# MTE672A-VS1

## Datasheet

| Products | Product Description |
|---|---|
| TS2TMTE672A-VS1 | M.2 2280, PCIe Gen3x4, M-Key, 3D TLC BiCS5, DRAM-less, PE: 3K, TCG |
| TS1TMTE672A-VS1 | OPAL, eDrive |
| TS512GMTE672A-VS1 | |
| TS256GMTE672A-VS1 | **FW version** |
| TS128GMTE672A-VS1 | X0122B3 |

**Datasheet version**

1.1

# Revision History

| Revision No. | History | Released Date | Editor by |
|---|---|---|---|
| 1.0 | First version (WD BICS5) | 2024/04/01 | PM |
| 1.1 | Update performance | 2024/04/25 | PM |

# Transcend MTE672A-VS1 Features

| Part Name | Capacity |
|---|---|
| TS2TMTE672A-VS1 | 2TB |
| TS1TMTE672A-VS1 | 1TB |
| TS512GMTE672A-VS1 | 512GB |
| TS256GMTE672A-VS1 | 256GB |
| TS128GMTE672A-VS1 | 128GB |

## FEATURES

- PCI Express Gen3 x 4, NVMe
- 3D TLC NAND Flash
- M.2 PCIe 2280 M Key
- DRAM-less
- Global wear-leveling function
- Enhance Bad block management
- Power shield function
- LDPC ECC (Error correction code) functionality
- NVM command support
- Advanced Garbage Collection
- Supports S.M.A.R.T. function
- Dynamic Thermal Throttling (Default)
- Corner Bond (Controller)
- Single side placement
- PCB Gold Finger 30u"
- Anti-sulfur resistor
- Self-encrypting drives(SED) with AES-256 (Default)
- Compliant with TCG Opal specifications and IEEE 1667 standards
- Supports Microsoft® eDrive standard
- Support Host Memory Buffer

## PERFORMANCE[1]

- Data Transfer Rate
  - Sequential Read          Up to 2000 MB/s
  - Sequential Write         Up to 1700 MB/s

## RELIABILITY[1]

- TBW
  - 2TB            1920 TB
  - 1TB            960 TB
  - 512GB          480 TB
  - 256GB          240 TB
  - 128GB          104 TB

- UBER             $10^{-15}$
- DWPD             Up to 0.88 DWPD
- MTBF             3,000,000 hours
- Data Retention   1 year
- Warranty         3 years

## ENVIRONMENTAL SPECIFICATIONS[1]

- Temperature
  - Operating         -20°C to 75°C
  - Non-operating     -55°C to 85°C
- Humidity(non-condensing)    5%~95%
- Shock             1500G, 0.5ms
- Vibration         20G, 7~2000Hz

## POWER REQUIREMENTS[1]

- Supply voltage / Tolerance    3.3V±5%
- Active (max)      4.5W
- Idle (max)        0.5W

## PHYSICAL DIMENSION
### No heat sink

- Width                                    22.00±0.15mm
- Length                                   80.00±0.15mm
- Height(max)                              2.23mm
- Weight                                   Up to 9g

### With Graphene heat sink (Optional)

- Width                                    22.00±0.15mm
- Length                                   80.00±0.15mm
- Height(max)                              2.52mm
- Weight                                   Up to 9g

### With Metal heat sink (Optional)

- Width                                    23.06±0.2mm
- Length                                   80.00±0.15mm
- Height(max)                              9.2mm
- Weight                                   Up to 36.4g

*Note:*
1) For detail information, please refer to document content.

# Table of Content

# 1. Introduction
## 1.1 General Feature Information

**Hardware Feature**
- PCI Express Gen3 x 4, NVMe
- Controller SM2263XT
- 3D TLC NAND Flash
- Temperature operation from -20°C to 75°C
- M.2 PCIe 2280 M Key
- DRAM-less
- Power shield function
- Corner Bond (Controller)
- Single side placement
- PCB Gold Finger 30u"
- Anti-sulfur resistor
- TCG-Opal 2.0 (Default)
- Support IEEE 1667 standard (Default Enable)
- Supports Microsoft® eDrive standard

**Firmware Feature**
- Global wear-leveling function
- Early Move function
- Read Retry function
- Enhance Bad block management function
- LDPC ECC(Error Correction Code) function
- NVM Command function
- Advanced Garbage Collection function
- Static Data Refresh function
- Dynamic Thermal Throttling (Default)
- S.M.A.R.T. function
- AES-256 function (Default)
- Host Memory Buffer

**Software Feature**
- Transcend Scope Pro
- Transcend Control Center
- Transcend One Touch Recovery

## 1.2 Product List

| Form Factor | Part Name | Capacity |
|---|---|---|
| 2280-S2-M | TS2TMTE672A-VS1 | 2TB |
| | TS1TMTE672A-VS1 | 1TB |
| | TS512GMTE672A-VS1 | 512GB |
| | TS256GMTE672A-VS1 | 256GB |
| | TS128GMTE672A-VS1 | 128GB |

## 1.3 Ordering Information

**T S X X X G M T E 6 7 2 A - V S 1**

      1      2    3    4        5

1 – Transcend

2 – SSD Density

3 – G: Gigabyte; T: Terabyte

4 – M.2 PCIe device

5 – 2280 form factor with 3D TLC NAND flash

    DRAM-Less

    Single Side placement

    Corner bond (Controller)

    Anti-sulfur resistor

    TCG-Opal function

# 2. Product Specifications

## 2.1 Interface and Compliance

- Compatible with PCI Express specification Rev. 3.1
- Compatible with NVM Express specification Rev. 1.3
- NVM command support
- RoHS Compliance
- CE, UKCA, FCC and BSMI Compliance

## 2.2 Drive Capacity

[Table 1] User Capacity and Addressable Sectors

|  | 128GB | 256GB | 512GB | 1TB | 2TB |
|---|---|---|---|---|---|
| **User-Addressable Sectors** | 250,069,680 | 500,118,192 | 1,000,215,216 | 2,000,409,264 | 4,000,797,360 |
| **Byte per Sector** | 512 Byte | | | | |

## 2.3 System Performance

[Table 2] Sequential Read / Write Performance

| **Read / Write** | **128GB** | **256GB** | **512GB** | **1TB** | **2TB** |
|---|---|---|---|---|---|
| Sequential Read | 1000 MB/s | 2000 MB/s | 2000 MB/s | 2000 MB/s | 2000 MB/s |
| Sequential Write | 520 MB/s | 1000 MB/s | 1600 MB/s | 1600 MB/s | 1700 MB/s |

*Note: Maximum transfer speed recorded*

1) 25°C, test on Gigabyte X570 UD, 4GB, Windows®10 64bit Professional, benchmark utility CrystalDiskMark (version 6.0.2), copied file 1000MB.

2) The recorded performance is obtained while the SSD is not operated as an OS disk Physical Specification.

[Table 3] Random Read / Write Performance

| **Read / Write** | **128GB** | **256GB** | **512GB** | **1TB** | **2TB** |
|---|---|---|---|---|---|
| Random Read IOPS | 48K | 60K | 100K | 100K | 157K |
| Random Write IOPS | 130K | 240K | 250K | 260K | 247K |

*Note: Maximum transfer speed recorded*

1) 25°C, test on ASUS Z170-E, 4GB, Windows®10 Professional, benchmark utility IOmeter 1.1.0 with 4K file size and queue depth of 32, unit IOPs

2) The recorded performance is obtained while the SSD is not operated as an OS disk Physical Specification.

## 2.4 Supply Voltage

[Table 4] Supply Voltage

| Item | Requirements |
|---|---|
| Allowable voltage | 3.3V$\pm$5% |
| Allowable noise / ripple | 100 mV p-p or less |

## 2.5 System Power Consumption

[Table 5] Power Consumption

| Read / Write | 128GB | 256GB | 512GB | 1TB | 2TB |
|---|---|---|---|---|---|
| Active Write (Max.)[1] | 2.4W | 2.9W | 3.0W | 3.1W | 3.9W |
| Active Read (Max.)[1] | 2.6W | 3.0W | 3.1W | 3.1W | 4.5W |
| Idle | 0.36W | 0.4W | 0.4W | 0.4W | 0.5W |

*Note:*

1) The power consumption is measured under SSD operation at maximum performance. The value is affected by system operation performance and workload.

## 2.6 Environment Specifications

[Table 6] Environment Specification

| Features | Operating[1] | Non-Operating[2] |
|---|---|---|
| **Temperature** | -20$^\circ$C to +75$^\circ$C | -55$^\circ$C to 85$^\circ$C |
| **Temperature Gradient** | 60$^\circ$C/Hr | 60$^\circ$C/Hr |
| **Humidity** | 5% to 95%, non-condensing | |
| **Shock** | 1500G, duration 0.5 ms, 3 axis[3] | |
| **Vibration** | 20G, 7~2000Hz, 3 axis[4] | |

*Note:*

1) The operating specification is regarded as Ambient Temperature. Extended grade (-20$^\circ$C to +75$^\circ$C) and Industrial grade (-40°C to +85°C) indicate the temperature conditions for testing devices on programmable temperature and humidity chamber room.

2) The non-operating specification is regarded as storage specification.

3) Refer IEC 68-2-27 standard.

4) Refer IEC 68-2-6 standard.

# Recommended Measurement Point

Recommended temperature measurement point is in the center of the connector inserted by the device. Sufficient airflow is recommended for proper operation on heavier workloads within the device operating temperature.
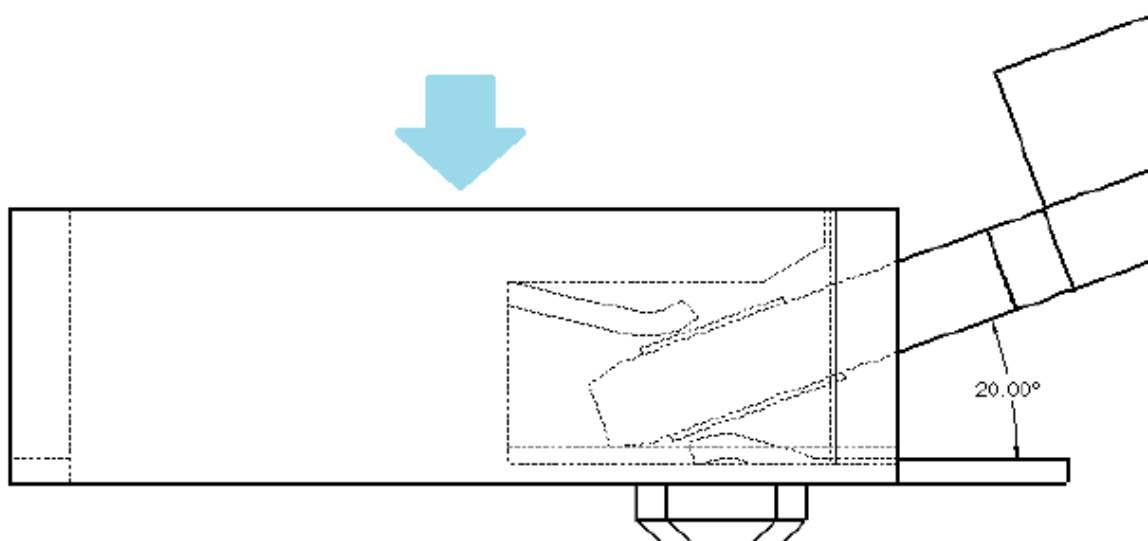


## 2.7 System Reliability

[Table 7] Telcordia SR332 issue 4 MTBF Specifications

| Parameter | 128GB | 256GB | 512GB | 1TB | 2TB |
|---|---|---|---|---|---|
| MTBF | 3,000,000 hours | | | | |

***Note:***

1) The calculation is based on 25°C.

[Table 8] UBER Specifications

| Parameter | 128GB | 256GB | 512GB | 1TB | 2TB |
|---|---|---|---|---|---|
| UBER | $10^{-15}$ | | | | |

***Note:***

1) Uncorrectable Bit Error Rate (UBER) is a metric for the rate of occurrence of data errors, equal to the number of data errors per bits read as specified in the JESD218 document of JEDEC standard. For the client application, JEDEC recommends that UBER shall be below $10^{-15}$.

[Table 9] TBW (Terabytes Written) Specifications

| Parameter | 128GB | 256GB | 512GB | 1TB | 2TB |
|---|---|---|---|---|---|
| TBW | 104 TB | 240 TB | 480 TB | 960 TB | 1920 TB |

***Note:***

1) TBW specification follows JESD219A Client workload.

## [Table 10] Drive Write Per Day (DWPD) Specifications

| Parameter | 128GB | 256GB | 512GB | 1TB | 2TB |
|---|---|---|---|---|---|
| DWPD[1] | 0.74 (3 Years) | 0.86 (3 Years) | | 0.88 (3 Years) | 0.88 (3 Years) |

***Note:***

1) DWPD is based on [Table 13] Warranty year to calculate.

## [Table 11] Data Retention Specifications

| Parameter | 128GB | 256GB | 512GB | 1TB | 2TB |
|---|---|---|---|---|---|
| Data Retention | 1 year | | | | |

***Note:***

1) Data retention was measured by assuming that SSD reaches the maximum rated endurance at $30^{\circ}$C under power-off state.

2) The data retention is defined in JESD218 Requirements for standard classes of SSDs.

## [Table 12] Power On to Ready

| Parameter | 128GB | 256GB | 512GB | 1TB | 2TB |
|---|---|---|---|---|---|
| Setup time | 9.45 s | | | | |

***Note:***

1) Tested by using Drive Master and power on to ready with proper shutdown condition.

## [Table 13] Warranty

| Parameter | 128GB | 256GB | 512GB | 1TB | 2TB |
|---|---|---|---|---|---|
| Warranty | 3 years limited | | | | |

## [Table 14] Regulations

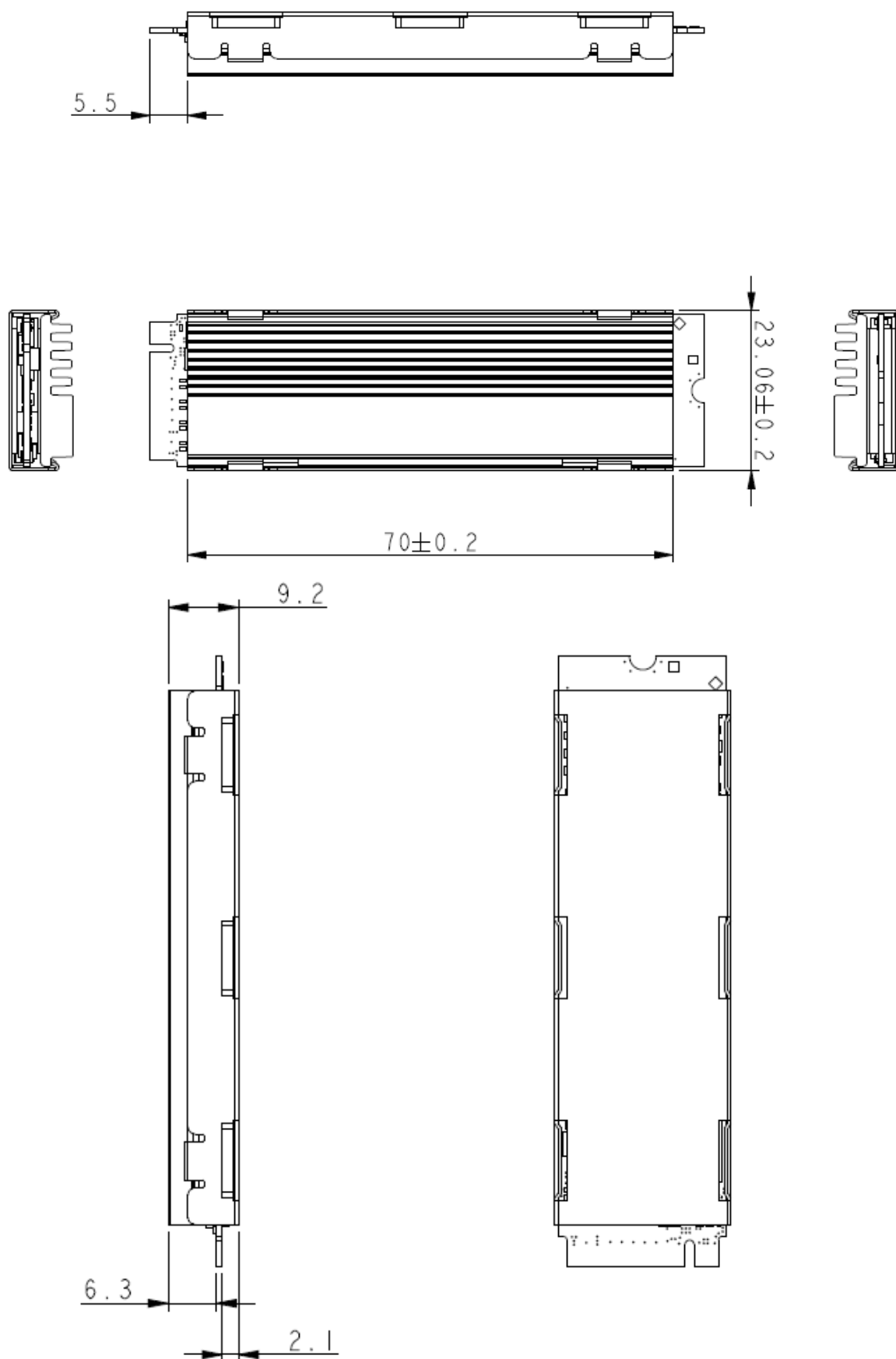| Parameter | 128GB | 256GB | 512GB | 1TB | 2TB |
|---|---|---|---|---|---|
| Compliance | CE, UKCA, FCC and BSMI | | | | |

# 3. Mechanical Specification

The figure below illustrates the Transcend M.2 Type 2280-S2-M Solid State Drive.

[Table 15] Physical Dimensions and Weight

| Model | Height (mm) | Width (mm) | Length (mm) | Weight (gram) |
|---|---|---|---|---|
| 128GB/256GB/512GB/1TB/2TB | Max 2.23 | 22.00±0.15 | 80.00±0.15 | Max 9g |
| With Graphene Heat Sink | Max 2.52 | 22.00±0.15 | 80.00±0.15 | Max 9g |
| With Metal Heat Sink | Max 9.2 | 23.06±0.2 | 80.00±0.15 | Max 36.4g |



| TYPE ID | Top Max | Bottom Max |
|---|---|---|
| S1 | 1.20 mm | N/A |
| S2 | 1.35 mm | N/A |
| S3 | 1.50 mm | N/A |
| S4 | 1.75 mm | N/A |
| S5 | 2.00 mm | N/A |
| D1 | 1.20 mm | 1.35 mm |
| D2 | 1.35 mm | 1.35 mm |
| D3 | 1.50 mm | 1.35 mm |
| D4 | 1.50 mm | 0.70 mm |
| D5 | 1.50 mm | 1.50 mm |

5.5

23.06±0.2

70±0.2

9.2

6.3

2.1
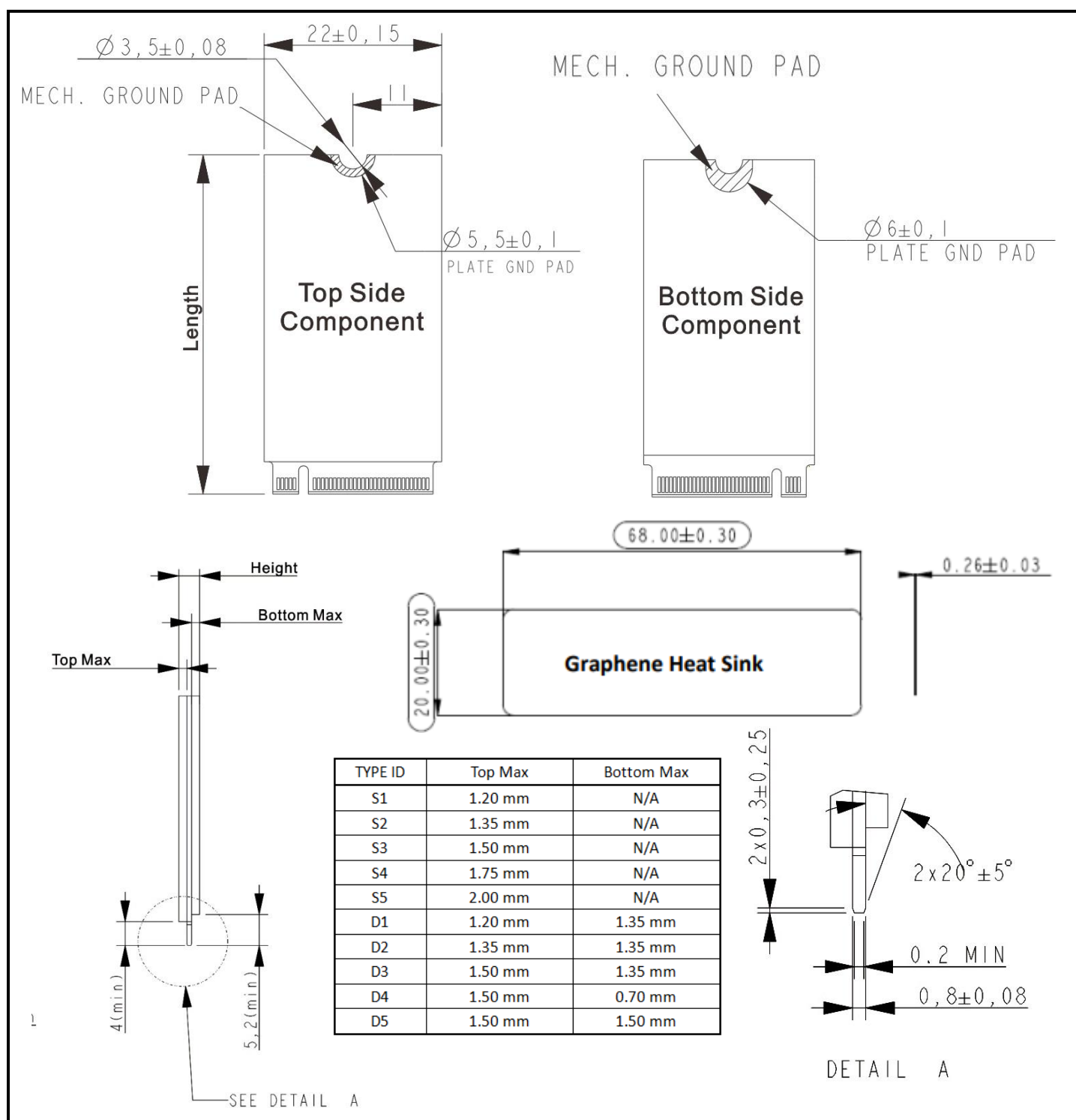
# 4. Pin Assignments

## 4.1 Pin Assignments

[Table 16] Pin Assignments

| Pin No. | Pin Name | Pin No. | Pin Name | Pin No. | Pin Name | Pin No. | Pin Name |
|---------|----------|---------|----------|---------|----------|---------|----------|
| 01 | GND | 02 | 3.3V | 39 | GND | 40 | NC |
| 03 | GND | 04 | 3.3V | 41 | PETn0 | 42 | NC |
| 05 | PETn3 | 06 | NC | 43 | PETp0 | 44 | NC |
| 07 | PETp3 | 08 | NC | 45 | GND | 46 | NC |
| 09 | GND | 10 | LED1 | 47 | PERn0 | 48 | NC |
| 11 | PERn3 | 12 | 3.3V | 49 | PERp0 | 50 | PERST# |
| 13 | PERp3 | 14 | 3.3V | 51 | GND | 52 | CLKREQ# |
| 15 | GND | 16 | 3.3V | 53 | REFCLKN | 54 | NC |
| 17 | PETn2 | 18 | 3.3V | 55 | REFCLKP | 56 | NC |
| 19 | PETp2 | 20 | NC | 57 | GND | 58 | NC |
| 21 | GND | 22 | NC | 59 | NOTCH | 60 | NOTCH |
| 23 | PERn2 | 24 | NC | 61 | NOTCH | 62 | NOTCH |
| 25 | PERp2 | 26 | NC | 63 | NOTCH | 64 | NOTCH |
| 27 | GND | 28 | NC | 65 | NOTCH | 66 | NOTCH |
| 29 | PETn1 | 30 | NC | 67 | NC | 68 | NC |
| 31 | PETp1 | 32 | NC | 69 | NC | 70 | 3.3V |
| 33 | GND | 34 | NC | 71 | GND | 72 | 3.3V |
| 35 | PERn1 | 36 | NC | 73 | GND | 74 | 3.3V |
| 37 | PERp1 | 38 | NC | 75 | GND | | |

*Note:*

1) NC. Do not connect.

# 5. Block Diagram and Function Explanations

## 5.1 Block Diagram
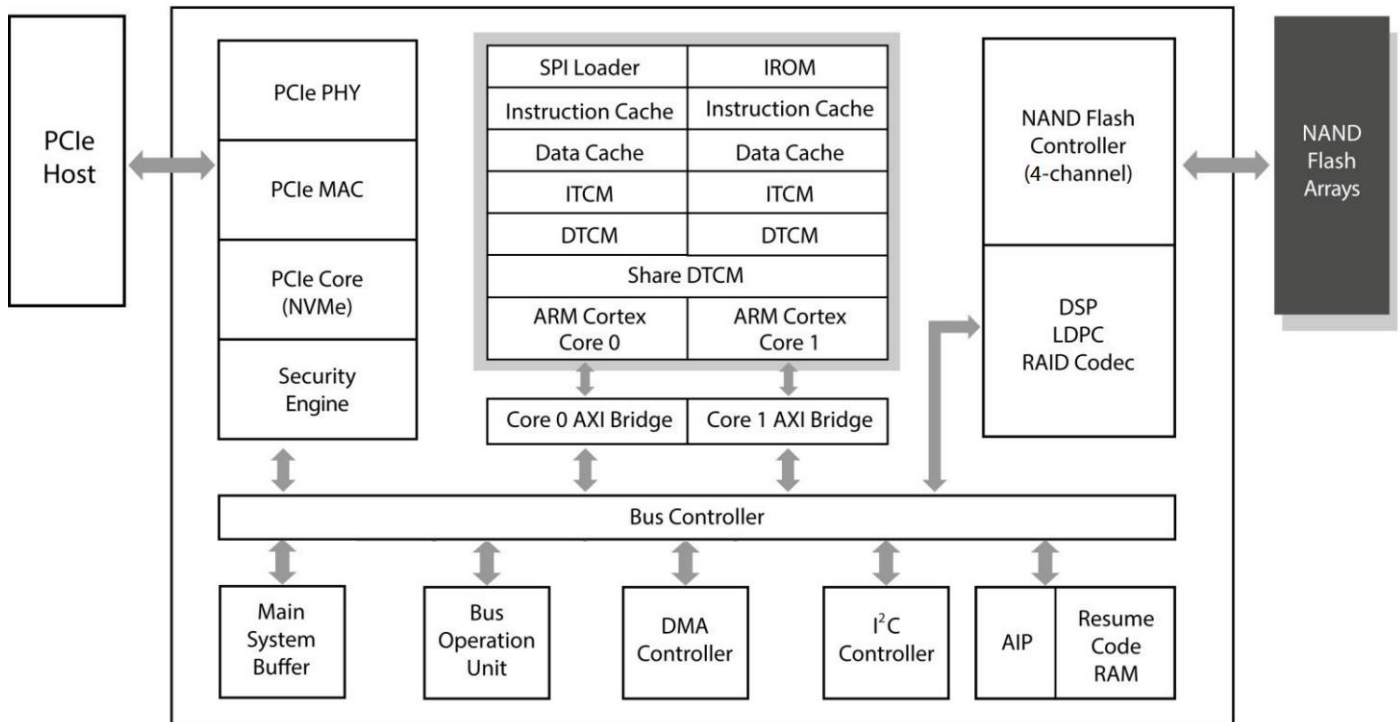


## 5.2 Function Explanations

### 5.2.1 Global Wear Leveling Function

Global wear leveling ensures that every block has an even erase count. This helps to extend the life expectancy of an SSD.

There are three main processes in global wear leveling:

(1) Record the block erase count and save this in the wear-leveling table.

(2) Find the static-block and save this in the wear-leveling pointer.

(3) Check the erase count when a block is pulled from the pool of spare blocks. If the block erase count is larger than WEARCNT, then swap the static-block and the over-count-block.

### 5.2.2 Bad Block Management Function

When the flash encounters ECC fail, program fail or erase fail, the controller will mark the block as a bad block. This will prevent the usage of bad blocks which may result in data loss in the future.

### 5.2.3 Enhanced S.M.A.R.T. function

Transcend SSD supports S.M.A.R.T. command (Self-Monitoring, Analysis, and Reporting Technology) that allows users to read the health information of the SSD. Transcend also define some innovated S.M.A.R.T. features which allows the user to evaluate the status of the SSD in a much more efficient way.

## 5.2.4 StaticDataRefresh Technology

Normally, ECC engine corrections are taken place without affecting the host normal operations. As time passes by, the number of error bits accumulated in the read transaction exceeds the correcting capability of the ECC engine, resulting in corrupted data being sent to the host. In order to prevent such occurrence, the controller monitors the error bit levels at each read operation; when it reaches the preset threshold value, the controller automatically performs data refresh to "restore" the correct charge levels in the cell. This implementation practically restores the data to its original, error-free state, and hence lengthening data life.

## 5.2.5 PS(Power shield) Function

Power Shield (PS) is a basic technology supported by all Transcend's embedded SSDs to prevent internal NAND flash data loss in event of a sudden power outage. The internal voltage detection circuit (VDT) of the controller monitors the external power supply. When the external voltage drops from 5V to 4V or from 3.3V to 2.7V, the VDT activates the PS detection mechanism. When a sudden power outage occurs, the internal power shield circuit would trigger the PS function so that the controller will stop accepting new write commands. The write operation is terminated to ensure that the firmware and the data in the NAND flash are undamaged.

When the external voltage drops to a certain level, the internal voltage detection circuit (VDT) of the controller activates the PS mechanism. The SSD controller then stops accepting new write commands from the host, ensuring the integrity of existing data for the NAND flash.

The PS function ensures the safety of the data which has already been written into the flash before sudden power outage.

## 5.2.6  Dynamic Thermal Throttling

For PCIe SSD applications, when operation temperature increases, system CLK will decrease to protect the SSD and controller with dynamic thermal throttling algorithm. The read/write speeds of the SSD will change at different temperature levels in order to extend its lifespan.

## 5.2.7  Transcend Scope Pro

Transcend's Scope Pro is a convenient software package that helps users monitor and manage SSD status via an intuitive interface. It offers various useful features, including drive information and S.M.A.R.T. status monitoring, diagnostic scan, secure erase, health indication, system clone, and monitoring. For more information, please refer the website link. **https://us.transcend-info.com/Embedded/Essay-20**

## 5.2.8  Early Move Function

Early move detects and corrects potential data errors. If error bits in a block reach upper limit, then the data should be moved to another block and the original block should be erased.

## 5.2.9  Read Retry Function

Read retry is designed for flash memory to adjust the read reference voltage and eliminate the read error.

## 5.2.10 Corner Bond (Controller)

Corner bond is used as a stress relieving agent, evenly distributing the expansion and contraction effects. By spreading stresses throughout the chip and PCB interface with a mechanical bond, less stress is concentrated on the solder joints, increasing device reliability.

## 5.2.11 ASPM (Active-State Power Management)

Active-state power management (ASPM) is a power management mechanism for PCI Express devices to garner power savings while otherwise in a fully active state. It can save the power of the PCI Express subsystem by reducing the power state of the PCIe connection when the PCIe device is not in use. ASPM will control the power status at both ends of the connection, and even when the device at one end is still at full power, it can still save the power of the connection.

While ASPM brings a reduction in power consumption, it can also result in increased latency as the serial bus needs to be 'woken up' from low-power mode, possibly reconfigured and the host-to-device link re-established. This is known as ASPM exit latency.

PCIe defines five power modes, including normal operation to complete shutdown mode: L0: Normal operation; L0s: Link Standby; L1: Link is idle; L2: Only auxiliary power is enabled; L3: Turn off the power and the device shuts down. Currently, the ASPM function supports two low-power modes; L0s and L1 modes.

[Table 19] Power Management Mechanism

| NVMe Power State | PCIe Link State | Power | Exit Latency |
|---|---|---|---|
| PS0 | L0/ L0S/ L1 | 5W | No |
| PS1 | L0/ L0S/ L1 | 3W | <1mS |
| PS2 | L0/ L0S/ L1 | 1.5W | <1mS |
| PS3 | L1/ L1.1/ L1.2 | 100mW | 5-10mS |
| PS4 | L1.2 | 2-5mW | <100ms |

*Note:* 1) Both NVMe Power State and PCIe Link State can be set in MP Tool.

*Note:* 2) L1.1 and L1.2 are sub-states of L1.
- L1.1 function turns off the PLL, receiver and transmitter.
- L1.2 function turns off the PLL, receiver, transmitter, and common mode keepers.

*Note:* 3) Default settings are enabled.

## 5.2.12  Anti-sulfur resistor

To prevent sulfurization, resistors should be made sulfur-resistant. Transcend`s anti-sulfur approach is to cover and therefore isolate the electrode, thus preventing hydrogen sulfide from coming into contact with the silver. Atmospheric sulfur is on the rise due to increasing levels of pollution, and the applications for anti-sulfur components are increasing. Transcend's anti-sulfur SSD modules all meet level G2 of ISA Standard S71.04-2013 and ASTM B809-95 standard, suitable for the Industrial Revolution 4.0, the Internet of Things, and the Internet of Vehicles, where the use of anti-sulfur technology is highly required.

## 5.2.13 TCG-Opal Function(Default)

Opal is a comprehensive set of guidelines. The target audience includes manufacturers of storage devices, software vendors, system integrators, and academia. These specifications cover the manufacture of

storage devices, system setup, management, and use; they allow for password protection and hierarchical storage management, while preventing data from being stolen or tampered with.

They are self-encrypting devices: Data encryption is performed on the device, without need to pass through the host. The encryption key is also stored on the device (commonly AES is utilized).

(1) Features boot authentication:

When the user starts the device, the shadow MBR will conduct a pre-boot identification; where the user is cleared, the normal boot process will begin and connections to the devices are to be made.

(2) Sector specific permissions:

The device manager may create a logical block address (LBA) range and assign different permissions for each LBA range. Only users with the correct key for a particular LBA range may perform permitted actions. Where drive locations are password-protected, only users with the correct key will be authorized entry.

## 5.2.14 Host Memory Buffer

Host Memory Buffer is a mechanism to allow the host to provide memory resources that are not currently needed for SSD use through the NVMe protocol to improve device performance.

## 5.2.15   Microsoft® eDrive (Encrypted Drive)

eDrive (Encrypted Drive) is BitLocker with advanced encryption for the Microsoft® Windows usage , called BitLocker with eDrive. Encrypted storage uses the rapid encryption that is provided by BitLocker Drive Encryption to enhance data security and management. By offloading the cryptographic operations to hardware, Encrypted storage increase BitLocker performance and reduce CPU usage and power consumption. eDrive builds on the TCG Opal 2.0 and IEEE 1667 security features, encrypted storage are a new class of storage that are self-encrypting at a hardware level and allow for full disk hardware encryption.

## 5.2.16 Other Functions

Transcend SSD embedded a lot of cutting-edge technology. Should you have any technical request, please contact the local support team or send us an e-mail.

# 6 Technology Term Explanations

## 6.1 TBW

Terabytes Written (TBW) directly measures how much you can write cumulatively into the drive over its lifetime. Essentially, it just includes the multiplication conducted above in the measurement itself.

For example, if your drive is rated for 365 TBW, that means you can write 365 TB into it before a replacement is required.

If its warranty period is 5 years, that works out to 365 TB ÷ (5 years × 365 days/year) = 200 GB of writes per day. If your drive was 200 GB in size, that's equivalent to 1 DWPD. Correspondingly, if your drive was rated for 3.65 PBW = 3,650 TBW, that works out to 2 TB of writes per day, or 10 DWPD.

As you can see, if you know the drive's size and warranty period, you can always calculate TBW from DWPD and vice-versa with simple multiplications or divisions. The two measurements are very similar.

## 6.2 DWPD

Drive Writes Per Day (DWPD) measures how many times you could overwrite the drive's entire size each day of its life. For example, suppose your drive is 200 GB and its warranty period is 5 years. If its DWPD is 1, that means you can write 200 GB (its size, one time) into it every single day for the next five years.

If you multiply that out, that's 200 GB per day × 365 days/year × 5 years = 365 TB of cumulative writes before you may need to replace it.

If the DWPD is 10 instead of 1, that means you can write 10 × 200 GB = 2 TB (its size, ten times) into it every day. Correspondingly, that's 3,650 TB = 3.65 PB of cumulative writes over 5 years.

## 6.3 MTBF – Telcordia SR-332

MTBF (mean time between failures) is a measure of how reliable a hardware product or component is. For most components, the measurement is typically in thousands or even tens of thousands of hours between failures. For example, a SSD may have a mean time between failures of 200,000 hours. A desired MTBF can be used as a quantifiable objective when designing a new product. The MTBF figure can be developed as the result of intensive testing, based on actual product experience, or predicted by analyzing known factors. The manufacturer may provide it as an index of a product's or component's reliability and, in some cases, to give customers an idea of how much service to plan for. In Transcend MTBF data, we use Telcordia SR-332 Issue 4 method to do estimated calculation.

# 7 Installation Requirements

## 7.1 Card Insertion

Angles insertion is allowable and preferred; the intention is to minimize the insertion/extraction force.

● Minimum of angle of insertion is 5°

Minimum two step insertion is desirable; the intention is to minimize the insertion/extraction force.

M.2 Screw Selection Suggestion: (Reference Only)

● Please refer chapter 3: Mechanical Specification

● M2 or M3 screw matching stand-off.

● Screw head diameter: not exceed 5mm

● Tightening Torques: 0.8 kgf

● Please refer to the specifications of the locked object for its torque and screw length, since the specifications of the copper pillars of the locked object are different.
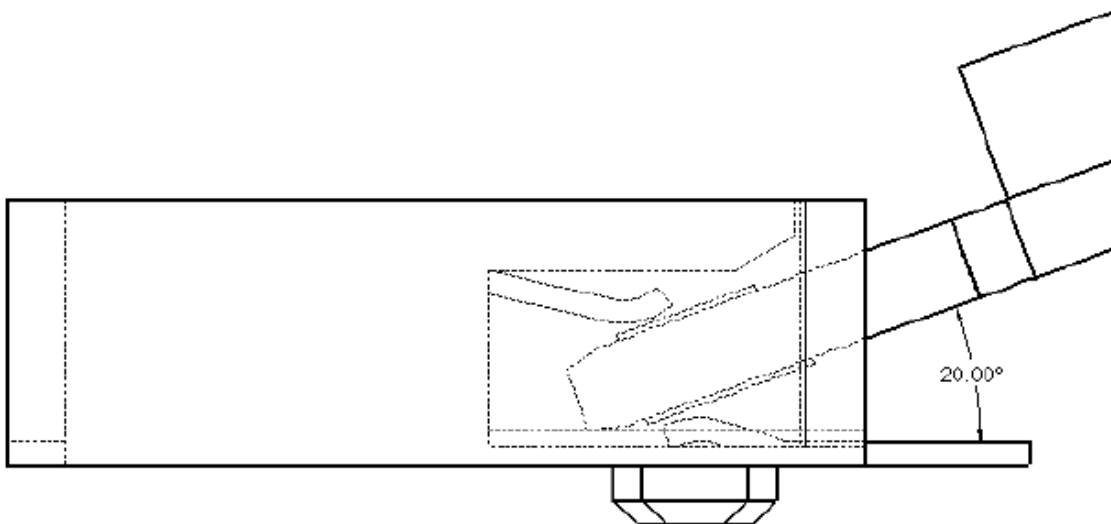
# 8 Command Descriptions

## 8.1 Support Admin Command Register

The Admin command set is the commands that are submitted to the Admin Submission Queues. The detailed specifications are described in NVM Express specification document.
[Table 17] Command Table

| Command Name | Code (Hex) |
|---|---|
| Delete I/O Submission Queue | 00h |
| Create I/O Submission Queue | 01h |
| Get Log Page | 02h |
| Delete I/O Completion Queue | 04h |
| Create I/O Completion Queue | 05h |
| Identify | 06h |
| Abort | 08h |
| Set Features | 09h |
| Get Features | 0Ah |
| Asynchronous Event Request | 0Ch |
| Namespace Management | 0Dh |
| Firmware Commit | 10h |
| Firmware Image Download | 11h |
| Namespace Attachment | 15h |
| Keep Alive | 18h |
| I/O Command Set Specific | 80h – BFh |
| Vendor Specific | C0h – FFh |

## 8.2 SMART / Health Log Page

[Table 18] SMART Data information

| BYTE | Description | | Default Value |
|---|---|---|---|
| 0 | Critical Warning | | 0 |
| | **Bits** | **Description** | |
| | 07:05 | Reserved | |
| | 04 | If set to'1', then the volatile memory backup device has failed. This field is only valid if the controller has a volatile memory backup solution. | |
| | 03 | If set to'1', then the media has been placed in read only mode. | |
| | 02 | If set to'1', then the NVM subsystem reliability has been degraded due to significant media related errors or any internal error that degrades NVM subsystem reliability. | |
| | 01 | If set to'1', then a temperature is above an over temperature threshold or below an under temperature threshold. | |
| | 00 | If set to'1', then the available spare has fallen below the threshold. | |
| 2:1 | Composite Temperature | | Current temperature |
| 3 | Available Spare | | 100 |
| 4 | Available Spare Threshold | | 10 |
| 5 | Percentage Used | | 0 |
| 31:6 | Reserved | | - |
| 47:32 | Data Units Read | | 0 |
| 63:48 | Data Units Written | | 0 |
| 79:64 | Host Read Commands | | 0 |
| 95:80 | Host Write Commands | | 0 |
| 111:96 | Controller Busy Time | | 0 |
| 127:112 | Power Cycles | | 0 |
| 143:128 | Power On Hours | | 0 |
| 159:144 | Unsafe Shutdowns | | 0 |
| 175:160 | Media and Data Integrity Errors | | 0 |
| 191:176 | Number of Error Information Log Entries | | 0 |
| 195:192 | Warning Composite Temperature Time | | 0 |
| 199:196 | Critical Composite Temperature Time | | 0 |

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# 9 Contact Information

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