

# Terabit™

Military 2.5" SATA 6.0Gbp.s Solid State Drive  
With On-board Tantalum Capacitor Array  
Data Sheet

Terabit Technology

Revision History

Version	Date	Changes	Note
V001	2015-06-28	Release	
	2016-10-10	Altitude and Encryption added	

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**1. Product Features**

Interface	7PIN+15PIN
Form Factor	2.5" SATAIII 6.0Gbps
Dimension	100.2 x 69.9 x 9.3 ±0.2(mm)
Capacity	NAND MLC: 32GB~1024GB NAND SLC: 16GB~512GB
Performance	Read up to 540MB/s Write up to 460MB/s
Power Supply	D/C 5.0V± 5%
Operating Temperature	-40~+85°C
Weight	<90g
Altitude	>80,000 feet
Encryption	AES-128/AES-256
Storage Temperature	-55~+95°C
Shock (Complied with MIL-STD-810G, 514.6)	Non-operating 1500G peak, 0.5ms Operating 50G peak, 11ms
Vibration (operational) (Complied with MIL-STD-810G, 514.6)	Frequency/Displacement: 20-80Hz/1.52mm(X, Y, Z) Frequency/Displacement: 80-2000Hz/20G
Burn-in Test	96 Hours
Max. Power Consumption	Sequential Reading 2.23W Sequential Writing 4.37W Idle 0.37W
Maximum Ripple	100mV, 0~30MHz
Drop (non-operational)	80cm free fall / 6 face of each unit, 2times each
Bending (non-operational)	≥20N / Hold 1 minute/ 5 times
Electrostatic Discharge (ESD) at Temp. 24.0° C and Relative Humidity 49% (RH)	Under +/-4KV, Device functions are affected, but EUT will be back to its normal or operational state automatically.
MTBF	3,000,000 Hours
Features	<ul style="list-style-type: none"> <li>- Enhanced endurance by dynamic/static wear-leveling</li> <li>- On-board Tantalum Capacitors for PLP</li> <li>- Support dynamic power management</li> <li>- Support S.M.A.R.T function</li> <li>- Automatic Bad-block Management</li> <li>- Support TRIM and NCQ</li> <li>- Support BCH ECC 66bits/1024bytes</li> <li>- Conformal Coating optional (MIL-I-46058C)</li> <li>- Secure Erase function optional</li> </ul>
Data Retention	@25°C: 10 years
Certification	CE/FCC/RoHS

## 2. Overview

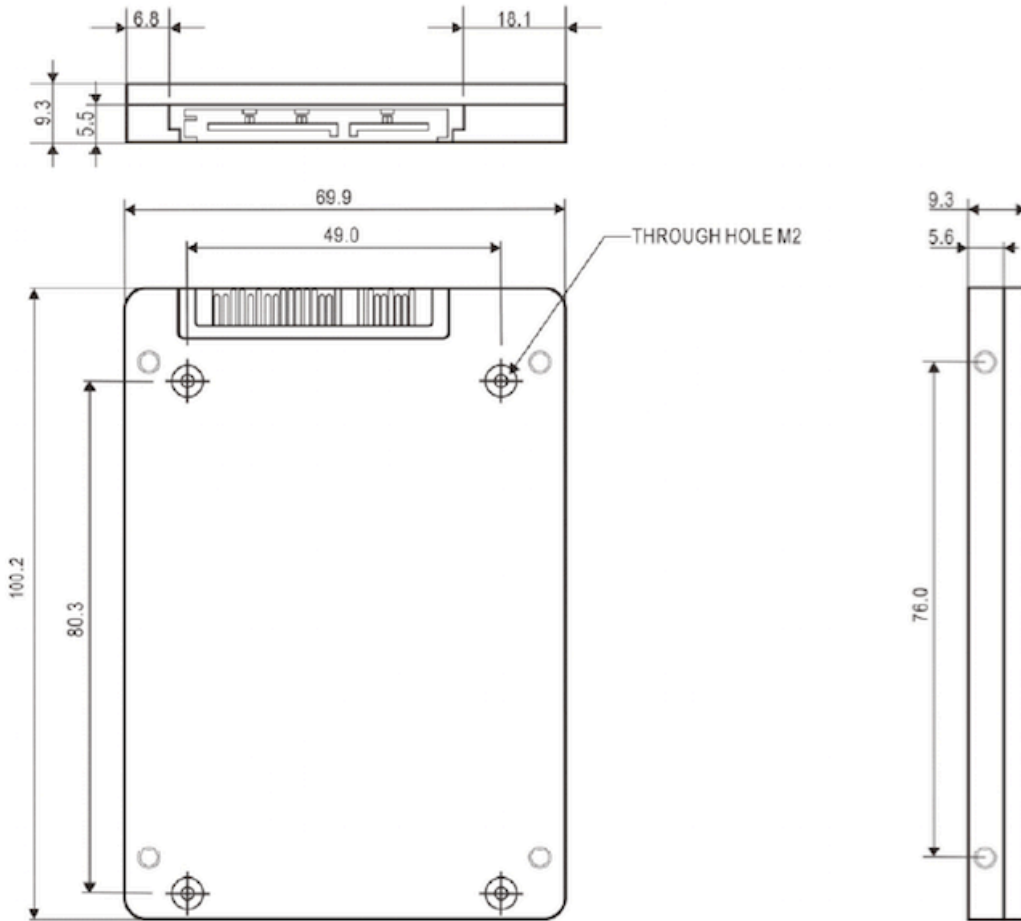
Terabit 2.5" military SATAIII SSD fully consists of semiconductor devices using original Toshiba NAND Flash and extended grade Controller which provide high reliability and high performance for data storage. Terabit 2.5" military SATAIII SSD has standard 22PIN interfaces, fully conform to the same mechanical and mounting requirements as standard rotating disk drives. This series of products are designed for premium Military applications that require both strong reliability and high capacity such as Rugged Computer, System Integration, Server, Embedded Systems, Workstations, RAID and Defense. With up to 1024GB capacity on NAND MLC Flash and 512GB on SLC Flash, Terabit 2.5" military SATAIII 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 & NAND Flash

Terabit 2.5" SATAIII Solid State Drive complies SATA 6.0Gbps Standard.

- SATA Revision 3.2
- Compatible with SATA 1.5Gbps and 3Gbps interface
- NCQ support up to queue depth=32
- Support power management
- Support expanded register for SATA protocol 48 bits addressing mode
- Embedded BIST function for SATA PHY for low cost mass production

4. Physical Dimension

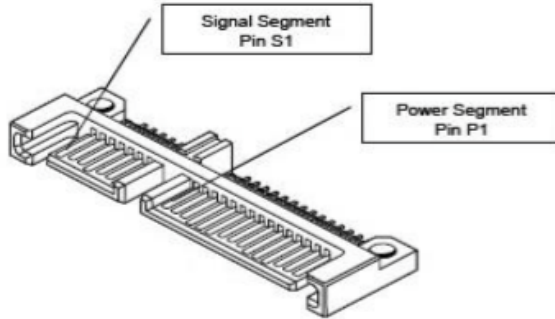


Parameter	Value	Unit
Length	100.2	mm
Width	69.9	mm
Height	9.3	mm

- All of the values are  $\pm 0.2$ mm

5. PIN Description

5.1 PIN Location



5.2 Signal Description

PIN#	PIN Name	PIN Definition
Signal		
S1	GND	
S2	A+	Differential signal pair A
S3	A -	Differential signal pair A
S4	GND	
S5	B-	Differential signal pair B
S6	B+	Differential signal pair B
S7	GND	
Power		
P1	3.3V	Not Used (3.3V)
P2	3.3V	Not Used (3.3V)
P3	DEVSLP	
P4	GND	
P5	GND	
P6	GND	
P7	5V	5V pre-charge
P8	5V	5V power
P9	5V	5V power
P10	GND	
P11	Reserved	
P12	GND	
P13	Reserved	
P14	12V	Not Used (12V)
P15	12V	Not Used (12V)

**6. Power Consumption**

Capacity	Idle	Read	Write	Unit
32GB	0.20	1.95	2.25	W
64GB	0.27	2.00	2.30	W
128GB	0.35	2.06	2.33	W
256GB	0.36	2.15	3.60	W
512GB	0.37	2.20	4.27	W
1024GB	0.37	2.23	4.37	W

**7. Product Reliability**

NAND MLC Flash:

Capacity	Endurance Total Bytes Written	Data Retention	MTBF	Warranty
32GB	Up to 90TB	@25°C >10 Years	3 Million Hours	5 Years Limited
64GB	Up to 180TB			
128GB	Up to 360TB			
256GB	Up to 720TB			
512GB	Up to 1500TB			
1024GB	Up to 3000TB			

NAND SLC Flash:

Capacity	Endurance Total Bytes Written	Data Retention	MTBF	Warranty
16GB	Up to 1250TB	@25°C >10 Years	3 Million Hours	5 Years Limited
32GB	Up to 2500TB			
64GB	Up to 5000TB			
128GB	Up to 10000TB			
256GB	Up to 20000TB			
512GB	Up to 40000TB			

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



### 7.1 Wear-Leveling

NAND flash devices can only undergo a limited number of program/erase cycles, and in most cases, the flash media are not used evenly. If some areas get updated more frequently than others, the lifetime of the device would be reduced significantly. Thus, Wear Leveling is applied to extend the lifespan of NAND Flash by evenly distributing write and erase cycles across the media. Terabit 2.5" military SATAIII SSD supports 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" military SATAIII 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 Over-Provision

Over Provisioning refers to the inclusion of extra NAND capacity in a SSD, which is not visible and cannot be used by users. With Over Provisioning, the performance and IOPS (Input /Output Operations per Second) are improved by providing the controller additional space to manage P/E cycles, which enhances the reliability and endurance as well. Moreover, the write amplification of the SSD becomes lower when the controller writes data to the flash.

### 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" military SATAIII 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. When a potential problem is detected, the SSD can be repaired or replaced before any data is lost or damaged.

7.6 TRIM Function

Terabit Solid State Drive equips built-in TRIM function, which helps collect and cleans data garbage, which keeps the system in a high performance status even after long-term using.

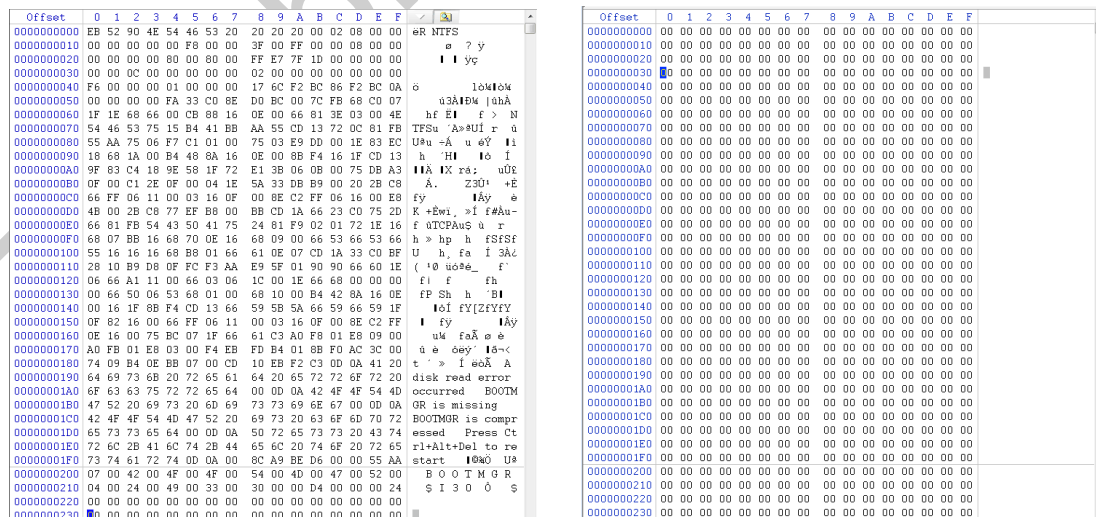
7.7 On-board UPS

Terabit 2.5" Military SATAIII SSD equips a Super Capacitor or 20~25 pieces of Tantalum Capacitors. When sudden power loss happens, the on-board capacitor array could support the drive to work for extra 150~300ms to save the operating data and keep the data safe.

7.8 Secure Erase Function

Terabit 2.5" Military SATAII SSD has secure erase function, which can erase all data in fast speed and the erased data could not be recovered by all ways. The erasing function can be triggered by inputting low currency into SSD through PIN13 by independent hardware button (press the button and keep this action for 2 seconds) and the erasing will start immediately and speed could reach up to 30GB/s. Military data erase protocols include:

- \*NSA/CSS 9-12
- \*NSA/CSS 130-2
- \*DoD 5220.22-M NISPOM
- \*DoD 5220.22-M NISPOM SuSF-1000
- \*US Army 380-19
- \*US Navy NAVSO P-5239-26
- \*US Air Force AFSSI 5020



\*It shows all 00 in WinHex after erasing.

**8. Performance**

Capacity	Sequential Read	Sequential Write	IOPS Read (max)	IOPS Write (max)
16GB	170MB/s	95MB/s	10000	7000
32GB	218MB/s	143MB/s	18000	10000
64GB	402MB/s	274MB/s	20000	12000
128GB	475MB/s	320MB/s	32000	16000
256GB	500MB/s	420MB/s	35000	18000
512GB	540MB/s	460MB/s	38000	22000
1024GB	540MB/s	460MB/s	40000	30000

**9. Cache**

Cache	DDR2	DDR3	Capacity
	/	/	/

**10. ATA Command List**

Op-Code	Command Description	Op-Code	Command Description
00h	NOP	60h	Read FPDMA queued
06h	Data Set Management	61h	Write FPDMA queued
10h	Recalibrate	70h	Seek
20h	Read Sectors	90h	Execute device diagnostic
21h	Read Sectors without retry	91h	Initialize device parameters
24h	Read Sectors EXT	92h	Download microcode
25h	Read DMA EXT	93h	Download microcode DMA

27h		Read Native Max Address EXT	B0h		SMART
29h		Read Multiple EXT	B0h	D0h	SMART read data
2Fh		Read log EXT	B0h	D1h	SMART read data attribute threshold
30h		Write sectors	B0h	D2h	SMART enable/disable attribute autosave
31h		Write sectors without retry	B0h	D3h	SMART save attribute values
34h		Write sectors EXT	B0h	D4h	SMART execute off-line immediate
35h		Write DMA EXT	B0h	D5h	SMART read log
37h		Set native max address EXT	B0h	D6h	SMART write log
39h		Write multiple EXT	B0h	D8h	SMART enable operations
3Dh		Write DMA FUA EXT	B0h	D9h	SMART disable operations
3Fh		Write Long EXT	B0h	DAh	SMART return status
40h		Read verify sectors	B0h	DBh	SMART enable/disable automatic off-line
41h		Read verify sectors without retry	B1h		Device configuration overlay
42h		Read verify sectors EXT	B1h	C0h	Device configuration restore
45h		Write uncorrectable EXT	B1h	C1h	Device configuration freeze lock
47h		Read log DMA EXT	B1h	C2h	Device configuration identify
57h		Write log DMA EXT	B1h	C3h	Device configuration set
B1h	C4h	Device configuration identify DMA	ECh		Identify device
B1h	C5h	Device configuration set DMA	EFh		Set features
C4h		Read multiple	EFh	02h	Enable 8-bit PIO

					transfer mode
C5h	Write multiple	EFh	03h		Set transfer mode based value in count field
C6h	Set multiple mode	EFh	05h		Enable advanced power management
C8h	Read DMA	EFh	10h		Enable use of serial ATA feature
C9h	Read DMA without retry	EFh	10h	02h	Enable DMA setup FIS auto-activate optimization
CAh	Write DMA	EFh	10h	03h	Enable device-initiated interface power state (DIPM) transitions
CBh	Write DMA without retry	EFh	10h	06h	Enable software settings preservation (SSP)
CEh	Write multiple FUA EXT	EFh	10h	07h	Enable device automatic partial to slumber transitions
E0h	Standby immediate	EFh	10h	09h	Enable device sleep
E1h	Idle immediate	EFh	55h		Disable read look-ahead feature
E2h	Standby	EFh	66h		Disable reverting to power-on defaults
E3h	Idle	EFh	82h		Disable write cache
E4h	Read buffer	EFh	85h		Disable advanced power management
E5h	Check power mode	EFh	90h		Disable use of serial ATA feature set
E6h	Sleep	EFh	90h	02h	Disable DMA setup FIS auto-activate optimization
E7h	Flush cache	EFh	90h	03h	Disable device-initiated interface power state (DIPM) transitions
E8h	Write buffer	EFh	90h	06h	Disable software setting preservation

					(SSP)	
E9h		Read buffer DMA	EFh	90h	07h	Disable device automatic partial to slumber transitions
EAh		Fluash cache EXT	EFh	90h	09h	Disable device sleep
EBh		Write buffer DMA	EFh	AAh		Enable read look-ahead feature
EFh	CCH	Enable reverting to power-on defaults	F4h			Security erase unit
F1h		Security set password	F5h			Security freeze lock
F2h		Security unlock	F6h			Security disable password
F3h		Security erase prepare	F8h			Read native max address

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

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**12. Ordering information**

Series	Model Name	Capacity	Flash	Housing
2.5" SATAIII SSD Military	MT25S3KTMLC-032G	32GB	NAND MLC	9.3mm
	MT25S3KTMLC-064G	64GB	NAND MLC	9.3mm
	MT25S3KTMLC-128G	128GB	NAND MLC	9.3mm
	MT25S3KTMLC-256G	256GB	NAND MLC	9.3mm
	MT25S3KTMLC-512G	512GB	NAND MLC	9.3mm
	MT25S3KTMLC-1024G	1024GB	NAND MLC	9.3mm

Series	Model Name	Capacity	Flash	Housing
2.5" SATAIII SSD Military	MT25S3KTSLC-016G	16GB	NAND SLC	9.3mm
	MT25S3KTSLC-032G	32GB	NAND SLC	9.3mm
	MT25S3KTSLC-064G	64GB	NAND SLC	9.3mm
	MT25S3KTSLC-128G	128GB	NAND SLC	9.3mm
	MT25S3KTSLC-256G	256GB	NAND SLC	9.3mm
	MT25S3KTSLC-512G	512GB	NAND SLC	9.3mm

**13. Contact Information**

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