5.1 S.M.A.R.T. error log version

This value is set to 01h.

5.3.5.2 Error log pointer

This points to the most recent error log data structure. Only values 1 through 5 are valid.

5.3.5.3 Device error count

This field contains the total number of errors. The value will not roll over.

5.3.5.4 Error log data structure

The data format of each error log structure is shown below.

Byte	Descriptions
n ~ n+11	1st command data structure
n+12 ~ n+23	2nd command data structure
n+24 ~ n+35	3rd command data structure
n+36 ~ n+47	4th command data structure
n+48 ~ n+59	5th command data structure
n+60 ~ n+89	Error data structure

[Table 7-5] Error log data structure

SAMSUNG ELECTRONICS

SAMSUNG

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD

5.3.5.5 Command data structure

Data format of each command data structure is shown below.

Byte	Descriptions
n	Content of the Device Control register when the Command register was written
n+1	Content of the Features Control register when the Command register was written
n+2	Content of the Sector Count Control register when the Command register was written
n+3	Content of the LBA Low register when the Command register was written
n+4	Content of the LBA Mid register when the Command register was written
n+5	Content of the LBA High register when the Command register was written
n+6	Content of the Device/Head register when the Command register was written
n+7	Content written to the Command register
n+8	Timestamp
n+9	Timestamp
n+10	Timestamp
n+11	Timestamp

[Table 7-6] Command data structure

Timestamp shall be the time since power-on in milliseconds when command acceptance occurred. This timestamp may wrap around.

5.3.5.6 Error data structure

Data format of error data structure is shown below.

Byte	Descriptions
n	Reserved
n+1	Content written to the Error register after command completion occurred.
n+2	Content written to the Sector Count register after command completion occurred.
n+3	Content written to the LBA Low register after command completion occurred.
n+4	Content written to the LBA Mid register after command completion occurred.
n+5	Content written to the LBA High register after command completion occurred.
n+6	Content written to the Device/Head register after command completion occurred.
n+7	Content written to the Status register after command completion occurred.
n+8 - n+26	Extended error information
n+27	State
n+28	Life Timestamp (least significant byte)
n+29	Life Timestamp (most significant byte)

[Table 7-7] Error data structure

Extended error information will be vendor specific.

State field contains a value indicating the device state when command was issued to the device.

Value	State
x0h	Unknown
x1h	Sleep
x2h	Standby
x3h	Active/Idle with BSY cleared to zero
x4h	Executing SMART off-line or self-test
x5h-xAh	Reserved
xBh-xFh	Vendor unique

The value of x is vendor specific and may be different for each state.

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD

5.3.6 Self-test log structure

The following defines the 512 bytes that make up the Self-test log sector.

Byte	Byte
0~1	Data structure revision
n*24+2	Self-test number
n*24+3	Self-test execution status
n*24+4~n*24+5	Life timestamp
n*24+6	Self-test failure check point
n*24+7~n*24+10	LBA of first failure
n*24+11~n*24+25	Vendor specific
...	...
506~507	Vendor specific
508	Self-test log pointer
509~510	Reserved
511	Data structure checksum

[Table 7-8] Self-test log data structure

Note: N is 0 through 20
The data structure contains the descriptor of the Self-test that the device has performed. Each descriptor is 24 bytes long and the self-test data structure is capable to contain up to 21 descriptors. After 21 descriptors has been recorded, the oldest descriptor will be overwritten with the new descriptor. The self-test log pointer points to the most recent descriptor. When there is no descriptor, the value is 0. When there are descriptor(s), the value is 1 through 21.

5.3.7 Selective self-test log data structure

The Selective self-test log is a log that may be both written and read by the host. This log allows the host to select the parameters for the self-test and to monitor the progress of the self-test. The following table defines the contents of the Selective self-test log which is 512 bytes long. All multi-byte fields shown in these data structures follow the specifications for byte ordering.

Byte	Description	Read/Write
0-1	Data structure revision	R/W
2-9	Starting LBA for test span 1	R/W
10-17	Ending LBA for test span 1	R/W
18-25	Starting LBA for test span 2	R/W
26-33	Ending LBA for test span 2	R/W
34-41	Starting LBA for test span 3	R/W
42-49	Ending LBA for test span 3	R/W
50-57	Starting LBA for test span 4	R/W
58-65	Ending LBA for test span 4+	R/W
66-73	Starting LBA for test span 5	R/W
74-81	Ending LBA for test span 5	R/W
82-337	Reserved	Reserved
338-491	Vendor specific	Vendor specific
492-499	Current LBA under test	Read
500-501	Current span under test	Read
502-503	Feature flags	R/W
504-507	Vendor Specific	Vendor specific
508-509	Selective self test pending time	R/W
510	Reserved	Reserved
511	Data structure checksum	R/W

SAMSUNG ELECTRONICS

SAMSUNG

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD

5.3.8 Error reporting

The following table shows the values returned in the Status and Error Registers when specific error conditions are encountered by a device.

Error condition	Status Register	Error Register
A S.M.A.R.T. FUNCTION SET command was received by the device without the required key being loaded into the LBA High and LBA Mid registers.	51h	04h
A S.M.A.R.T. FUNCTION SET command was received by the device with a subcommand value in the Features Register that is either invalid or not supported by this device.	51h	04h
A S.M.A.R.T. FUNCTION SET command subcommand other than S.M.A.R.T. ENABLE OPERATIONS was received by the device while the device was in a "S.M.A.R.T. Disabled" state.	51h	04h
The device is unable to read its Attribute Values or Attribute Thresholds data structure	51h	10h or 04h
The device is unable to write to its Attribute Values data structure.	51h	10h or 40h

[Table 7-9] SMART Error Codes

6.0 SPOR Specification (Sudden Power Off and Recovery)

6.1 Data Recovery in Sudden Power Off

If power interruption is detected, SSD dumps all cached 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.

6.2 Time to Ready Sequence

SSD gives drive ready signal finishing FTL OPEN when is maximum 3 seconds, but SSD does not use cache right after becoming ready. SSD needs maximum 65 seconds to charge fully additional power source, and then SSD turns cache on status when charging is done. This status is operating mode where SSD works as cache on(write back) in operating mode protected by additional power source while working to cache off(write through) on protection mode status. SSD works as protection mode during SPOR(Sudden Power Off and Recovery)
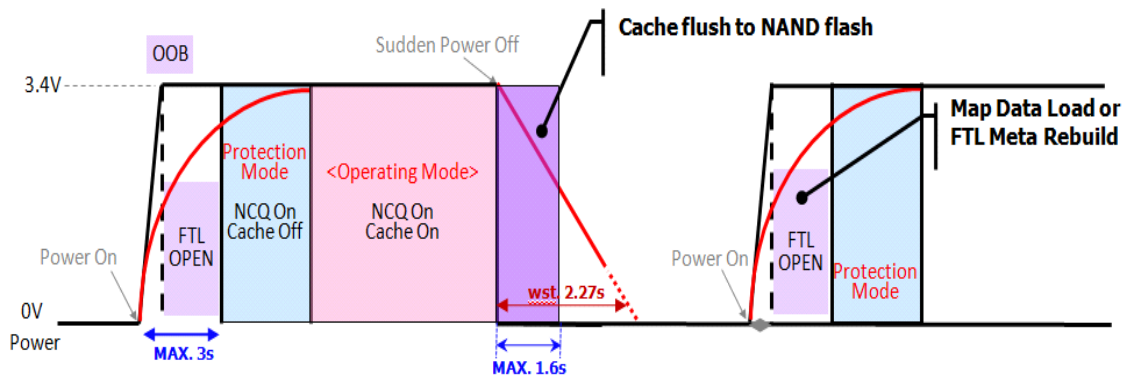
6.3 Treatment Specification

Detaching additional power source from SSD PCB causes SSD not to work.

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD

7.0 SATAII Optional Feature

7.1 Power Segment Pin P11

Pin P11 of the power segment of the device connector may be used by the device to provide the host with an activity indication and it may be used by the host to indicate whether staggered spinup should be used. To accomplish both of these goals, pin P11 acts as an input from the host to the device prior to PHYRDY for staggered spin-up control and then acts as an output from the device to the host after PHYRDY for activity indication. The activity indication provided by pin P11 is primarily for use in backplane applications.
A host may only support one pin P11 feature, either receiving activity indication or staggered spin-up disable control. If a host supports receiving activity indication via pin P11, then the host shall not use pin P11 to disable staggered spin-up. If a host does not support receiving activity indication via pin P11, then the host may use pin P11 to disable staggered spin-up.

7.2 Activity LED indication

The signal provides for activity indication. This is a low-voltage and low-current driver intended for efficient integration into present and future IC manufacturing processes. The signal is NOT suitable for directly driving an LED and must first be buffered using a circuit external to the drive before driving and LED. The LED indication signal is working on 200msec periods on FORMAT and Write same command. (100ms at high state and then 100msec at low state) On the other case of commands, the signal is workinig on 100ms periods.

7.3 Asynchronous Signal Recovery

Phys may support asynchronous signal recovery for those applications where the usage model of device insertion into a receptacle does not apply. When signal is lost, both the host and the device may attempt to recover the signal. A host or device shall determine loss of signal as represented by a transition from PHYRDY to PHYRDYn, which is associated with entry into states LSI: NoCommErr or LS2:NoComm within the Link layer. Note that negation of PHYRDY does not always constitute a loss of signal. Recovery of the signal is associated with exit from state LS2:NoComm. If the device attempts to recover the signal before the host by issuing a COMINIT, the device shall return its signature following completion of the OOB sequence which included COMINIT. If a host supports asynchronous signal recovery, when the host receives an unsolicited COMINIT, the host shall issue a COMRESET to the device. When a COMRESET is sent to the device in response to an unsolicited COMINIT, the host shall set the Status register to 7Fh and shall set all other Shadow Command Block Registers to FFh. When the COMINIT is received in response to the COMRESET which is associated with entry into state HP2B:HR_AwaitNoCOMINIT, the Shadow Status register value shall be updated to either FFh or 80h to reflect that a device is attached.

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD

8.0 OOB signaling and Phy Power State

8.1 OOB signaling

8.1.1 OOB signal spacing

There shall be three Out Of Band (OOB) signals used/detected by the Phy: COMRESET,COMINIT, and COMWAKE. Each burst is followed by idle periods (at common-mode levels), having durations as depicted in following Figure and Table. The COMWAKE OOB signaling is used to bring the Phy out of a power-down state (Partial or Slumber)

Time	Value
T1	106.7 ns
T2	320 ns

8.2 Phy Power State

8.2.1 COMRESET sequence state diagram

8.2.2 Interface Power States

8.2.2.1 PHYRDY

The Phy logic and main PLL are both on and active. The interface is synchronized and capable of receiving and sending data.

8.2.2.2 Partial

The Phy logic is powered, but is in a reduced power state. Both signal lines on the interface are at a neutral logic state (common mode voltage). The exit latency from this state shall be no longer than 10 us.

8.2.2.3 Slumber

The Phy logic is powered but is in a reduced power state. The exit latency from this state shall be no longer than 10 ms.

8.2.3 Partial/Slumber to PHYRDY

8.2.3.1 Host Initiated

The host may initiate a wakeup from the Partial or Slumber states by entering the power-on sequence at the "Host COMWAKE" point in the state machine. Calibration and speed negotiation is bypassed since it has already been performed at power-on and system performance depends on quick resume latency. The device, therefore, shall transmit ALIGNP primitives at the speed determined at power-on.

8.2.3.2 Device Initiated

The device may initiate a wakeup from the Partial or Slumber states by entering the power-on sequence at the "Device COMWAKE" point in the state machine. Calibration and speed negotiation is bypassed since it has already been performed at power-on and system performance depends on quick resume latency. The device, therefore, shall transmit ALIGNP primitives at the speed determined at power-on.

8.2.4 PHYRDY to Partial/Slumber

8.2.4.1 Host Initiated for Partial

8.2.4.2 Device Initiated for Partial

*For Slumber, the same sequence applies except PMREQ_PP is replaced with PMREQ_SP and Partial is replaced with Slumber.

SAMSUNG ELECTRONICS

SAMSUNG

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD

9.0 Identify Device Data

Word	100GB	200GB	400GB	Description
0	0040h	0040h	0040h	General information
1	3FFFh	3FFFh	3FFFh	Number of logical cylinders
2	C837h	C837h	C837h	Specific configuration
3	0010h	0010h	0010h	Number of logical heads
4 - 5	0000h	0000h	0000h	Retired
6	003Fh	003Fh	003Fh	Number of logical sectors per logical track
7 - 8	0000h	0000h	0000h	Reserved
9	0000h	0000h	0000h	Retired
10 -19	XXXXh	XXXXh	XXXXh	Serial number(20 ASCII characters)
20 - 21	0000h	0000h	0000h	Retired
22	0000h	0004h	0004h	Obsolete
23 - 26	XXXXh	XXXXh	XXXXh	Firmware revision(8 ASCII characters)
27- 46	XXXXh	XXXXh	XXXXh	Model number
47	8008h	8008h	8008h	Number of sectors on multiple commands - 8 sectors support
48	4000h	4000h	4000h	Trusted computing features
49	2F00h	2F00h	2F00h	Capabilities
50	4000h	4000h	4000h	Capabilities
51 - 52	0200h	0200h	0200h	Obsolete
53	0007h	0007h	0007h	Reserved
54	3FFFh	3FFFh	3FFFh	Number of current logical cylinders
55	0010h	0010h	0010h	Number of current logical heads
56	003Fh	003Fh	003Fh	Number of current logical sectors per track
57	FC10h	FC10h	FC10h	Current capacity in sectors
58	00FBh	00FBh	00FBh	
59	0108h	0108h	0108h	Multiple sector setting - 8sectors support
60	2230h	FFFFh	FFFFh	Maximum user LBA
61	0BA5h	0FFFh	0FFFh	Maximum user LBA
62	0000h	0000h	0000h	Obsolete
63	0007h	0007h	0007h	Multi-word DMA transfer
64	0003h	0003h	0003h	Flow control PIO transfer modes supported
65	0078h	0078h	0078h	Minimum Multiword DMA transfer cycle time per word
66	0078h	0078h	0078h	Manufacturer's recommended Multiword DMA transfer cycle time per word
67	0078h	0078h	0078h	Minimum PIO transfer cycle time without flow control
68	0078h	0078h	0078h	Minimum PIO transfer cycle time with IORDY flow control
69 - 74	0000h	0000h	0000h	Reserved
75	001Fh	001Fh	001Fh	32 queue depth
76	0506h	0506h	0506h	Support NCQ
77	0000h	0000h	0000h	Reserved for future Serial ATA definition
78	0046h	0046h	0046h	Serial ATA features supported - Non-zero buffer offsets in DMA setup FIS - support - DMA setup auto-activate optimization - support - Initiating interface power management - not support
79	0044h	0044h	0044h	Serial ATA features enabled
80	01FCh	01FCh	01FCh	Major version number
81	0028h	0028h	0028h	Minor version number
82	746Bh	746Bh	746Bh	Command set supported
83	7D01h	7D01h	7D01h	Command set supported - Automatic acoustic management feature - not support
84	6163h	6163h	6163h	Command set/feature supported extension
85	7469h	7469h	7469h	Command set enabled
86	BC01h	BC01h	BC01h	Command set/feature enabled

Word	100GB	200GB	400GB	Description
87	6163h	6163h	6163h	Command set/feature default
88	407Fh	407Fh	407Fh	Ultra DMA mode 6 is selected
89	0001h	0001h	0001h	Time required for security erase unit completion
90	0001h	0001h	0001h	Time required for Enhanced security erase complete
91	0000h	0000h	0000h	Current advanced power management value
92	FFFEh	FFFEh	FFFEh	Master Password Revision Code
93	0000h	0000h	0000h	Hardware reset result
94	0000h	0000h	0000h	Current automatic acoustic management value - not support
95-99	0000h	0000h	0000h	Reserved
100	2230h	F1B0h	90B0h	Maximum user LBA
101	0BA5h	1749h	2E93h	Maximum user LBA
102-103	0000h	0000h	0000h	Maximum user LBA
104-105	0000h	0000h	0000h	Compliant with IDEMA Standard
106	4000h	4000h	4000h	Compliant with IDEMA Standard
107	0000h	0000h	0000h	Compliant with IDEMA Standard
108-111	XXXXh	XXXXh	XXXXh	Reserved for World Wide Name
112-115	0000h	0000h	0000h	Reserved
116-118	0000h	0000h	0000h	Compliant with IDEMA Standard
119-120	401Eh	401Eh	401Eh	Compliant with IDEMA Standard - Write, read, verify feature set - support - Read log dma ext, write log dma ext - support
121-126	0000h	0000h	0000h	Compliant with IDEMA Standard
127	0000h	0000h	0000h	Removable Media Status Notification feature set supported
128	0021h	0021h	0021h	Security status
129-159	0000h	0000h	0000h	Reserved
160	0000h	0000h	0000h	CFA power mode1
161-167	0000h	0000h	0000h	Reserved
168	0003h	0003h	0003h	Reserved
169-175	0000h	0000h	0000h	Reserved
176-205	0000h	0000h	0000h	Current media serial number
206	003Fh	003Fh	003Fh	SCT command transport support
207 - 208	0000h	0000h	0000h	Reserved
209	4000h	4000h	4000h	Init value
210 - 216	0000h	0000h	0000h	Reserved
217	0001h	0001h	0001h	Non-rotating Media Device
218-221	0000h	0000h	0000h	Reserved
222	101Fh	101Fh	101Fh	Support SATA Rev 2.6, SATA Rev 2.5, SATA II: Extensions,SATA 1.0a, ATA8
223-234	0000h	0000h	0000h	Reserved
235	0080h	0080h	0080h	Maximum number of 512 byte data blocks per DOWNLOAD MICROCODE cmd for mode 03h
236-254	0000h	0000h	0000h	Reserved
255	5CA5h	53A5h	53A5h	Integrity word

SAMSUNG ELECTRONICS

SAMSUNG

MZ5EA100HMDR-00003
MZ5EA200HMDR-00003
MZ5EA400HMFP-00003

datasheet

Rev. 1.0

SSD

10.0 Ordering Information

1. Module: M

2. SSD : Z

3. Form Factor
5 : 2.5 inch

4. Line-up
E : SV/Storage(Ep 2bit MLC)

5. SSD CTRL
A : MAX

6~8. : SSD Density
100 : 100GB   200 : 200GB
400 : 400GB

9. : NAND PKG + Voltage
H : BGA(LF, HF)

10. Flash Generation
M : 1st Generation

11~12. NAND Density
DR : 128G QDP 4CE
FP : 256G ODP 4CE
13. -

14. Default
0 : With Label

15. HW revision
0 : No revision

16. Packaging Type
0 : Bulk

17~18. Bucket
03 : Enterprise SV & Storage

11.0 Product Line up

Part Number	Density	Type	Remark
MZ5EA100HMDR-00003	100GB	2.5"	
MZ5EA200HMDR-00003	200GB	2.5"	
MZ5EA400HMFP-00003	400GB	2.5"	

SAMSUNG ELECTRONICS

- 28 -

SAMSUNG