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HK4E SERIES
ENTERPRISE SATA SSD

SSD

Specifically engineered for value-endurance workloads, the HK4E eSSD delivers high reliability, high performance and low power usage. Data center and enterprise applications benefit from the excellent quality of service, provided by the series.

The 7.0mm height drive is available in high capacities up to 1.6TB and supports 6.0 Gbit/s SATA interface. Each model is provided with enterprise-class features such as Power Loss Protection.

Product image may represent a design model

KEY FEATURES

- Capacities up to 1.6 TB
- SATA 6.0 Gbit/s Interface
- Value Endurance Class (3 DWPD)
- Low Operation Power
- Power Loss Protection
- End to end data protection
- Hot-Plug/OS-Aware Hot Removal

APPLICATIONS

- OLTP
- VDI
- Data center
- Database
- E-Commerce
- E-Mail/Messaging Server

SPECIFICATIONS

Standard Models	2.5-inch (7.0mmH)
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]	200/400/800/1600 GB
Performance [1] [2] [3]	Sequential Read: 524 MB/s{500 MiB/s} Sequential Write: 503 MB/s{480 MiB/s} Random Read: 75,000 IOPS Random Write: 30,000 IOPS
Supply Voltage	5.0 V ±5 %
Power Consumption	Active: 4.5 W typ. Idle: 1.2 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	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, cUL(CSA), TÜV, KC, FCC, BSMI, CE, RCM, ISED, VCCI

Refer to the notes on the next page.

1) Definition of capacity: Toshiba defines a megabyte (MB) as 1,000,000 bytes, a gigabyte (GB) as 1,000,000,000 bytes and a terabyte (TB) as 1,000,000,000,000 bytes. A computer operating system, however, reports storage capacity using powers of 2 for the definition of 1GB = 2^{30} = 1,073,741,824 bytes and therefore shows less storage capacity. Available storage capacity (including examples of various media files) will vary based on file size, formatting, settings, software and operating system, such as Microsoft Operating System and/or pre-installed software applications, or media content. Actual formatted capacity may vary.
2) A kibibyte (KiB) means 2^{10}, or 1,024 bytes, a mebibyte (MiB) means 2^{20}, or 1,048,576 bytes, and a gibibyte (GiB) means 2^{30}, or 1,073,471,824 bytes.
3) Performances are measured when the SSD is on a steady state.

* MTTF (Mean Time to Failure) is not a guarantee or estimate of product life; it is a statistical value related to mean failure rates for a large number of products which may not accurately reflect actual operation. Actual operating life of the product may be different from the MTTF.

* DWPD: Drive Write Per Day. One full drive write per day means the drive can be written and re-written to full capacity once a day every day for five years, the stated product warranty period. Actual results may vary due to system configuration, usage and other factors.

* Read and write speed may vary depending on the host device, read and write conditions, and file size.

* IOPS: Input Output Per Second (or the number of I/O operations per second)

* PLP (Power Loss Protection): PLP supports to record data in buffer memory to NAND flash memory, utilizing back up power of solid capacitor in case of sudden supply shut down.

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> **ORDERING INFORMATION**

<table>
<tr><td>THN</td><td>SN</td><td>8</td><td>xxxx</td><td>C</td><td>S</td><td>E</td></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
</table>

1.	Model Name	THN: Toshiba NAND drive
2.	Model Type	SN: SED not supported
3.	Controller Type	8: Type 8
4.	Capacity	200P/400P/800P/1Q60: 200GB/400GB/800GB/1600GB with PLP
		(1 GB = 1,000,000,000 bytes)
5.	Form Factor	C: 2.5-inch case (7.0 mm height)
6.	Host I/F Type	S: Standard SATA
7.	NAND Type	E: MLC

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> ## PRODUCT LINE UP

Model Number	Formatted Capacity	PLP [1]	SED [2]	Form Factor
THNSN8200PCSE	200 GB	Supported	Not supported	
THNSN8400PCSE	400 GB	Supported	Not supported	2.5-inch 7.0 mm case
THNSN8800PCSE	800 GB	Supported	Not supported	
THNSN81Q60CSE	1600GB	Supported	Not supported	

1) PLP: Power Loss Protection
2) SED: Self Encrypting Drive based on TCG Enterprise SSC

> ## CAPACITY

Capacity	Total Number of User Addressable Sectors in LBA Mode 512 bytes sector
200 GB	250,069,680
400 GB	500,118,192
800 GB	1,000,215,216
1600 GB	2,000,409,264

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

> ## PERFORMANCE

	THNSN81Q60CSE	THNSN8800PCSE	THNSN8400PCSE	THNSN8200PCSE
Interface Speed	6 Gbit/s Max			
Sequential Read 64KiB, QD=32	524 MB/s {500 MiB/s}			
Sequential Write 64KiB, QD=32	503 MB/s {480 MiB/s}			283 MB/s {270 MiB/s}
Random Read 4KiB, QD=32	75,000 IOPS			
Random Write 4KiB, QD=32	30,000 IOPS			20,000 IOPS

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

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> ## 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 has over current protection circuit. (Rated current: 3.15A)

> ## POWER CONSUMPTION

Operation (Ta [1]=25°C)	2.5-inch Case(7.0 mmH)
Active	4.5 W typ.
Idle	1.2 W typ.

1) Ambient Temperature

ENVIRONMENTAL CONDITIONS

> ## TEMPERATURE

Condition	Range	Gradient
Operating (Ta) [1]	0 °C – 55 °C	20 °C/h Max
Non-operating (Ta) [1]	-40 °C – 70 °C	20 °C/h Max
Under Shipment (Ta) [1] [2]	-40 °C – 70 °C	20 °C/h Max

1) Ta: Ambient Temperature, Tc: Case or Components Temperature
2) Packaged in Toshiba's original shipping package

> ## 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.

1) Packaged in Toshiba's original shipping package

> ## SHOCK

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

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.

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	

COMPLIANCE

SAFETY / EMI STANDARDS

Title	Description	Region
UL (Underwriters Laboratories)	UL 60950-1	USA
cUL(CSA) (Underwriters Laboratories of Canada (Canadian Standard Association))	CSA-C22.2 No.60950-1	Canada
TÜV (Technischer Überwachungs Verein)	EN 60950-1	Germany
KC	KN22, KN24	Korea
FCC	FCC part 15 Subpart B Class B	USA
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
ISED	ICES-003	Canada
VCCI	Class B	Japan

RELIABILITY

Parameter	Value
Mean Time to Failure	2,000,000 hours
Product Life	Approximately 5 years

MECHANICAL SPECIFICATIONS

> **2.5-inch**

Model	Weight	Width	Height	Length
THNSN8200PCSE				
THNSN8400PCSE	60 g Max	69.85 mm +/- 0.25 mm	7.0 mm + 0.2, -0.5 mm	100.45 mm Max
THNSN8800PCSE				
THNSN81Q60CSE				

The enclosure of this device complies with SFF-8201.
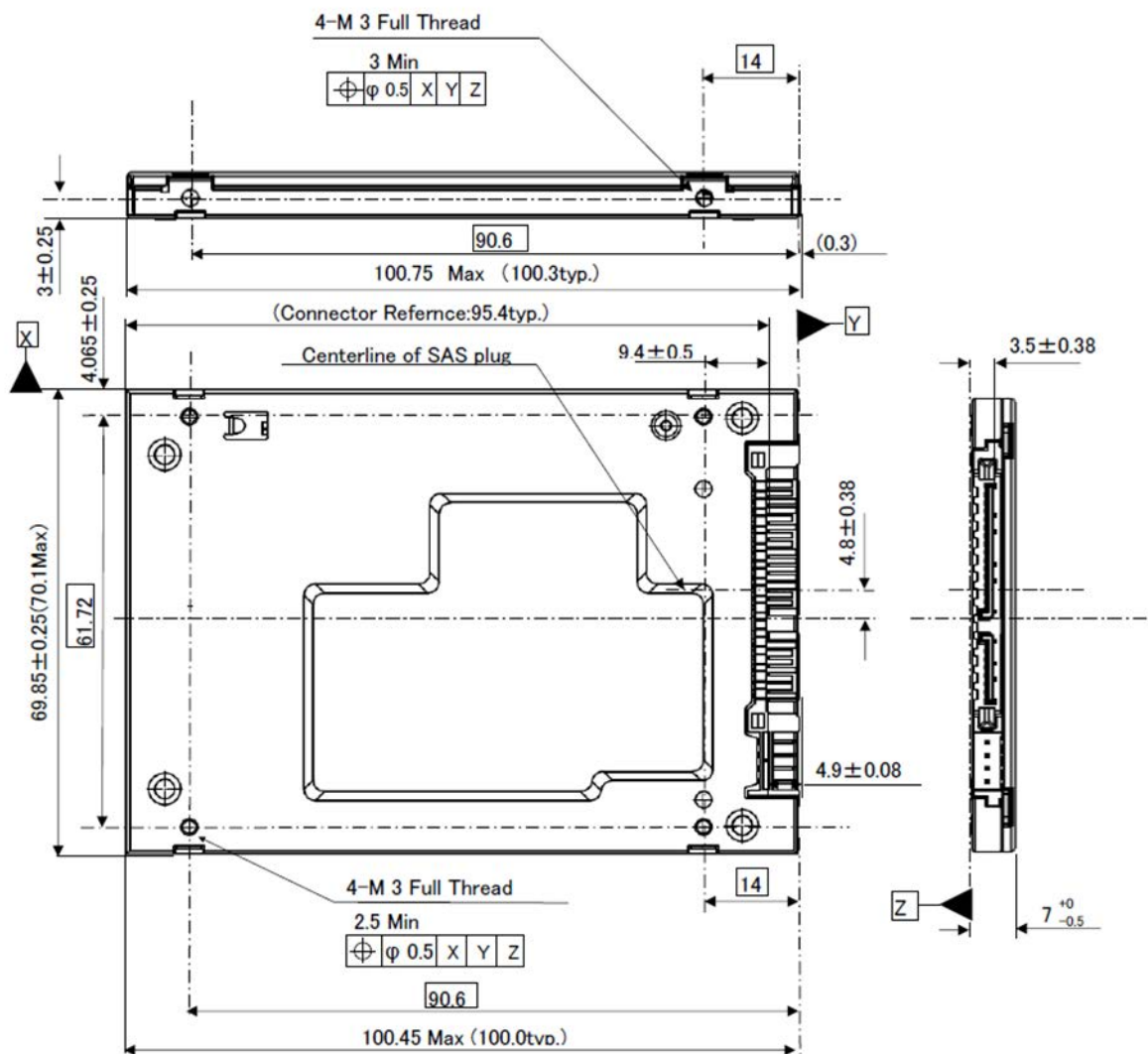
Figure 1: 2.5-inch Drive Dimension

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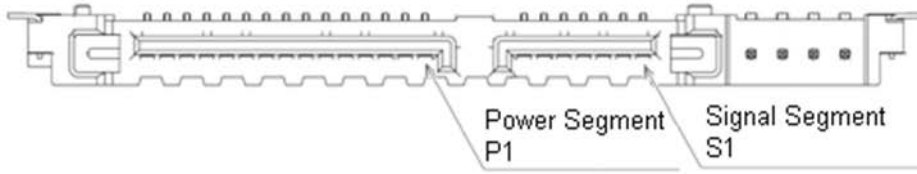# INTERFACE CONNECTOR

> **2.5-inchSATA Interface Connector**

Figure 2: 2.5-inch SATA Interface connector

> **2.5-INCH DRIVE CONNECTER PIN ASSIGNMENT**

Segment	Pin Position	Name	Signal Description
Signal Segment	S1	GND	Ground
	S2	A+	Differential Pair A
	S3	A-	
	S4	GND	Ground
	S5	B-	Differential Pair B
	S6	B+	
	S7	GND	Ground
Signal segment "L"			
Central connector polarizer			
Power segment "L"			
Power Segment	P1	V33	3.3 V power (Unused) [1] [2]
	P2	V33	3.3 V Power (Unused) [1] [2]
	P3	V33	3.3 V power pre-charge (Unused) [1]
	P4	GND	Ground
	P5	GND	Ground
	P6	GND	Ground
	P7	V5	5 V power, pre-charge
	P8	V5	5 V power
	P9	V5	5 V power
	P10	GND	Ground
	P11	DAS/DSS	Drive Active Signal / Disable Staggered Spin-up [3]
	P12	GND	Ground
	P13	V12	12 V power, pre-charge (Unused)
	P14	V12	12 V power (Unused)
	P15	V12	12 V power (Unused)
Power segment key			

1) This drive uses 5V power. 12V and 3.3V power are not used. DE and DC ground (ground pins on interface) are connected electrically each other.
2) P1 and P2 are connected together.
3) DSS is not supported.

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> ## COMMAND TABLE

ATA Command Set

Op-Code		Command Name
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

Op-Code		Command Name
92h		DOWNLOAD MICROCODE
92h	03h	Download with offsets and save microcode for immediate and future use.
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 Name
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	10h	09h	Enable Device Sleep
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	90h	09h	Disable Device Sleep
EFh	AAh		Enable read look-ahead
EFh	CCh		Enable reverting to power-on defaults

Op-Code			Command Name
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

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