

Solid State Drive HK3R2 Series

Key Features

- Hot-Plug/OS-Aware Hot Removal
- Deterministic Zeroing TRIM supported
- WWN (World Wide Name) supported
- Strong & highly-efficient ECC named QSBC™*1
- End to End data protection
- Serial ATA DIPM (Device Initiated Power Management) supported for reducing power consumption
- Read only mode supported for emergency
- Power loss protection (PLP)

NOTE:*1) QSBC is a trademark of Toshiba Corporation.



Applications

- For Enterprise server and storage systems especially cost sensitive or read-intensive applications

Specifications and Features

Form Factor	2.5-inch (7.0 mmH)
Connector Type	Standard SATA
Memory	TOSHIBA MLC NAND Flash Memory
Interface *1	ACS-3, SATA revision 3.2 1.5/3/6 Gbit/s
Capacity *1	120/240/480/960 GB
Performance *1*2*3	Sequential Read: 524 MB/s{500 MiB/s} Sequential Write: 419 MB/s{400 MiB/s} Random Read: 75,000 IOPS Random Write: 14,000 IOPS
Supply Voltage	5.0 V ±5 %
Power Consumption	Active: 4.5 W typ. Idle: 1.0 W typ.
Temperature	Operating: 0 °C - 55 °C Non-operating: -40 °C - 70 °C
Shock	Operating / Non-operating: 9,800 m/s ² {1000 G} at 0.5 ms
Vibration	Operating: 21 m/s ² {2.17 Grms} at 100-800 Hz Non-operating: 159 m/s ² {16.3 Grms} at 20-2,000 Hz
Reliability	Mean Time to Failure (MTTF): 2,000,000 hours Product Life: Approximately 5 years
Size	100.45 mm(Length) x 69.85 mm(Width) x 7.0 mm(Height)
Weight	60 g Max.
More Features	<ul style="list-style-type: none"> • 28-bit LBA mode commands and 48-bit LBA mode commands support • Automatic retries and corrections for read errors • NCQ (Native Command Queuing) function supported
Compliance	UL, CSA, TÜV, KC, BSMI, CE, RCM

Note: *1) 1 MB = 1,000,000 bytes, 1 GB = 1,000,000,000 bytes, 1 Gbit = 1,000,000,000 bits

*2) 1 MiB (mebibytes) = 2²⁰ bytes = 1,048,576 bytes

*3) Performances are measured when the SSD is on a steady state.

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Ordering Information

<u>THN</u>	<u>SN</u>	<u>J</u>	<u>XXX</u>	<u>P</u>	<u>C</u>	<u>S</u>	<u>Z</u>
1	2	3	4	5	6	7	8

1. Model Name THN: Toshiba NAND drive
2. Model Type SN: Non-SED
3. Controller Type J: Type J
4. Capacity 120 / 240 / 480 / 960
120 is 120 GB, 240 is 240 GB, 480 is 480 GB and 960 is 960GB
(1 GB = 1,000,000,000 bytes)
5. PLP P: Supported
6. Form Factor C: 2.5-inch case (7.0 mm height)
7. Host I/F Type S: Standard SATA
8. NAND Type Z: MLC

Product Line up

Product Number	Capacity	Form Factor	PLP(*1)
THNSNJ960PCSZ	960 GB	2.5-inch 7.0 mm case	Supported
THNSNJ480PCSZ	480 GB		Supported
THNSNJ240PCSZ	240 GB		Supported
THNSNJ120PCSZ	120 GB		Supported

*1) PLP: Power Loss Protection

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1. General Description

The TOSHIBA SSD HK3R2 series is a memory storage device using NAND Flash Memories, which has no mechanical moving parts and provides high performance and reliability compared to Hard Disk Drive.

The drive features an ACS-3 and Serial ATA revision 3.2 interface embedded controller that requires a simplified adapter board for interfacing to a Serial ATA or Serial ATA compatible bus.

2. Product Specifications

2.1. Capacity

Table 2-1. User Addressable Sectors in LBA Mode

Capacity	Total Number of User Addressable Sectors in LBA Mode
120 GB	234,441,647
240 GB	468,862,127
480 GB	937,703,087
960 GB	1,875,385,008

NOTE: 1 GB (Gigabyte) = 1,000,000,000 bytes

Bytes per sector: 512 bytes

2.2. Performance

Table 2-2. Interface Speed and Data Transfer Rate in Read/Write

Parameter	Transfer Rate			
	THNSNJ960PCSZ	THNSNJ480PCSZ	THNSNJ240PCSZ	THNSNJ120PCSZ
Interface Speed	6 Gbit/s Max.			
Sequential Read 64 KiB, QD = 32	524 MB/s {500 MiB/s}			
Sequential Write 64 KiB, QD = 32	419 MB/s{400 MiB/s}		283 MB/s {270 MiB/s}	126 MB/s {120 MiB/s}
Random read 4 KiB, QD = 32	75,000 IOPS			
Random write 4 KiB, QD = 32	14,000 IOPS	12,000 IOPS	10,000 IOPS	4,000 IOPS

Note: Performances are measured when the SSD is on a steady state.

3. Electrical Characteristics

3.1. Supply Voltage

Table 3-1. Supply Voltage

	2.5-inch Case(7.0 mmH)
Allowable voltage	5.0 V ±5 %
Allowable noise/ripple	250 mV p-p or less

NOTE: This drive have over current protection circuit. (Rated current: 3.15A)

3.2. Power Consumption

Table 3-2. Power Consumption

Operation (Ta ^{*1} = 25 °C)	2.5-inch Case(7.0 mmH)
Active	4.5 W Typ.
Idle	1.0 W Typ.

NOTE: *1) Ambient Temperature.

4. Environmental Conditions

4.1. Temperature and Humidity

Table 4-1. Temperature

Condition	Range	Gradient
Operating ^{*1}	0 °C (Ta) – 55 °C (Ta)	20 °C (Ta)/h Max.
Non-operating	-40 °C – 70 °C	20 °C/h Max.
Under Shipment ^{*2}	-40 °C – 70 °C	20 °C/h Max.

NOTE: *1) Ta: Ambient Temperature

*2) Packaged in Toshiba's original shipping package

Table 4-2. Humidity

Condition	Range
Operating	5 % – 95 % R.H. (No condensation)
Non-operating	5 % – 95 % R.H. (No condensation)
Under Shipment ^{*1}	5 % – 95 % R.H.

NOTE: *1) Packaged in Toshiba's original shipping package

4.2. Shock and Vibration

Table 4-3. Shock

Condition	Range
Operating	9,800 m/s ² {1000 G} / 0.5 ms duration
Non-operating	
Under Shipment *1	

NOTE: *1) Apply shocks in each direction of the drive's three mutually perpendicular axes, one axis at a time. Packaged in Toshiba's original shipping package.

Table 4-4. Vibration

Condition	Range
Operating	21 m/s ² {2.17 Grms} (100 to 800 Hz)
Non-operating	159 m/s ² {16.3 Grms} (20 to 2000 Hz)
Under Shipment *1	

5. Compliance

TOSHIBA SSD HK3R2 series comply with the following.

Table 5-1. Compliance

Mark Name	Description	Region
UL (Underwriters Laboratories)	UL 60950-1	USA
CSA (Canadian Standard Association) *Included UL logo mark	CSA-C22.2 No.60950-1	Canada
TÜV (Technischer Überwachungs Verein)	EN 60950-1	Germany
KC	KN22 KN24	Korea
BSMI (Bureau of Standards, Metrology and Inspection)	CNS13438(CISPR Pub. 22) Class B	Taiwan
CE	EN 55022, EN 55024	Europe
RCM	AS/NZS CISPR Pub. 22 Class B	Australia, New Zealand

6. Reliability

Table 6-1. Reliability

Parameter	Value
Mean Time to Failure	2,000,000 hours
Product Life	Approximately 5 years
Drive Write Per Day	1

7. Mechanical Specifications

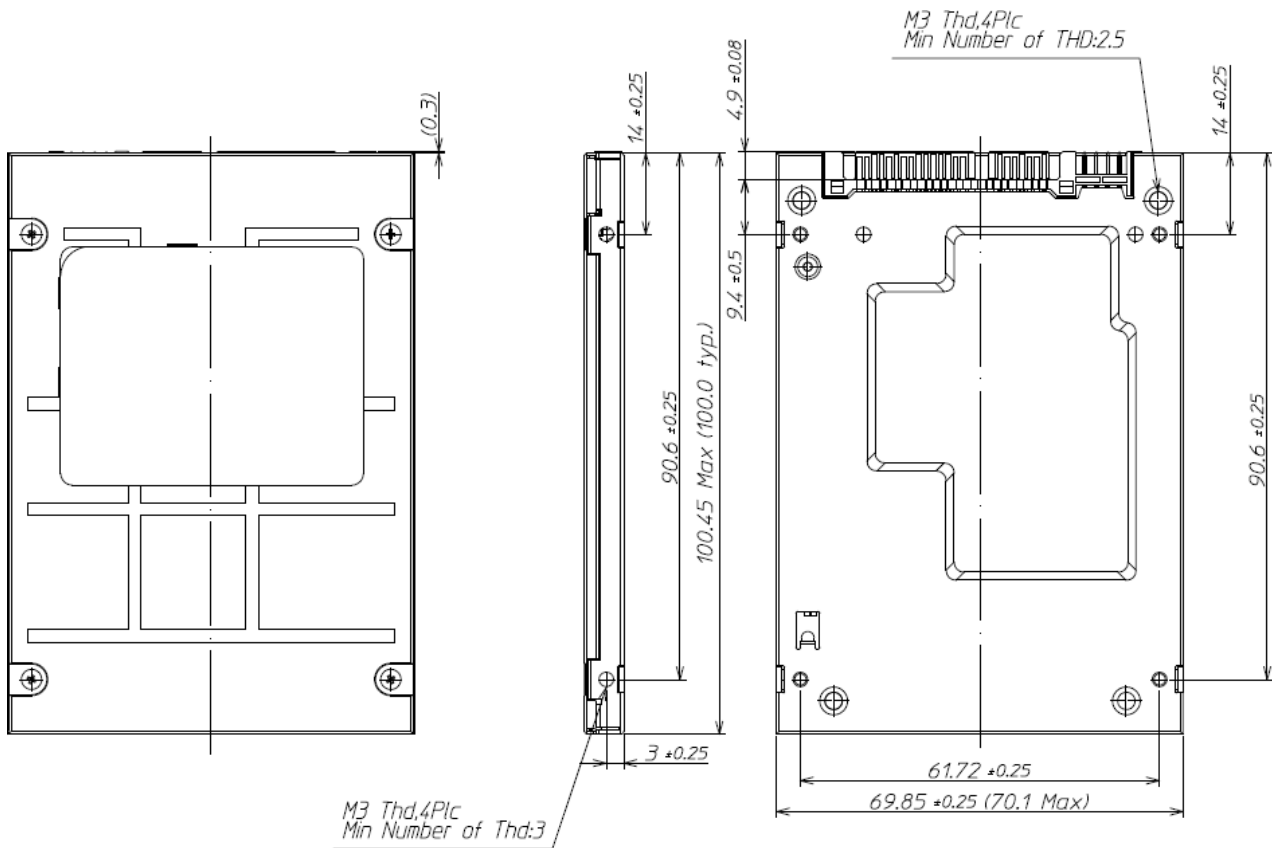
7.1. 2.5-inch Case (7.0 mmH)

The enclosure of this device complies with SFF-8201.

Table 7-1. Weight and Dimensions

Model	Weight	Width	Height	Length
THNSNJ960PCSZ	60 g Max.	69.85 mm ± 0.25 mm	7.0 mm + 0, -0.5 mm	100.45 mm Max.
THNSNJ480PCSZ				
THNSNJ240PCSZ				
THNSNJ120PCSZ				

Figure 7-1. 2.5-inch Case (7.0 mmH) Drive Dimension



8. Interface Connector

8.1. 2.5-inch Case (7.0 mmH)

Figure 8-1. 2.5-inch Case Serial ATA Interface Connector

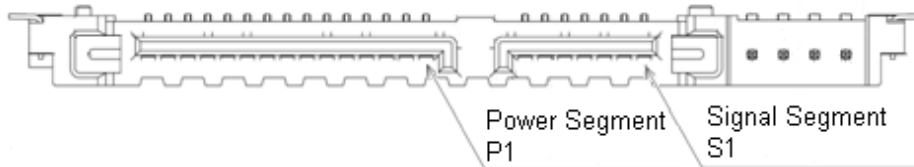


Table 8-1. 2.5-inch Case Drive Connector Pin Assignment *1

Signal segment key			
Signal Segment	S1	GND	2 nd Mate
	S2	A+	Differential Pair A from PHY
	S3	A-	
	S4	GND	2 nd Mate
	S5	B-	Differential Pair B from PHY
	S6	B+	
	S7	GND	2 nd Mate
Signal segment "L"			
Central connector polarizer			
Power segment "L"			
Power Segment	P1	V33 *2	3.3V power (Unused)
	P2	V33 *2	3.3V Power (Unused)
	P3	V33 *2	3.3V power pre-charge 2 nd mate (Unused)
	P4	GND	1 st Mate
	P5	GND	2 nd Mate
	P6	GND	2 nd Mate
	P7	V5	5 V power, pre-charge *4, 2 nd Mate
	P8	V5	5 V power
	P9	V5	5 V power
	P10	GND	2 nd Mate
	P11	DAS/DSS *3	Drive Active Signal / Disable Staggered Spin-up, 3 rd Mate
	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)
Power segment key			

- NOTE: *1) The Mate orders are for backplane usage. Hot-Plug and OS-Aware Hot Removal are supported when using with a backplane connector.
 *2) Previously, 3.3 V was assigned to pins P1, P2 and P3 by Serial ATA International Organization.
 *3) DAS signal is option. DSS signal is not used for this drive.
 *4) Direct connect to non pre-charge pins.

9. Command Descriptions

Table 9-1. Supported ATA Command Set

Op-Code		Command Description
00h		NOP
06h		DATA SET MANAGEMENT
10h		RECALIBRATE
20h		READ SECTOR(S)
21h		READ SECTOR(S) without retry
24h		READ SECTOR(S) EXT
25h		READ DMA EXT
27h		READ NATIVE MAX ADDRESS EXT
29h		READ MULTIPLE EXT
2Fh		READ LOG EXT
30h		WRITE SECTOR(S)
31h		WRITE SECTOR(S) without retry
34h		WRITE SECTOR(S) EXT
35h		WRITE DMA EXT
37h		SET MAX ADDRESS EXT
39h		WRITE MULTIPLE EXT
3Dh		WRITE DMA FUA EXT
3Fh		WRITE LOG EXT
40h		READ VERIFY SECTOR(S)
41h		READ VERIFY SECTOR(S) without retry
42h		READ VERIFY SECTOR(S) EXT
45h		WRITE UNCORRECTABLE EXT
45h	55h	Create a pseudo-uncorrectable error with logging
45h	AAh	Create a flagged error without logging
47h		READ LOG DMA EXT
57h		WRITE LOG DMA EXT
60h		READ FPDMA QUEUED
61h		WRITE FPDMA QUEUED
70h		SEEK
90h		EXECUTE DEVICE DIAGNOSTIC
91h		INITIALIZE DEVICE PARAMETERS
92h		DOWNLOAD MICROCODE
92h	03h	Download with offsets and save microcode for immediate and future use.

Op-Code		Command Description
92h	07h	Download and save microcode for immediate and future use.
92h	0Eh	Download with offsets and save microcode for future use.
92h	0Fh	Activate downloaded microcode.
93h		DOWNLOAD MICROCODE DMA
93h	03h	Download with offsets and save microcode for immediate and future use.
93h	07h	Download and save microcode for immediate and future use.
93h	0Eh	Download with offsets and save microcode for future use.
93h	0Fh	Activate downloaded microcode
B0h		SMART
B0h	D0h	SMART READ DATA
B0h	D1h	SMART READ ATTRIBUTE THRESHOLDS
B0h	D2h	SMART ENABLE/DISABLE ATTRIBUTE AUTOSAVE
B0h	D3h	SMART SAVE ATTRIBUTE VALUES
B0h	D4h	SMART EXECUTE OFF-LINE IMMEDIATE
B0h	D5h	SMART READ LOG
B0h	D6h	SMART WRITE LOG
B0h	D8h	SMART ENABLE OPERATIONS
B0h	D9h	SMART DISABLE OPERATIONS
B0h	DAh	SMART RETURN STATUS
B0h	DBh	SMART ENABLE/DISABLE AUTOMATIC OFF-LINE
B1h		DEVICE CONFIGURATION OVERLAY
B1h	C0h	DEVICE CONFIGURATION RESTORE
B1h	C1h	DEVICE CONFIGURATION FREEZE LOCK
B1h	C2h	DEVICE CONFIGURATION IDENTIFY
B1h	C3h	DEVICE CONFIGURATION SET
B1h	C4h	DEVICE CONFIGURATION IDENTIFY DMA
B1h	C5h	DEVICE CONFIGURATION SET DMA
B4h		SANITIZE DEVICE
B4h	00h	SANITIZE STATUS EXT
B4h	12h	BLOCK ERASE EXT
B4h	20h	SANITIZE FREEZE LOCK EXT
C4h		READ MULTIPLE
C5h		WRITE MULTIPLE
C6h		SET MULTIPLE MODE
C8h		READ DMA
C9h		READ DMA without retry

Op-Code		Command Description	
CAh		WRITE DMA	
CBh		WRITE DMA without retry	
CEh		WRITE MULTIPLE FUA EXT	
E0h		STANDBY IMMEDIATE	
E1h		IDLE IMMEDIATE	
E2h		STANDBY	
E3h		IDLE	
E4h		READ BUFFER	
E5h		CHECK POWER MODE	
E6h		SLEEP	
E7h		FLUSH CACHE	
E8h		WRITE BUFFER	
E9h		READ BUFFER DMA	
EAh		FLUSH CACHE EXT	
EBh		WRITE BUFFER DMA	
ECh		IDENTIFY DEVICE	
EFh		SET FEATURES	
EFh	02h	Enable volatile write cache	
EFh	03h	Set transfer mode	
EFh	05h	Enable APM feature set	
EFh	10h	Enable Serial ATA feature set	
EFh	10h	02h	Enable DMA Setup FIS Auto-Activate optimization
EFh	10h	03h	Enable Device-initiated interface power state (DIPM) transitions
EFh	10h	06h	Enable Software Settings Preservation(SSP)
EFh	10h	07h	Enable Device Automatic Partial to Slumber transitions
EFh	55h	Disable read look-ahead	
EFh	66h	Disable reverting to power-on defaults	
EFh	82h	Disable volatile write cache	
EFh	85h	Disable APM feature set	
EFh	90h	Disable Serial ATA feature set	
EFh	90h	02h	Disable DMA Setup FIS Auto-Activate optimization
EFh	90h	03h	Disable Device-initiated interface power state (DIPM) transitions
EFh	90h	06h	Disable Software Settings Preservation(SSP)
EFh	90h	07h	Disable Device Automatic Partial to Slumber transitions
EFh	AAh	Enable read look-ahead	
EFh	CCh	Enable reverting to power-on defaults	

Op-Code		Command Description
F1h		SECURITY SET PASSWORD
F2h		SECURITY UNLOCK
F3h		SECURITY ERASE PREPARE
F4h		SECURITY ERASE UNIT
F5h		SECURITY FREEZE LOCK
F6h		SECURITY DISABLE PASSWORD
F8h		READ NATIVE MAX ADDRESS
F9h		SET MAX ADDRESS
F9h	01h	SET MAX SET PASSWORD
F9h	02h	SET MAX LOCK
F9h	03h	SET MAX UNLOCK
F9h	04h	SET MAX FREEZE LOCK
F9h	05h	SET MAX SET PASSWORD DMA
F9h	06h	SET MAX UNLOCK DMA

10. Revision History

Rev.	Description	Date
1.0.0	Initial release	Nov.1, 2014

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