

TerabitTM

Military 2.5" SATAIII 6.0Gbp.s Solid State Drive

Data Sheet

Terabit Technology

Revision History

| Version | Date | Changes | Note |
|---------|-----------|---------|----------------------------|
| V001 | 2015-6-28 | Release | 3 rd Generation |
| | | | |
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Terabit Technology

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1. Product Features

| | |
|--|---|
| Connector | Standard 7PIN+15PIN 30um |
| Form Factor | 2.5" SATAIII 6.0Gbps |
| Dimension | 100.2 x 69.80 x 7.0/9.0 ±0.2(mm) |
| Capacity | NAND SLC: 32GB~512GB NAND MLC: 32GB~2048GB |
| Performance | Read up to 540MB/s Write up to 480MB/s |
| Power Supply | D/C 5.0V± 5% |
| Maximum Ripple | 100mV, 0~30Mhz |
| Operating Temperature | -40~+85°C |
| Weight | <90g |
| Storage Temperature | -55~+95°C |
| Shock (Complied with MIL-STD-810G, 514.6) | Non-operational 1500G, 0.5ms Operational 1500G, 0.5ms |
| Vibration (operational) (Complied with MIL-STD-810G, 514.6) | Frequency/Displacement 20Hz~80Hz/1.52mm Frequency/Acceleration 80Hz~2000Hz/20G X, Y, Z axis/60 min for each |
| Burn-in (operational) | 96 Hours |
| Bending (non-operational) | ≥20N, Hold 1min/5 times |
| Altitude | 20,000 feet |
| Drop (non-operational) | 1.0 meter free fall, 6 face of each unit, 2 times each |
| Typical Power Consumption | Sequential Reading 1.62W Sequential Writing 4.60W Idle 0.3W |
| MTBF | >2,000,000 Hours |
| Features | <ul style="list-style-type: none"> - 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 - Built-in DDR - Conformal Coating (optional) |
| Data Retention | @25°C: 10 years |
| Certification | CE/FCC/RoHS |

2. Overview

Terabit 2.5" SATAIII Military SSD fully consists of semiconductor devices using original 2D NAND Flash and SM2246EN Controller which provide high reliability for data storage. Terabit 2.5" SATAIII Military 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 military applications that require strong reliability such as Rugged Computer, Military Systems, Workstations, RAID and Defense. With up to 512GB capacity on NAND SLC Flash and 2048GB on NAND MLC Flash, Terabit 2.5" SATAIII Military SSD totally goes through a variety of proofing tests such as Shock Test, Vibration Test, Burn-in Test and Twisting Test. Conformal Coating and on-board UPS are also optional for this series of product. 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.

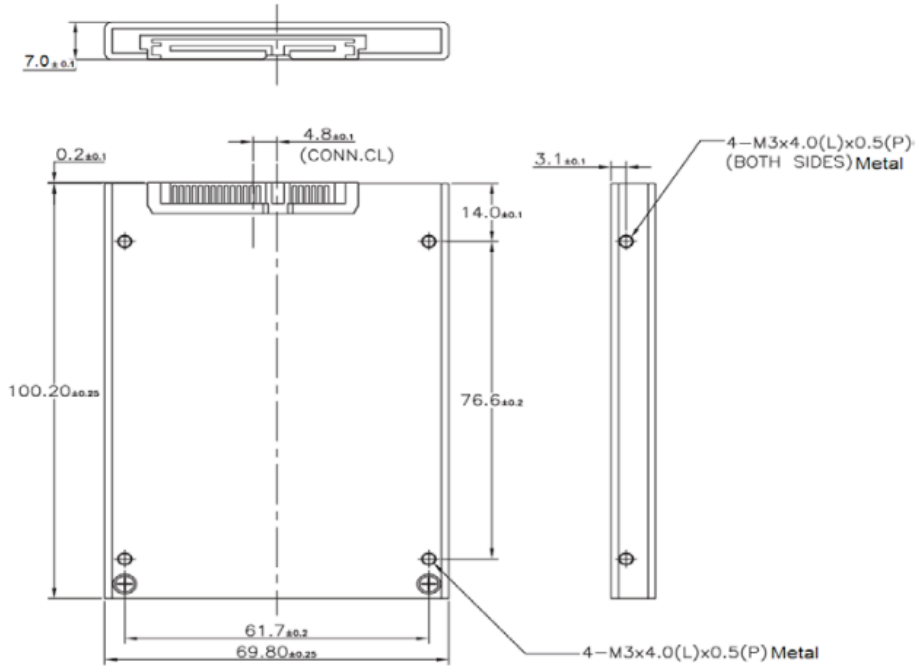
3. Interface

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

- Compliant with SATA Revision 3.2
- Compatible with SATA 1.5Gbps and 3Gbps
- NCQ support up to queue depth =32
- Support Power Management
- Support expanded register for SATA protocol 48 bits addressing mode

4. Physical Dimension

2.5" SATAIII Military Solid State Drive adopts 7.0/9.0mm black metal/CNC housing, meeting the standard from Serial ATA 2.6 to 2.5" dimension.

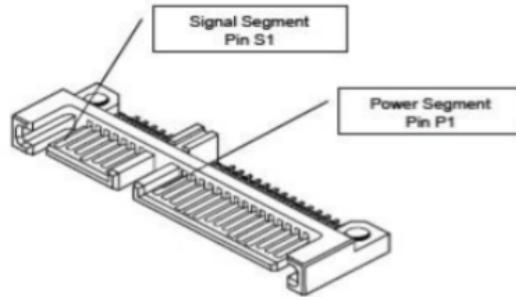


| Parameter | Value | Unit |
|-----------|---------|------|
| Length | 100.2 | mm |
| Width | 69.80 | mm |
| Height | 7.0/9.0 | mm |

- All of the values are ±0.2mm

5. PIN Description

5.1 PIN Location



5.2 Signal Description

| PIN# | PIN Name | PIN Definition |
|--------|----------|-------------------------|
| Signal | | |
| S1 | GND | |
| S2 | RxP | Serial Data Receiver |
| S3 | RxN | |
| S4 | GND | |
| S5 | TxN | Serial Data Transmitter |
| S6 | TxP | |
| S7 | GND | 2 nd mate |
| Power | | |
| P1 | V33 | 3.3V power (unused) |
| P2 | V33 | 3.3V power (unused) |
| P3 | V33 | 3.3V power (unused) |
| P4 | GND | |
| P5 | GND | |
| P6 | GND | |
| P7 | V5 | 5V power |
| P8 | V5 | 5V power |
| P9 | V5 | 5V power |
| P10 | GND | |
| P11 | GND | |
| P12 | GND | |
| P13 | V12 | 12V power (unused) |
| P14 | Reserved | SE Trigger |
| P15 | V12 | 12V power (unused) |

5.3 ATA Command

Support ATA8 Standard, including ATA-ACS2

| Command Name | Command Code (hex) | Command Name | Command Code (hex) |
|-------------------------------------|--------------------|--|--------------------|
| CHECK POWER MODE | E5h or 98h | Enable Power-Up in Standby | Efh/06h |
| DEVICE CONFIGURATION | - | Disable Power-UP in Standby | Efh/86h |
| DEVICE CONFIGURATION FREEZE LOCK | B1h/C1h | Enable DMA Setup FIS Auto-Activity optimization | Efh/10h/02h |
| DEVICE CONFIGURATION IDENTITY | B1h/C2h | Disable DMA Setup FIS Auto-Activity optimization | Efh/90h/02h |
| DEVICE CONFIGURATION RESTORE | B1h/C0h | Enable Device-initiated interface power state transitions | Efh/10h/03h |
| DEVICE CONFIGURATION SET | B1h/C3h | Disable Device-initiated interface power state transitions | Efh/10h/03h |
| DOWNLOAD MICROCODE | 92h | SET MAX | - |
| DATA SET MANAGEMENT | 06h | SET MAX ADDRESS | F9h/na |
| EXECUTE DEVICE DIAGNOSTIC | 90h | SET MAX FREEZE LOCK | F9h/04h |
| FLUSH CACHE | E7h | SET MAX LOCK | F9h/02h |
| FLUSH CACHE EXT | EAh | SET MAX SET PASSWORD | F9h/01h |
| IDENTITY DEVICE | ECh | SET MAX UNLOCK | F9h/03h |
| IDLE | E3h or 97h | SET MAX ADDRESS EXT | 37h |
| IDLE IMMEDIATE | E1h or 95h | SET MULTIPLE MODE | C6h |
| INITIALIZE DEVICE PARAMETERS | 91h | SLEEP | E6h or 99h |
| NOP | 00h/00h | SMART | - |
| READ BUFFER | E4h | SMART DISABLE OPERATIONS | B0h/D9h |
| READ DMA | C8h | SMART ENABLE OPERATION | B0h/D8h |
| READ DMA EXT | 25h | SMART ENABLE/DISABLE ATTRIBUTE AUTOSAVE | B0h/D2h |
| READ FPDMA QUEUED | 60h | SMART ENABLE/DISABLE | B0h/DBh |

| | | | |
|-----------------------------|---------|----------------------------------|------------|
| | | AUTOMATIC OFF-LINE | |
| READ LOG EXT | 2Fh | SMART EXECUTE OFF-LINE IMMEDIATE | B0h/D4h |
| READ MULTIPLE | C4h | SMART READ ATTRIBUTE THRESHOLDS | B0h/D1h |
| READ MULTIPLE EXT | 29h | SMART READ DATA | B0h/D0h |
| READ NATIVE MAX ADDRESS | F8h | SMART READ LOG | B0h/D5h |
| READ NATIVE MAX ADDRESS EXT | 27h | SMART RETURN STATUS | B0h/DAh |
| READ SECTOR(S) | 20h | SMART SAVE ATTRIBUTE VALUES | B0h/D3h |
| READ SECTOR(S) EXT | 24h | SMART WRITE LOG | B0h/D6h |
| READ VERIFY SECTOR(S) | 40h | STANDBY | E2h or 96h |
| READ VERIFY SECTOR(S) EXT | 42h | STANDBY IMMEDIATE | E0h or 94h |
| SECURITY DISABLE PASSWORD | F6h | WRITE BUFFER | E8h |
| SECURITY ERASE PREPARE | F3h | WRITE DMA | CAh |
| SECURITY ERASE UNIT | F4h | WRITE DMA EXT | 35h |
| SECURITY FREEZE LOCK | F5h | WRITE FPDMA QUEUED | 61h |
| SECURITY SET PASSWORD | F1h | WRITE LOG EXT | 3Fh |
| SECURITY UNLOCK | F2h | WRITE MULTIPLE | C5h |
| SEEK | 70h | WRITE MULTIPLE EXT | 39h |
| SET FEATURE | - | WRITE SECTOR(S) | 30h |
| Enable write cache | EFh/02h | WRITE SECTOR(S) EXT | 34h |
| Disable write cache | EFh/82h | | |
| Set transfer mode | EFh/03h | | |

5.4 S.M.A.R.T Attribute ID

| ID | Attribute Name | ID | Attribute Name |
|-----|--|-----|---|
| 0 | (Indicates unused attribute data) | 199 | Total count of write sectors |
| 1 | Raw Read Error Rate* | 200 | Total count of error bits from Flash |
| 9 | Power-On Hours | 201 | Total count of read sectors with correctable bit errors |
| 12 | Power On Count | 202 | Bad block full flag |
| 184 | Init Bad Block Count | 203 | Max PE Count Spec. |
| 195 | Program Failure Block Count | 204 | Erase Count Min |
| 196 | Erase Failure Block Count | 205 | Erase Count Max |
| 197 | Read Failure Block Count (uncorrectable bit errors) | 206 | Erase Count Average |
| 198 | Total count of read sectors | 207 | Remaining life[%] |

6. Power Consumption

| Capacity | Idle | Read | Write | Unit |
|----------|------|------|-------|------|
| 32GB | 0.27 | 1.15 | 3.02 | W |
| 64GB | 0.27 | 1.28 | 3.43 | W |
| 128GB | 0.28 | 1.44 | 3.90 | W |
| 256GB | 0.30 | 1.47 | 4.20 | W |
| 512GB | 0.30 | 1.50 | 4.42 | W |
| 1024GB | 0.30 | 1.60 | 4.50 | W |
| 2048GB | 0.30 | 1.62 | 4.60 | W |

7. Product Reliability

NAND SLC Flash:

| Capacity | Endurance Total Bytes Written | Data Retention | MTBF | Warranty |
|----------|----------------------------------|--------------------|--------------------|-----------------------|
| 32GB | Up to 1800TB | @25°C >10 Years | 2 Million Hours | Five Years Limited |
| 64GB | Up to 3600TB | | | |
| 128GB | Up to 7200TB | | | |
| 256GB | Up to 14400TB | | | |
| 512GB | Up to 28800TB | | | |

NAND MLC Flash:

| Capacity | Endurance Total Bytes Written | Data Retention | MTBF | Warranty |
|----------|----------------------------------|--------------------|--------------------|------------------------|
| 32GB | Up to 60TB | @25°C >10 Years | 2 Million Hours | Three Years Limited |
| 64GB | Up to 120TB | | | |
| 128GB | Up to 240TB | | | |
| 256GB | Up to 480TB | | | |
| 512GB | Up to 960TB | | | |
| 1024GB | Up to 1920TB | | | |
| 2048GB | Up to 3840TB | | | |

*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" SATAIII Military 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" SATAIII Military 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" SATAIII Military 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 2.5" SATAIII Military SSD equips built-in TRIM 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.

8. Performance

| Capacity | Sequential Read | Sequential Write | IOPS Read (max) | IOPS Write (max) |
|----------|-----------------|------------------|-----------------|------------------|
| 32GB | 402MB/s | 252MB/s | 31000 | 24000 |
| 64GB | 450MB/s | 276MB/s | 32000 | 27000 |
| 128GB | 500MB/s | 330MB/s | 44000 | 32000 |
| 256GB | 510MB/s | 405MB/s | 55000 | 43000 |
| 512GB | 520MB/s | 420MB/s | 67000 | 54000 |
| 1024GB | 540MB/s | 460MB/s | 68000 | 65000 |
| 2048GB | 540MB/s | 480MB/s | 70000 | 66000 |

9. Environmental Conditions

Temperature and Humidity:

- Operating Temperature: -40~+85°C
- Storage Temperature: -55~+95°C

Humidity:

- RH 95% under 55°C (operational)

Table 9-1 High Temperature Test Condition

| | Temperature | Humidity | Test Time |
|-----------|-------------|----------|-----------|
| Operation | 85°C | 0% RH | 72 hours |
| Storage | 95°C | 0% RH | 168 hours |

Table 9-2 Low Temperature Test Condition

| | Temperature | Humidity | Test Time |
|-----------|-------------|----------|-----------|
| Operation | -40°C | 0% RH | 72 hours |
| Storage | -55°C | 0% RH | 168 hours |

Table 9-3 High Humidity Test Condition

| | Temperature | Humidity | Test Time |
|-----------|-------------|----------|-----------|
| Operation | 55°C | 95% RH | 72 hours |
| Storage | 55°C | 95% RH | 96 hours |

Table 9-4 Temperature Cycle Test

| | Temperature | Test Time | Cycle |
|-----------|-------------|-----------|-----------|
| Operation | -40°C | 30 min | 20 cycles |
| | +85°C | 30 min | |
| Storage | -55°C | 30 min | 50 cycles |
| | +95°C | 30 min | |

10. Thermal Monitor

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

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12. Ordering information

| Series | Model Name | Capacity | Flash | Housing |
|--------------------------------------|-----------------|----------|----------|-----------|
| Terabit 2.5" SATAIII Military SSD | M25S3KTSLC-032G | 32GB | NAND SLC | 7.0/9.0mm |
| | M25S3KTSLC-064G | 64GB | NAND SLC | 7.0/9.0mm |
| | M25S3KTSLC-128G | 128GB | NAND SLC | 7.0/9.0mm |
| | M25S3KTSLC-256G | 256GB | NAND SLC | 7.0/9.0mm |
| | M25S3KTSLC-512G | 512GB | NAND SLC | 7.0/9.0mm |

| Series | Model Name | Capacity | Flash | Housing |
|--------------------------------------|------------------|----------|----------|-----------|
| Terabit 2.5" SATAIII Military SSD | M25S3KTMLC-032G | 32GB | NAND MLC | 7.0/9.0mm |
| | M25S3KTMLC-064G | 64GB | NAND MLC | 7.0/9.0mm |
| | M25S3KTMLC-128G | 128GB | NAND MLC | 7.0/9.0mm |
| | M25S3KTMLC-256G | 256GB | NAND MLC | 7.0/9.0mm |
| | M25S3KTMLC-512G | 512GB | NAND MLC | 7.0/9.0mm |
| | M25S3KTMLC-1024G | 1024GB | NAND MLC | 7.0/9.0mm |
| | M25S3KTMLC-2048G | 2048GB | NAND MLC | 7.0/9.0mm |

13. Contact Information

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