Terabit™

Industrial 2.5'' 44PIN PATA/IDE Solid State Drive

Data Sheet

Revision History

Version	Date	Changes	Note
V001	2015-06-28	Release	3rd Generation
	2016-01-05	512GB added	
	2016-06-19	Secure Erase added	

Contents

1. Product Features

Interface	44PIN
Form Factor	2.5'' IDE/ATA
Dimension	100.00 x 69.85 x 7.2 ±0.2(mm)
Capacity	NAND MLC: 8GB~512GB NAND SLC: 8GB~128GB
Performance	Read up to 146MB/s Write up to 109MB/s
Power Supply	D/C 5.0V± 5%
Operating Temperature	Standard: 0~+70°C Industrial: -20~+70°C Extended: -40~+85°C
Weight	<70g
Storage Temperature	-55~+95°C
Shock	Non-operating 1500G peak, 0.5ms Operating 50G peak, 11ms
Vibration	Jet (Random) Vibration, 10-2000Hz, 16.4G(X, Y, Z)
Burn-in Test	72 Hours
Falling Test	1.1 meter free falling
Max. Power Consumption	Sequential Reading 1.95W Sequential Writing 3.98W Idle 0.27W
MTBF	2,000,000 Hours
Features	- Enhanced endurance by dynamic/static wear-leveling - Support dynamic power management - Support S.M.A.R.T function - Automatic Bad-block Management - Support TRIM and NCQ (Native Command Queuing) Command - Support BCH ECC 66bits/1024bytes - Conformal Coating optional - Secure Erase function by software optional
Data Retention	@25°C: 10 years
Certification	CE/FCC/RoHS

2. Overview

Terabit 2.5'' PATA SSD fully consists of semiconductor devices using original NAND Flash and Industrial Controller which provide high reliability and high performance for data storage. Terabit 2.5'' PATA SSD has standard 44PIN interfaces, fully conform to the same mechanical and mounting requirements as standard rotating disk drives. This series of products are designed for premium industrial applications that require both strong reliability and high performance such as Industrial Computer, Rugged Computer, Industrial Systems, Industrial Server, Embedded Systems, Workstations, RAID and Defense. With up to 512GB capacity, Terabit 2.5'' PATA SSD totally goes through a variety of proofing tests such as Shock Test, Vibration Test, Burn-in Test, and Twisting Test. Well proved under -40~+85°C wide temperature and equipped with Power Failure Protect and Over Load Protect, this series of products can work smoothly under severe environments.

3. Interface

Terabit 2.5'' PATA Solid State Drive fully complies PATA Standard.
Support Transfer Mode:
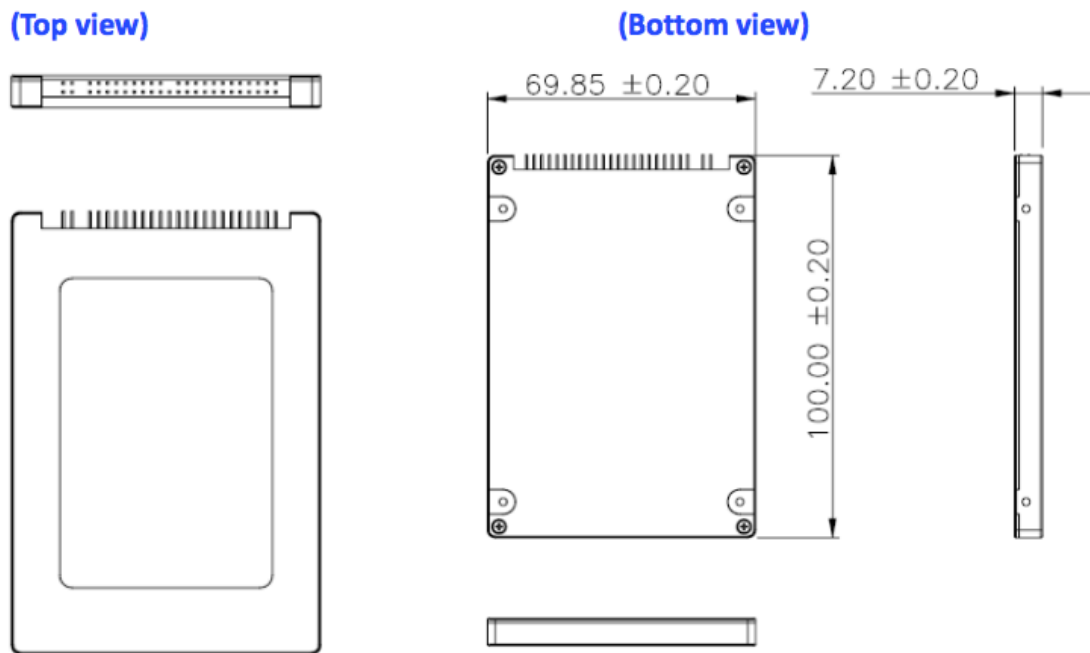PIO:0, 1, 2, 3, 4
MW-DMA: 0, 1, 2
UDMA: 0, 1, 2, 3, 4, 5, 6, 7
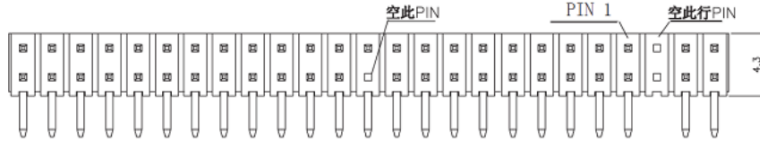ATA-compatible command set

4. Physical Dimension

Parameter	Value	Unit
Length	100.00	mm
Width	69.85	mm
Height	7.2	mm

● All of the values are ±0.2mm

5. PIN Description

5.1 PIN Location

5.2 Signal Description

PIN#	Assignment	PIN#	Assignment
1	RESET	23	IOWR
2	GND	24	GND
3	HD7	25	IORD
4	HD8	26	GND
5	HD6	27	WAIT
6	HD9	28	HCSEL
7	HD5	29	REG
8	HD10	30	GND
9	HD4	31	READY
10	HD11	32	NC
11	HD3	33	HA1
12	HD12	34	HBVD1
13	HD2	35	HA0
14	HD13	36	HA2
15	HD1	37	CE1
16	HD14	38	CE2
17	HD0	39	BDV2
18	HD15	40	GND
19	GND	41	VCC5V
20	NC	42	VCC5V
21	INPACK	43	GND
22	GND	44	NC

5.3 Support ATA Command

Command Name	Code (Hex)	Command Name	Code (Hex)
CHECK POWER MODE	E5h	SECURITY ERASE UNIT	F4h
EXECUTE	90h	SECURITY FREEZE LOCK	F5h
FLUSH CACHE	E7h	SECURITY SET PASSWORD	F1h
IDENTIFY DEVICE	ECh	SECURITY UNLOCK	F2h
IDLE	E3h	SEEK	7xH
IDLE IMMEDIATE	E1h	SET FEATURES	EFh
INITIALIZE DEVICE PARAMETERS	91h	SET MULTIPLE MODE	C6h
READ DMA	C8h or C9h	SLEEP	E6h
READ MULTIPLE	C4h	SMART	B0h
READ SECTOR (S)	20h or 21h	STANDBY	E2h
READ VERIFY SECTOR (S)	40h or 41h	STANDBY IMMEDIATE	E0h
RECALIBRATE	10h	WRITE DMA	CAh or CBh
SECURITY DISABLE PASSWORD	F6h	WRITE MULTIPLE	C5h
SECURITY ERASE PREPARE	F3h	WRITE SECTOR (S)	30h or 31h

ATA COMMAND SPECIFICATIONS CHECK POWER MODE (E5h)

The host can use this command to determine the current power management mode.

EXECUTE DIAGNOSITICS (90h)

This command performs the internal diagnostic tests implemented by the drive. See ERROR register for diagnostic codes.

FLUSH CACHE (E7h)

This command is used by the host to request the device to flush the write cache. If there is data in the write cache, that data shall be written to the media. The BSY bit shall remain set to one until all data has been successfully written or an error occurs.

IDENTIFY DEVICE (ECh)

This commands read out 512Bytes of drive parameter information. Parameter Information consists of the arrangement and value as shown in the following table. This command enables the host to receive the Identify Drive Information from the device.

IDLE (E3h)

This command causes the device to set BSY, enter the Idle mode, clear BSY and generate an interrupt. If sector count is non-zero, the automatic power down mode is enabled. If the sector count is zero, the automatic power mode is disabled.

IDLE IMMEDIATE (E1h)

This command causes the device to set BSY, enter the Idle (Read) mode, clear BSY and generate an interrupt.

INITIALIZE DEVICE PARAMETERS (91h)

This command enables the host to set the number of sectors per track and the number of tracks per heads.

READ DMA (C8h)

Read data from sectors during Ultra DMA and Multiword DMA transfer. Use the SET FEATURES command to specify the mode value. A sector count of zero requests 256 sectors.

READ MULTIPLE (C4h)

This command performs similarly to the Read Sectors command. Interrupts are not generated on each sector, but on the transfer of a block which contains the number of sectors defined by a Set Multiple command.

READ SECTOR(S) (20h/21h)

This command reads 1 to 256 sectors as specified in the Sector Count register from sectors which is set by Sector number register. Each sector of count 0 requests 256 sectors. The transfer beings specified in the Sector Number register.

READ VERIFY SECTOR(S) (40h/41h)

This command verifies one or more sectors on the drive by transferring data from the flash media to the data buffer in the drive and verifying that the ECC is correct. This command is identical to the Read Sectors command, except that DRQ is never set and no data is transferred to the host.

RECALIBRATE (10h)

The current drive performs no processing if it receives this command. It is supported for backward compatibility with previous devices.

SECURITY DISABLE PASSWORD (F6h)

Disables any previously set user password and cancels the lock. The host transfers 512 bytes of data, as shown in the following table, to the drive. The transferred data contains a user or

master password, which the drive compares with the saved password. If they match, the drive cancels the lock. The master password is still saved. It is re-enabled by issuing the SECURITY SET PASSWORD command to re-set a user password.

SECURITY ERASE PREPARE (F3h)

This command shall be issued immediately before the Security Erase Unit command to enable erasing

and unlocking. This command prevents accidental loss of data on the drive.

SECURITY ERASE UNIT (F4h)

The host uses this command to transfer 512 bytes of data, as shown in the following table, to the drive. The transferred data contains a user or master password, which the drive compares with the saved password. If they match, the drive deletes user data, disables the user password, and cancels the lock. The master password is still saved. It is re-enabled by issuing the SECURITY SET

SECURITY FREEZE LOCK (F5h)

Cause the drive to enter frozen mode. Once this command has been executed, the following commands to update a lock result in the Aborted Command error:

●*SECURITY SET PASSWORD*

●*SECURITY UNLOCK*

●*SECURITY DISABLE PASSWORD*

●*SECURITY ERASE PREPARE*

●*SECURITY ERASE UNIT*

The drive exits from frozen mode upon a power-off or hard reset. If the SECURITY FREEZE LOCK command is issued when the drive is placed in frozen mode, the drive executes the command, staying in frozen mode.

SECURITY SET PASSWORD (F1h)

This command set user password or master password. The host outputs sector data with PIO data-out protocol to indicate the information defined in the following table.

SECURITY UNLOCK (F2h)

This command used to disable LOCKED MODE of the device. This command transfers 512 bytes of data from the host with PIO data-out protocol. The following table defines the content of this information.

SEEK (7xh)

This command is effectively a NOP command to the device although it does perform a range check.

SET FEATURES (EFh)

This command set parameter to Features register and set drive FLS operation. For transfer mode, parameter is set to Sector Count Register. This command is used by the host to establish or select certain features.

Value	Function
02h	Enable write cache
03h	Set transfer mode based on value in Sector Count register
55h	Disable read look-ahead feature
82h	Disable write cache
AAh	Enable read look-ahead feature

SET MULTIPLE MODE (C6h)

This command enables the device to perform READ MULTIPLE and WRITE MULTIPLE operations and establishes the block count for these commands.

SLEEP (E6h)

This command causes the device to set BSY, enter the Sleep mode, clear BSY and generate an interrupt.

SMART Function Set (B0h)

Performs different processing required for predicting device failures, according to the subcommand specified in the Features register. If the Features register contains an unsupported value, the Aborted Command error is returned. If the SMART function is disabled, any subcommand other than SMART ENABLE OPERATIONS results in the Aborted Command error.

STANDBY (E2h)

This command causes the device to set BSY, enter the Sleep mode (which corresponds to the ATA Standby Mode), clear BSY and return the interrupt immediately.

STANDBY IMMEDIATE (E0h)

This command causes the drive to set BSY, enter the Sleep mode (which corresponds to the ATA Standby Mode), clear BSY and return the interrupt immediately.

WRITE DMA (CAh)

Write data to sectors during Ultra DMA and Multiword DMA transfer. Use the SET FEATURES command to specify the mode value.

WRITE MULTIPLE (C5h)

This command is similar to the Write Sectors command. Interrupts are not presented on each sector, but on the transfer of a block which contains the number of sectors defined by Set Multiple command.

WRITE SECTOR(S) (30h/31h)

Write data to a specified number of sectors (1 to 256, as specified with the Sector Count register) from the specified address. Specify "00h"– to write 256 sectors.

6. Power Consumption

Capacity	Idle	Read	Write	Unit
08GB	0.20	0.86	2.60	W
16GB	0.21	0.95	2.75	W
32GB	0.24	1.05	2.85	W
64GB	0.25	1.30	2.90	W
128GB	0.27	1.60	3.50	W
256GB	0.27	1.80	3.72	W
512GB	0.27	1.95	3.98	W

7. Product Reliability

NAND MLC Flash：

Capacity	Endurance Total Bytes Written	Data Retention	MTBF	Warranty
08GB	Up to 16TB			
16GB	Up to 32TB			
32GB	Up to 65TB			
64GB	Up to 130TB	@25℃ >10 Years	2 Million Hours	3 Years Limited
128GB	Up to 260TB			
256GB	Up to 520TB			
512GB	Up to 1040TB			

NAND SLC Flash：

Capacity	Endurance Total Bytes Written	Data Retention	MTBF	Warranty
08GB	Up to 450TB			
16GB	Up to 900TB			
32GB	Up to 1800TB	@25℃ >10 Years	2 Million Hours	5 Years Limited
64GB	Up to 3600TB			
128GB	Up to 7200TB			

*Total Bytes Written=　【（Flash P/E cycle）x (number of bits in drive)】/WAI
　WAI=1.428704724

7.1 Wear-Leveling

Terabit 2.5'' PATA SSD support both static and dynamic wear-leveling technology. These two algorithms guarantee each block of flash memory at same level of erase cycles to improve lifetime limitation of NAND based storage.

7.2 ECC

ECC (Error Correction Code): Enhanced configurable BCH ECC engine. Terabit 2.5'' PATA SSD implements the BCH ECC Algorithm, which is one of the most powerful ECC algorithms in the industry. This algorithm can correct up to 12 random bit errors in each 512 bytes.

7.3 MTBF

Mean time between failures (MTBFs) for the SSD can be predicted based on the component reliability data using the methods referenced in the SR-332 reliability prediction procedures for electronic equipment, the prediction result for this SSD is more than 2,000,000 hours.

7.4 Bad-block Management

Terabit implements an efficient bad block management algorithm into the SSD to detect factory produced bad blocks as well as those that develop over the lifetime of the device. This process is completely transparent to the user through the use of S.M.A.R.T. command tools, i.e., the user will not be aware of the existence of the bad blocks during operation.

7.5 S.M.A.R.T Function

S.M.A.R.T stands for Self-Monitoring, Analysis and Reporting Technology. This technology enables the PC to predict the future failure of hard disk drives. Through the S.M.A.R.T. system, Terabit 2.5'' PATA SSD incorporates a suite of advanced diagnostics that monitor the internal operation of the drive and provide an early warning for many types of potential problems.

7.6 TRIM Function

Terabit Solid State Drive equips built-in TRIM and garbage collection function, it helps collect and clean data garbage when the system in an idle situation, which keeps the system in a high performance status even after long-term using.

7.7 Secure Erase

Secure Erase is a standard ATA command and will write all "0xFF" to fully wipe all the data on hard drives and SSDs. When this command is issued, the SSD controller will erase its storage blocks and return to its factory default settings.

8. Performance

Capacity	Sequential Read	Sequential Write	Flash Structure	Flash Type
08GB	40 MB/s	29 MB/s	2GB x 4	TSOP
16GB	78 MB/s	52 MB/s	2GB x 8	TSOP
32GB	85 MB/s	58 MB/s	4GB x 8	TSOP
64GB	92 MB/s	72 MB/s	8GB x 8	TSOP
128GB	108 MB/s	85 MB/s	8GB x 16	TSOP
256GB	128 MB/s	91 MB/s	16GB x 16	TSOP
512GB	146 MB/s	109 MB/s	32GB x 16	TSOP

Note:

① Test platform: ASUS P8H67-M, CPU i5, DDR III 4GB, Windows® 8 64bit with AHCI mode.

② Tested base on Crystal Disk Mark (Version 5.1.1), default test data (Random), copied file 1000MB, unit MB/s.

9. Cache

Cache	DDR2	DDR3	Capacity
Support	/	Yes	/

10. Thermal Sensor

Thermal monitors are devices for measuring temperature, and can be found in SSDs in order to issue warnings when SSDs go beyond a certain temperature. The higher temperature the thermal monitor detects, the more power the SSD consumes, causing the SSD to get aging quickly. Hence, the processing speed of a SSD should be under control to prevent temperature from exceeding a certain range. Meanwhile, the SSD can achieve power savings.

11． Certifications

EN 55022:2010

EN: 55024:2010

EN 61000-3-2:2013

EN 61000-3-3:2014

47 CFR, Part2, Part15, CISPR PUB.22

With reference to RoHS Directive 2011/65/EU recasting 2002/95/EC

12．Ordering information

Series	*Model Name	Capacity	Flash	Secure Erase
2.5'' PATA SSD	T(E)25IDEXTMLC-008G	08GB	NAND MLC	Optional
	T(E)25IDEXTMLC-016G	16GB	NAND MLC	Optional
	T(E)25IDEXTMLC-032G	32GB	NAND MLC	Optional
	T(E)25IDEXTMLC-064G	64GB	NAND MLC	Optional
	T(E)25IDEXTMLC-128G	128GB	NAND MLC	Optional
	T(E)25IDEXTMLC-256G	256GB	NAND MLC	Optional
	T(E)25IDEXTMLC-512G	512GB	NAND MLC	Optional

Series	Model Name	Capacity	Flash	Secure Erase
2.5'' PATA SSD	T(E)25IDEXTSLC-008G	08GB	NAND SLC	Optional
	T(E)25IDEXTSLC-016G	16GB	NAND SLC	Optional
	T(E)25IDEXTSLC-032G	32GB	NAND SLC	Optional
	T(E)25IDEXTSLC-064G	64GB	NAND SLC	Optional
	T(E)25IDEXTSLC-128G	128GB	NAND SLC	Optional

*XT refers to temperature range, ST refers to standard temperature, CT refers to industrial temperature, KT refers to extended temperature.

13. Contact Information

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