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Rev. 1.0,Nov. 2019

MZILT960HBHQ-00007
MZILT1T9HBJR-00007
MZILT3T8HBLS-00007
MZILT7T6HALA-00007
MZILT15THALA-00007
MZILT30THALA-00007

PM1643a 2.5" SAS 12Gb/s SSD
(NAND based Solid State Drive)

datasheet *For General*

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Revision History

Revision No	History	Draft Date	Remark	Edited by	Reviewed by
1.0	1. Initial Release	Nov.19, 2019	Initial	J.S.Kim	C.W.Sun

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PM1643a

PART NUMBER	MZILT960HBHQ-00007	MZILT1T9HBJR-00007	MZILT3T8HBLS-00007	MZILT7T6HALA-00007	MZILT15THALA-00007	MZILT30THALA-00007
Capacity[1]	960GB	1.92TB	3.84TB	7.68TB	15.36TB	30.72TB
LBA[2]	1,875,385,008	3,750,748,848	7,501,476,528	15,002,931,888	30,005,842,608	60,001,615,872

FEATURES

· SAS 12 Gb/s interface

· Fully complies Active-active dual port

· Enhanced Power-Loss Data Protection with Aluminum Electrolytic Capacitors

· TCG-compliant Self-Encryption Drive (Optional)

· Hardware based AES 256-bit Encryption Engine (optional)

· End-to-End Data Protection

· Support 32 Initiator with TCQ (Up to 256Q-depth) Command Set

· 8 RRDY provide

· Auto good response

· Supports Tag-overlap check and reserved field check

· Compliant with SCSI Specification (SAS-3 / SPL-3 / SBC-4 / SPC-5 / SAM-5)

· Compliant with TCG Enterprise Specification Rev. 1.01 (Optional)

· RoHS Compliant

· Support T10 DIF

Performance Specifications[3]

Data Transfer Rate[4]

Sequential Read (128KB)	(PM1643a)		2,100MB/s
Sequential Write (128KB)	(PM1643a)	Up to 2,000MB/s	

Data I/O Speed[4]

Random Read (4KB)	(PM1643a)	Up to 450K IOPS	
Sustained Random Write (4KB)	(PM1643a)	Up to	90K IOPS

Latency (Sustained random workload)

Read (typical)	(960GB~3.84TB)	120us
	(7.68TB~30.72TB)	130us
Write (typical)	(960GB~30.72TB)	45us

Quality of service

Read/Write (99%)	(960GB~30.72TB)	Up to	170us/90us
Read/Write (99.99%)	(960GB~30.72TB)		220us/100us

Drive Configuration

Capacity[1]	960GB/1.92/3.84/7.68/15.36/30.72TB
From Factor	2.5"
Interface	SAS 12Gbps
Bytes per Sector	512/520/4096/4160 Bytes

POWER REQUIREMENTS

Supply Voltage	5V±5%, 12V±5%(960GB/1.92TB/3.84TB) 5V±5%, 12V±6%(7.68TB/15.36TB/30.72TB)
Active [7](Max. RMS)	12.5W
Idle (typical)	5.5W

Reliability Specifications

Uncorrectable Bit Error Rate	1sector error in 10^{17} bits read
MTBF	2,000,000 hours
Component Design Life	5 years

Endurance

960GB 1.92/3.84/7.68/15.36/30.72TB	1DWPD
Data loss protection	Yes

Environmental Specifications

Temperature, Case	
Operating[5]	0°C to 70°C
Non-operating[6]	-40°C to 85°C
Humidity (non-condensing)	5 ~ 95%

Physical Dimension

Width	69.85 ± 0.25 mm
Depth	100.20 ± 0.25 mm
Height	14.80 ± 0.20 mm
Weight	Up to 157.5 g

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Linear Shock (0.5ms duration with sine wave)

    Non-operating   1,500 G

Vibration (20Hz to 2,000Hz, 4min/cycle, 5cycle/axis on 3axis)

    Non-operating   20 G

Altitude (relative to sea level)

    Operating   -1,000 to 15,000 feet

NOTE:
Design and specifications are subject to change without prior 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) 1Sector = 512bytes, LBA Count is based on the IDEMA standard.
3) Performance measured using FIO with queue depth 128. Actual performance. Actual performance may vary depending on use conditions and environment.
4) Performance is measured at dual port.
5) Tc is measured at the hottest point on the case. Sufficient airflow is recommended to be operated properly on heavier workload within device operating temperature.
6) Storing (or shipping) temperature without power connection.
7) Active power is measured using IOMeter2006
8) IDLE POWER IS MEASURED USING DRIVE MASTER 2010.

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1.0 INTRODUCTION

1.1 General Description

This document describes the specification of the PM1643a SSD which use SAS 12Gb/s interface. Supporting SAS 12Gb/s interface shows much faster performance than previous SAS 6G SSDs.

PM1643a 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 in a Enterprise server and Storage for a storage device with a high performance, high capacity.

PM1643a delivers 2,100GB/s for sequential read and 2,000GB/s for sequential write speed under up to 9.5W(Read)/12.5W(Write) power.

By combining the enhanced reliability Samsung NAND Flash memory silicon with NAND Flash management technologies, PM1643a delivers the extended endurance of up to 1 Drive Writes Per Day (DWPD) for 5 years, which is suitable for enterprise applications, in three 2.5-inch form factor line-ups: 960GB, 1.92TB, 3.84TB, 7.68TB, 15.36TB, 30.72TB.

Because of SAS 12Gb/s interface has backward compatibility with SAS, you can use PM1643a as 6Gbps speed at old systems for SAS 6G interface.

In addition, PM1643a supports Power Loss Protection which can guarantee that data issued by the host system are written to the storage media without any loss in the event of sudden power off or sudden power failure.

1.2 Product List

[Table 1] Product Line-up

Type	Capacity	Part Number
PM1643a 2.5"	960GB	MZILT960HBHQ-00007
	1.92TB	MZILT1T9HBJR-00007
	3.84TB	MZILT3T8HBLS-00007
	7.68TB	MZILT7T6HALA-00007
	15.36TB	MZILT15THALA-00007
	30.72TB	MZILT30THALA-00007

NOTE:
1) SFF-8680 standard connector

1.3 Ordering Information

M Z X X X X X X X X X X
1 2 3 4 5 6 7 8 9 10 11 12

1. Memory (M)

2. Module Classification
   Z: SSD

3. Interface/ Form Factor
   I: SAS 12G 2.5 inch

4. Line-Up
   L: VT: Client/SV (VNAND 3bit MLC)

5. SSD CTRL
   T: RFX

6~8. NAND Density
   960: 960GB
   1T9: 1920GB
   3T8: 3840GB
   7T6: 7680GB
   15T: 1536GB
   30T: 3072GB

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

10. Flash Generation
   A: 2nd Generation
   B: 3rd Generation

11~12. NAND Density
   HQ: 1T QDP 4CE
   JR : 2T ODP 2CE(FBI)
   LS: 4T HDP 2CE(FBI)
   LA: 8/16/32T HDP 2CE(FBI)

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2.0 PRODUCT SPECIFICATION

2.1 Capacity

Support the high capacity product compared previous models and help the same system implement higher capacity than previous status. Samsung SSD fulfills IDEMA (The International Disk Drive Equipment and Materials Association) rule to represent a maximum LBA in SSD. According to the IDEMA rule (LBA1-G3), the maximum LBA numbers can be represented are the following table.

512bytes logical block size:
*Maximum LBA = (97,696,368) + (1,953,504 * (Advertised Capacity in Gigabytes - 50))*

4096bytes logical block size:
*Maximum LBA = (12,212,046) + (244,188 * (Advertised Capacity in Gigabytes - 50))*

[Table 2] User Capacity and Addressable Sectors

Cacacity[1]	Max LBA[2]			
	512B	**520B**	**4096B**	**4160B**
960GB	1,875,385,008	1,875,385,008	234,423,126	234,423,126
1.92TB	3,750,748,848	3,750,748,848	468,843,606	468,843,606
3.84TB	7,501,476,528	7,501,476,528	937,684,566	937,684,566
7.68TB	15,002,931,888	15,002,931,888	1,875,366,486	1,875,366,486
15.36TB	30,005,842,608 (30,001,856,512)	30,005,842,608 (29,391,585,280)	3,750,730,326 (3,750,232,064)	3,750,730,326 (3,750,232,064)
30.72TB	60,001,615,872	58,781,073,408	7,500,201,984	7,347,634,176

NOTE :
1) 1 Gigabyte(GB) = 1,000,000,000 Bytes
2) Capacity shown in Table 2 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.

2.2 Performance

[Table 3] Sequential Read/Write Performance

Max. Performance[1]	960GB	1.92TB	3.84TB	7.68TB	15.36TB	30.72TB
Sequential Read	2,100 MB/s	2,100 MB/s	2,100 MB/s	2,100 MB/s	2,100 MB/s	2,100 MB/s
Sequential Write	1,000 MB/s	1,800 MB/s	2,000 MB/s	2,000 MB/s	1,800 MB/s	1,700 MB/s

NOTE :
1) Measured performance with FIO on CentOS 7.x, 128KB data size and 32-Queue depth on active-active mode based sustained precondition. Sustained means the test is performed with 2 times full LBA range sequential write operation prior to the test. The Performance value had gotten by the condition that 1'st port's test LBA start at 0, and 2'nd port's test LBA start at half of the disk's capacity. Actual performance may vary depending on use conditions and environment.

[Table 4] Sustained Random Read/Write Performance

Max. Performance[1]	960GB	1.92TB	3.84TB	7.68TB	15.36TB	30.72TB
Random Read (QD[2] = 64)	380 KIOPS	430 KIOPS	450 KIOPS	400 KIOPS	400 KIOPS	400 KIOPS
Random Write (QD = 64)	40 KIOPS	60 KIOPS	90 KIOPS	90 KIOPS	65 KIOPS	60 KIOPS

NOTE :
1) Measured performance with FIO on CentOS 7.x, 4KB data size and 64-Queue depth on active-active mode based sustained precondition. Sustained means the test is performed with 2 times full LBA range random write operation prior to the test. Actual performance may vary depending on use conditions and environment.
2) Queue Depth : An initiator is guaranteed at least one command queue slot at any time, regardless of the actions of other initiators. A single initiator may queue up to 192 commands, but the maximum number may be reduced as other initiators consume queue slots. The total number of commands in the drive can never exceed 256.

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2.3 Latency

[Table 5] Latency[1)](sustained state)

Queue Depth = 1	960GB	1.92TB	3.84TB	7.68TB	15.36TB	30.72TB
Random Read/Write[2)]	120us/45us	120us/45us	120us/45us	130us/45us	130us/45us	130us/45us
Sequential Read/Write[3)]	240us/220us	240us/220us	240us/220us	240us/220us	240us/220us	240us/220us

NOTE :
1) Typical values.
2) The random read/write latency is measured by using FIO in CentOS7.x and 4KB transfer size with queue depth 1 on a random workload of sustained state.
3) The sequential read/write latency is measured by using FIO in CentOS7.x and 4KB transfer size with queue depth 1 on a sequential workload of sustained state.

2.4 Quality of Service (QoS)

[Table 6] Quality of Service (QoS)

Quality of Service (99%)	960GB	1.92TB	3.84TB	7.68TB	15.36TB	30.72TB
Read(4KB)(QD=1)	160us	160us	160us	170us	170us	170us
Write(4KB)(QD=1)	90us	90us	90us	90us	90us	90us
Read(4KB)(QD=128)	1600us	1600us	1600us	1600us	1600us	1600us
Write(4KB)(QD=128)	10000us	10000us	10000us	10000us	10000us	10000us

Quality of Service (99.99%)	960GB	1.92TB	3.84TB	7.68TB	15.36TB	30.72TB
Read(4KB)(QD=1)	220us	220us	220us	220us	220us	220us
Write(4KB)(QD=1)	100us	100us	100us	100us	100us	100us
Read(4KB)(QD=128)	2500us	2500us	2500us	2500us	2500us	2500us
Write(4KB)(QD=128)	13000us	13000us	13000us	13000us	13000us	13000us

NOTE :
1) QoS is measured using FIO (99/99.99 %) with queue depth 1 and 128 on 4 KB random and write.
2) QoS is measured as the maximum round-trip time taken for 99 % of commands to host.
3) QoS is measured as the maximum round-trip time taken for 99.99 % of commands to host.

2.5 Power Consumption

PM1643a is implemented in standardized 2.5-inch form factor and gets 12V power as well as 5V power through the indicated pins (#P13~15 for 12V and #P7~P9 for 5V in SFF-8680 connector plug) from the host system. For 12V and 5V, the allowable voltage tolerance and noise level in SSD are described in Table 7, the power consumption in Table

[Table 7] Maximum Voltage Ratings[1)]

Operating Voltage	960GB/1.92TB/ 3.84TB/ 7.68TB/ 15.36TB/ 30.72TB
Allowable Voltage	5V±7% 12V±10%
Allowable Voltage noise/ripple	250mV p-p or less (5V) 300mV p-p or less (12V)

NOTE :
 1) The components inside SSD were designed to endure the range of voltage fluctuations, which might be induced by the host system

[Table 8] Power Consumption

Parameter		Power consumption
Active	Read	9.5W (960GB~30.72TB)
	Write	12.5W (960GB~30.72TB)
Idle		5.5W (960GB~30.72TB)

NOTE :
1) The active and idle power is defined as the highest averaged power value, which is the maximum RMS average value
2) The measurement condition for active power is assumed for 100% sequential read and write
3) The idle state is defined as the state that the host system can issue any commands into SSD at any time
4) 100% sequential read and write Queue depth condition is 64depth and I/O size is 128KB.

2.6 Reliability

The reliability specification of the PM1643a follows JEDEC standard, which are included in JESD218A and JESD219A documents.

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2.6.1 Mean Time Between Failures

MTBF is Mean Time Between Failure, and is the predicted elapsed time between inherent failures of a system during operation. MTBF can be calculated as the arithmetic average time between failures of a system.

[Table 9] MTBF Specifications

Parameter	960GB	1.92TB	3.84TB	7.68TB	15.36TB	30.72TB
MTBF			2,000,000 hours			

NOTE :
1) AFR(annual failure ratio) is 0.44%

2.6.2 Uncorrectable Bit Error Rate

By definition, 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.

[Table 10] UBER Specifications

Parameter	960GB	1.92TB	3.84TB	7.68TB	15.36TB	30.72TB
UBER			1 sector per 10^{17} bits read			

2.6.3 Data Retention

By definition, data retention is the expected time period for retaining data in the SSD at the maximum rated endurance in power-off state as specified in the JESD218 document of JEDEC standard.

[Table 11] Data Retention Specifications

Parameter	960GB	1.92TB	3.84TB	7.68TB	15.36TB	30.72TB
Data Retention[1]			3 months			

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

2.6.4 Endurance

By definition, the endurance of SSD in enterprise application is defined as the maximum number of drive writes per day that can meet the requirements specified in the JESD218 document of JEDEC standard.

[Table 12] Drive Write Per Day (DWPD) Specifications

Parameter	960GB	1.92TB	3.84TB	7.68TB	15.36TB	30.72TB
DWPD			1 DWPD			

[Table 13] TBW(TeraBytes Written)

Parameter	960GB	1.92TB	3.84TB	7.68TB	15.36TB	30.72TB
TBW(TB)[1]	1,752	3,504	7,008	14,016	28,032	56,064

NOTE :
1) TBW = DWPD x 365 x 5 x User capacity

2.7 Environmental Specifications

2.7.1 Temperature

[Table 14] Temperature Specifications

Parameter		960GB	1.92TB	3.84TB	7.68TB	15.36TB	30.72TB
Temperature[1]	Operating			0 to 70 °C			
	Non-Operating			-40 to 85 °C			

NOTE :
1) Temperature of the hottest point on the case (Tc). The drive will be working properly within the operating temperature range without deteriorating device reliability or any throttling. Sufficient airflow would be recommended to be operated properly on any heavier workloads within device operating temperature.
2) The thermal workload limit for PM1643a : 100% Seq. Write (in a full-filled)

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Figure 1. Thermal Probe Location (960GB~7.68TB)
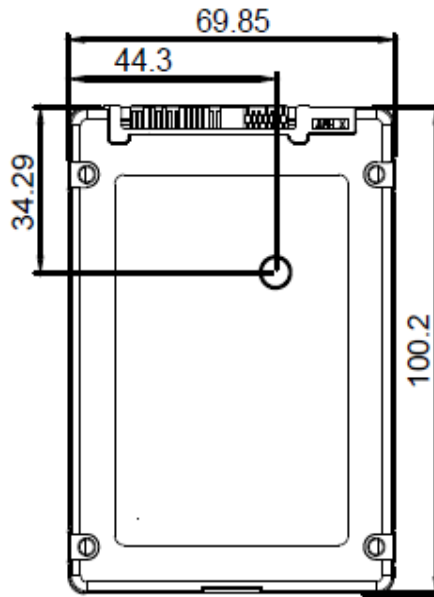
Figure 2. Thermal Probe Location (15.36TB~30.72TB)

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2.7.2 Humidity

[Table 15] Humidity Specifications

Parameter		960GB	1.92TB	3.84TB	7.68TB	15.36TB	30.72TB
Humidity[1]	Non-Operating			5 to 95%			

NOTE :
1) Humidity is measured in non-condensing state

2.7.3 Shock and Vibration

[Table 16] Shock and Vibration Specifications

Parameter		960GB	1.92TB	3.84TB	7.68TB	15.36TB	30.72TB
Shock[1]	Non-Operating			1500G			
Vibration [2]	Non-Operating			20G			

NOTE :
1) Test condition for shock : 0.5ms duration with half sine wave
2) Test condition for vibration : 20Hz to 2,000Hz, 4min/cycle, 5cycle/axis on 3 axis

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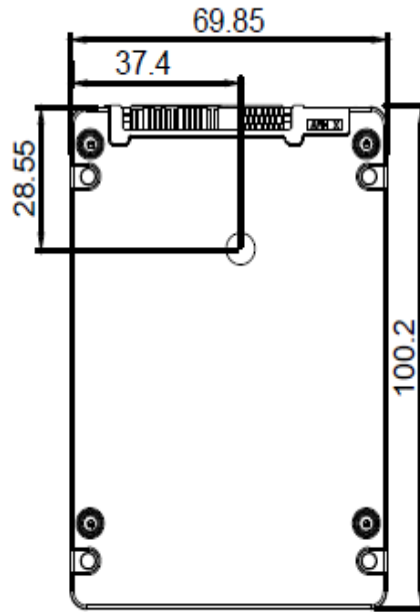HEADQUARTERS OF SAMSUNG ELECTRONICS.**

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3.0 MECHANICAL SPECIFICATION

3.1 Physical Information

The physical case of the PM1643a in 2.5-inch form factor follows the standardized dimensions defined by SSD Form Factor Work Group

[Table 17] Physical Dimensions and Weight

Parameter	960GB	1.92TB	3.84TB	7.68TB	15.36TB	30.72TB
Width (mm)	69.85±0.25					
Length (mm)	100.20±0.25					
Thickness (mm)	14.80±0.2					
Weight (g)	Up to 157.5g					

3.2 Form Factor
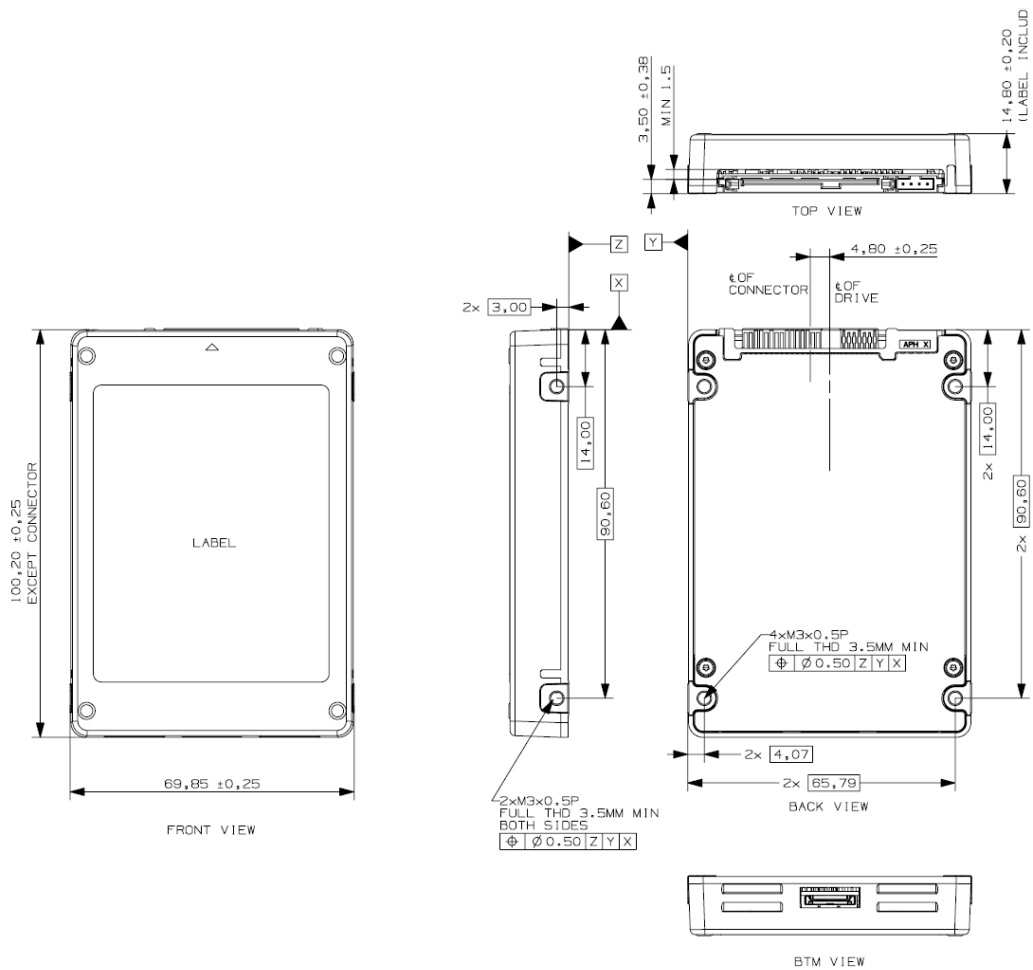
Figure 3. Mechanical Outline (960GB~7.68TB)

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Figure 4. Mechanical Outline (15.36TB~30.72TB)

NOTE :
1) Do not disassemble the SSD, damage the SSD, or remove the sticker or the label affixed on the product. Any product that has had its case opened or its label damaged or removed shall not be covered by the warranty.

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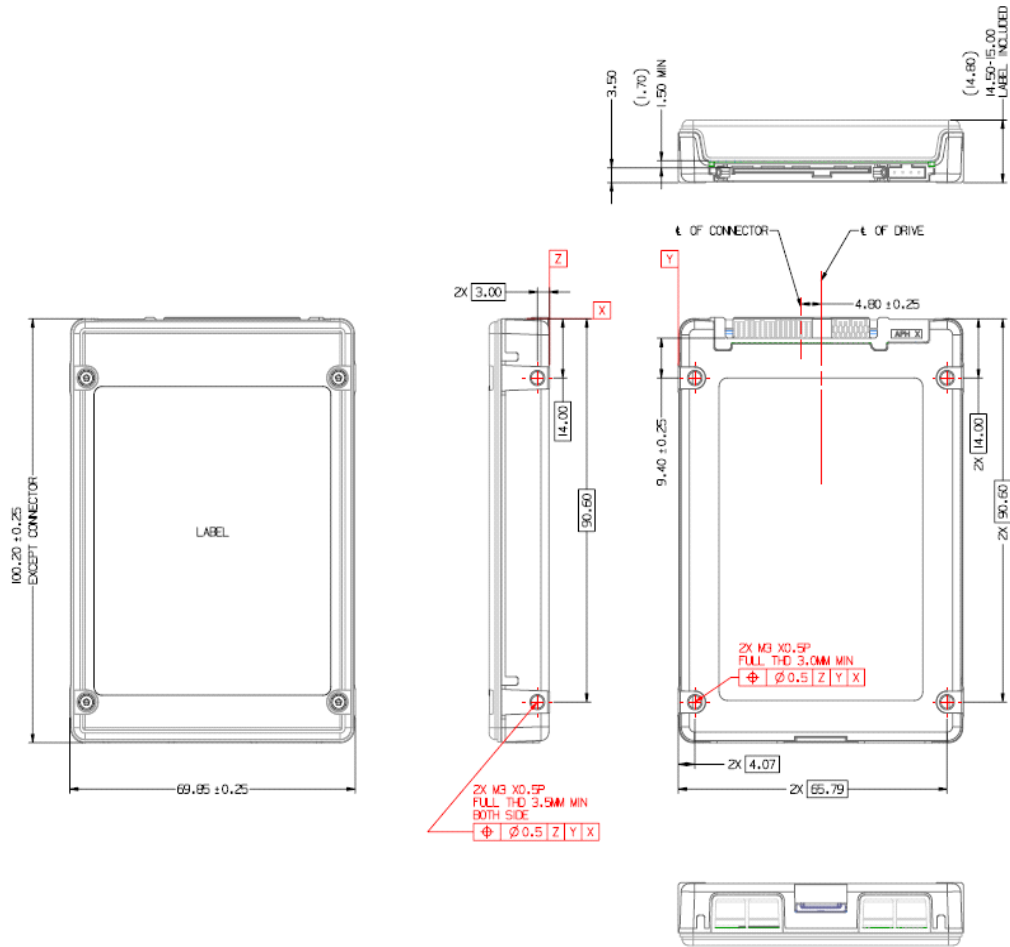
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MZILT1T9HBJR-00007 MZILT15THALA-00007
MZILT3T8HBLS-00007 MZILT30THALA-00007

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4.0 INTERFACE SPECIFICATION

4.1 Connector Dimension and Pin Location

[TOP VIEW]

[Bottom VIEW]
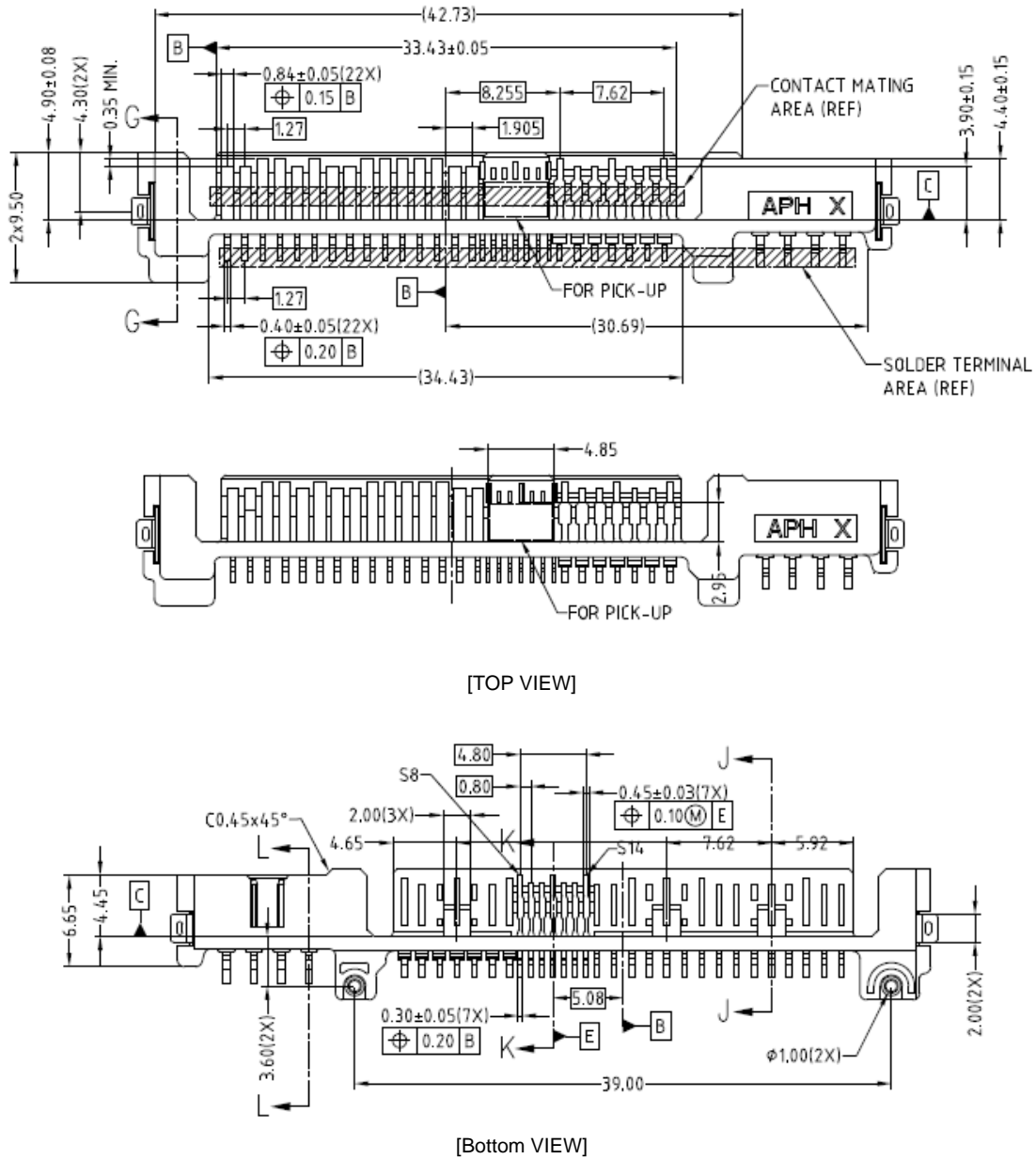
Figure 5. Layout of 2.5-inch Form Factor Connector Pins

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4.2 Pin Assignments and Definition

[Table 18] Pin Assignments

Pin#	Assignment	Description
S1	GND	Ground
S2	S0T+ (A+)	SAS 0 Transmit
S3	S0T- (A-)	SAS 0 Transmit
S4	GND	Ground
S5	S0R- (B-)	SAS 0 Receive
S6	S0R+ (B+)	SAS 0 Receive
S7	GND	Ground
S8	GND	Ground
S9	S1T+	SAS 1 Transmit
S10	S1T-	SAS 1 Transmit
S11	GND	Ground
S12	S1R-	SAS 1 Receive
S13	S1R+	SAS 1 Receive
S14	GND	Ground
P1	Not Connected	Not Used
P2	Not Connected	Not Used
P3	3.3V Power disable[1]	Power Disable
P4	GND	Ground
P5	GND	Ground
P6	GND	Ground
P7	5V Precharge [2]	5V Precharge power
P8	5V	5V power
P9	5V	5V power
P10	GND	Ground
P11	Activity	Device Activity Signal
P12	GND	Ground
P13	12V Precharge [2]	12V Precharge power
P14	12V	12V power
P15	12V	12V power

NOTE :
1) Host can power on/off control each SSD using this pin. If Host inserts 3.3V, the SSD is power off. And If host inserts 0V, the SSD is Power on.
   It follows SAS3 spec.
2) It recommends the enclosure (Back Plane) has precharge resistor to prevent hot-plug inrush voltage or current. It follows the SATA/SAS spec.

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5.0 SUPPORTED COMMAND SET

5.1 Supported SAS/SCSI Commands

This chapter provides the information regarding of the supported commands by the drive as listed below. For more detailed command description, refer to "Samsung RFX SSD SAS Command Code Specification Rev 16" or SCSI standard command specifications from T10 committee.

[Table 19] Supported SAS/SCSI Commands

Command Name	Command Code (Hex)	Command Name
Format Unit	04h	SBC–4
Get LBA Status	9Eh/12h	SBC-4
Get Stream Status	9Eh/16h	SBC-4
Inquiry	12h	SPC–5
Log Select	4Ch	SPC–5
Log Sense	4Dh	SPC–5
Mode Select 6	15h	SPC–5
Mode Select 10	55h	SPC–5
Mode Sense 6	1Ah	SPC–5
Mode Sense 10	5Ah	SPC–5
Persistent Reserve In	5Eh	SPC–5
Persistent Reserve Out	5Fh	SPC–5
Read 6	08h	SBC–3
Read 10	28h	SBC–4
Read 12	A8h	SBC–4
Read 16	88h	SBC–4
Read 32	7Fh/0009h	SBC–4
Read Buffer 10	3Ch	SPC-5
Read Buffer 16	9Bh	SPC-5
Read Capacity 10	25h	SBC–4
Read Capacity 16	9Eh/10h	SBC–4
Read Defect Data 10	37h	SBC–4 Actual implementation different from SBC definition
Read Defect Data 12	B7h	SBC–4 Actual implementation different from SBC definition
Read Long 10	3Eh	SBC–3
Read Long 16	9Eh/11h	SBC–3
Reassign Blocks	07h	SBC–4
Receive Diagnostic Results	1Ch	SPC-5
Release 6	17h	SPC-2 Based implementation supported
Release 10	57h	SPC-2 Based implementation supported
Report Identifying Information	A3h/05h	SPC–5
Report LUNS	A0h	SPC–5
Report Supported Operation Codes	A3h/0Ch	SPC–5
Report Supported Task Mgt. Functions	A3h/0Dh	SPC–5
Report Timestamp	A3h/0Fh	SPC-5
Request Sense	03h	SPC–5
Reserve 6	16h	SPC-2
Reserve 10	56h	SPC-2
Sanitize	48h	SBC-4
Send Diagnostics	1Dh	SPC–5
Start Stop Unit	1Bh	SBC-4
Set Identifying Information	A4h/06h	SPC–5
Set Timestamp	A4h/0Fh	SPC-5

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Stream Control	9Eh/14h	SBC-4
Synchronize Cache 10	35h	SBC–3
Synchronize Cache 16	91h	SBC–3
Test Unit Ready	00h	SPC–5
Unmap	42h	SBC–4
Verify 10	2Fh	SBC–4
Verify 12	AFh	SBC–4
Verify 16	8Fh	SBC–4
Verify 32	7Fh/000Ah	SBC–4
Write 6	0Ah	SBC–3
Write 10	2Ah	SBC–4
Write 12	AAh	SBC–4
Write 16	8Ah	SBC–4
Write 32	7Fh/000Bh	SBC–4
Write and Verify 10	2Eh	SBC–4
Write and Verify 12	AEh	SBC–4
Write and Verify 16	8Eh	SBC–4
Write and Verify 32	7Fh/000Ch	SBC–4
Write Buffer	3Bh	SPC–5
Write Long 10	3Fh	SBC–3
Write Long 16	9Fh/11h	SBC–3
Write Same 10	41h	SBC–4
Write Same 16	93h	SBC–4
Write Same 32	7Fh/00Dh	SBC–4
Write Stream 16	9Ah	SBC–4
Write Stream 32	7Fh/010h	SBC–4

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6.0 SPOR SPECIFICATION

This chapter provides the information regarding of the SPOR (Sudden Power Off and Recovery) feature of the SSD.

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 operation period.

6.2 Time to Ready Sequence

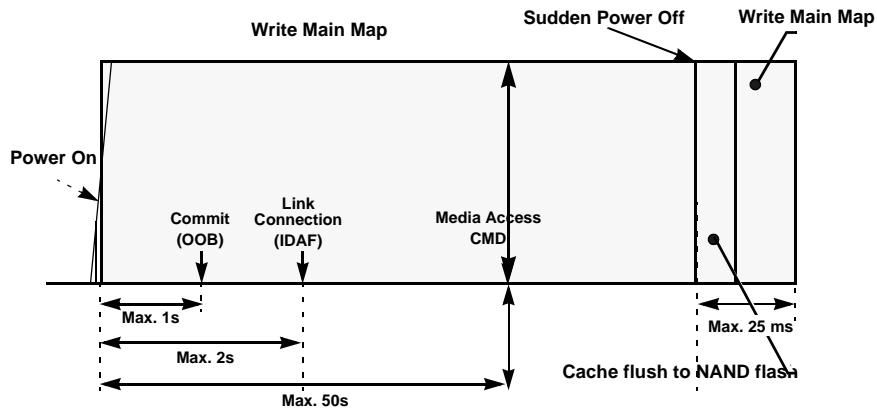SSD gives drive ready signal finishing FTL OPEN when is maximum 50 seconds.

Figure 6. Time to Ready Sequence

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7.0 PRODUCT COMPLIANCE

7.1 Product regulatory compliance and Certifications

[Table 20] Standards Reference

Category	Certification
Safety	cUL
	CE
	TUV-GS
	CB
EMC	CE (EU)
	BSMI (Taiwan)
	KC (South Korea)
	VCCI (Japan)
	RCM (Australia)
	FCC (USA) / IC (Canada)

NOTE : 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.

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-0G3 Compliance Label:

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

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8.0 REFERENCES

[Table 21] References

Item	Website
Serial Attached SCSI (SAS-3)	http://www.t10.org/
SCSI Architecture Model-5 (SAM-5)	http://www.t10.org/
SCSI Primary Commands-4 (SPC-5)	http://www.t10.org/
SCSI Block Commands-4 (SBC-4) Standard	http://www.t10.org/
SFF-8680	ftp://ftp.seagate.com/sff/SFF-8680.PDF
Enterprise SSD Form Factor Version 1.0a	http://www.ssdformfactor.org/
Solid-State Drive Requirements and Endurance Test Method (JESD218A)	http://www.jedec.org/standards-documents/docs/jesd218a

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