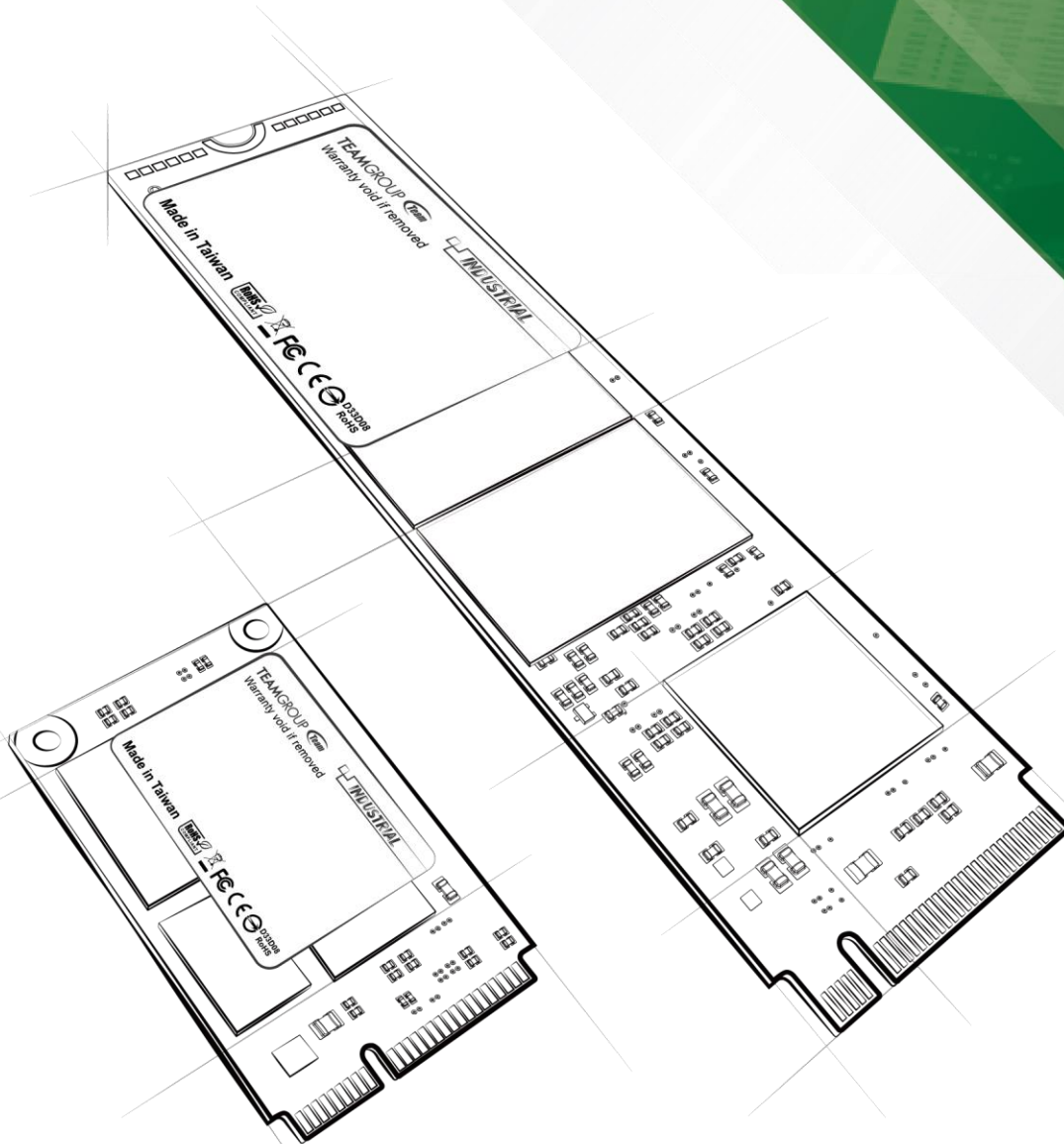




**M.2 SATAIII SSD**

**S745-M80** Series

**Datasheet**

| Specification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Feature                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>Capacity: 128GB to 2TB</li> <li>Interface:                             <ul style="list-style-type: none"> <li>➤ SATA Revision 3.1</li> <li>➤ SATA 1.5Gbps, 3Gbps, and 6Gbps</li> </ul> </li> <li>Flash Type: 3D TLC</li> <li>Performance:                             <ul style="list-style-type: none"> <li>➤ Read up to 545 MB/s (Max.)</li> <li>➤ Write up to 485 MB/s (Max.)</li> </ul> </li> <li>Power Consumption:                             <ul style="list-style-type: none"> <li>➤ Active mode: &lt; 245mA</li> <li>➤ Idle mode: &lt; 65mA</li> </ul> </li> <li>TBW (Terabyte Written):                             <ul style="list-style-type: none"> <li>➤ 3400 (TB) for 2TB</li> </ul> </li> <li>Temperature Range:                             <ul style="list-style-type: none"> <li>➤ Operation (Standard):<br/>0°C ~ 70°C</li> <li>➤ Storage: -55°C ~ 95°C</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>Advanced Global Wear-Leveling and Block management for reliability</li> <li>Supports Advanced Garbage Collection</li> <li>LDPC ECC engine functionality</li> <li>Supports DEVSLP mode</li> <li>Supports Enhanced SMART function</li> <li>MTBF: 3,000,000 hours</li> <li>Compliant (RoHS/CE/FCC)</li> </ul> |

# Table of Contents

|                                            |    |
|--------------------------------------------|----|
| 1. Product Overview.....                   | 4  |
| 1.1 Introduction.....                      | 4  |
| 1.2 SATA Interface.....                    | 4  |
| 1.3 Block Diagram.....                     | 4  |
| 2. Product Specification .....             | 6  |
| 2.1 Capacity and Device Parameters .....   | 6  |
| 2.2 Performance.....                       | 6  |
| 2.3 Electrical Specifications .....        | 7  |
| 2.3.1 Power Requirement .....              | 7  |
| 2.3.2 Power Consumption.....               | 8  |
| 2.4 Environmental Specifications.....      | 8  |
| 2.4.1 Temperature Ranges .....             | 8  |
| 2.4.2 Humidity.....                        | 8  |
| 2.4.3 Shock and Vibration .....            | 9  |
| 2.5 CE and FCC Compatibility .....         | 9  |
| 2.6 RoHS Compliance.....                   | 9  |
| 2.7 Reliability .....                      | 9  |
| 2.8 Transfer Mode.....                     | 10 |
| 2.9 Pin Assignment .....                   | 10 |
| 2.10 Mechanical Dimensions and Weight..... | 12 |
| 3. SMART Feature Set.....                  | 13 |
| 4. Ordering Information .....              | 15 |
| 5. Part Number Rule .....                  | 15 |
| 6. Revision History .....                  | 15 |

# 1. Product Overview

## 1.1 Introduction

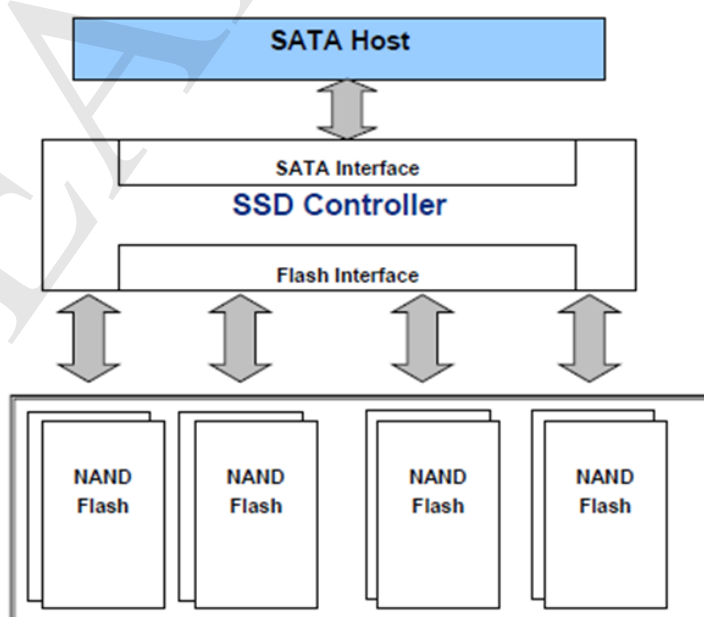
Team M.2 2280 DRAM-less SSD is a high-performance with the latest SATA III (6.0Gbps) SM2259XT2. Team's exclusive proprietary NANDXtend® error-correcting code (LDPC ECC) technology, provides comprehensive data protection and enhances the endurance and retention of TLC NAND, achieving longer durability for SSD. It is designed for industrial field, and supports several standard features, including TRIM, NCQ, and SMART. In addition, Team's exclusive industrial-oriented firmware provides a flexible customization service, making it perfect for a variety of industrial applications.

The SSD is using 3D NAND flash memory chip, which is durable, shockproof, and drop resistant and offers a total protection for the data. Even if you accidentally drop your computer or it landed on a hard surface, it can still prevent SSD damages and data corruption from accidents.

## 1.2 SATA Interface

Team M.2 SSD supports SATA III interface, and compliant with SATA Revision 3.1 and ATA-8 ACS-3 specifications, and supports device sleep mode to efficiently save power consumption.

## 1.3 Block Diagram



- **Wear-Leveling algorithm**

The controller supports static/dynamic wear leveling. When the host writes data, the controller will find and use the block with the lowest erase count among the free blocks. This is known as dynamic wear leveling. When the free blocks' erase count is higher than the data blocks', it will activate the static wear leveling, replacing the not-so-frequently-used user blocks with the high erase count free blocks.

- **LDPC ECC**

The LDPC ECC engine executes parity generation and error detection/correction features, and enhances decoding throughput and data reliability. With LDPC of correction capability  $1e-2$  RBER, the hard and soft decoding mechanism provides powerful error correction. Hence the Controller can enhance the endurance and retention of TLC NAND and extends the SSD lifespan.

- **Enhanced SMART function**

Team's SSDs support the innovative SMART command (Self-Monitoring, Analysis, and Reporting Technology) that allows the users to evaluate the health information of their SSD in an efficient way.

- **Bad-block management**

When the flash encounters ECC fail, program fail or erase fail, the controller will mark the block as a bad block to prevent using this block and cause data loss in the future.

## 2. Product Specification

### 2.1 Capacity and Device Parameters

Table 1: Device parameters

| Capacity | LBA           |
|----------|---------------|
| 128GB    | 250,069,680   |
| 256GB    | 500,118,192   |
| 512GB    | 1,000,215,216 |
| 1TB      | 2,000,409,264 |
| 2TB      | 4,000,797,360 |

### 2.2 Performance

Burst Transfer Rate: 6.0Gbps

Table 2: Sequential Read/Write Performance (Unit: MB/s, Max.)

| Capacity | Sequential Read | Sequential Write |
|----------|-----------------|------------------|
| 128GB    | 525             | 460              |
| 256GB    | 535             | 470              |
| 512GB    | 540             | 475              |
| 1TB      | 540             | 485              |
| 2TB      | 545             | 480              |

**Notes:**

1. Test Platform: ASUS Z390-F GAMING / Intel i7-9700K / Windows 10
2. Performance measured using CrystalDiskMark 6.0.2 x64 with file size 1000M of Seq. Q32T1.
3. Performance may differ according to flash configuration and platform.

Table 3: Random Read/Write Performance (Max.)

| Capacity | Random Read (IOPS) | Random Write (IOPS) |
|----------|--------------------|---------------------|
| 128GB    | 64K                | 34K                 |
| 256GB    | 70K                | 60K                 |
| 512GB    | 71K                | 63K                 |
| 1TB      | 73K                | 66K                 |
| 2TB      | 72K                | 64K                 |

**Notes:**

1. Test Platform: ASUS Z390-F GAMING / Intel i7-9700K / Windows 10
2. Performance measured using Iometer.
3. Performance may differ according to flash configuration and platform.

## 2.3 Electrical Specifications

### 2.3.1 Power Requirement

Table 4: Power Requirement

| Item          | Symbol   | Rating          | Unit |
|---------------|----------|-----------------|------|
| Input Voltage | $V_{IN}$ | +3.3V DC +/- 5% | V    |

## 2.3.2 Power Consumption

Table 5: Power Consumption (Unit: mA)

| Capacity | Read | Write | Idle |
|----------|------|-------|------|
| 128GB    | 220  | 215   | 65   |
| 256GB    | 235  | 235   | 65   |
| 512GB    | 225  | 240   | 65   |
| 1TB      | 215  | 205   | 65   |
| 2TB      | 230  | 245   | 65   |

**Notes:**

1. Test Platform: ASUS Z390-F GAMING / Intel i7-9700K / Windows 10
2. The average value of power consumption is achieved based on 100% conversion efficiency.
3. The measured power voltage is 3.3V
4. R/W is measured while testing 1000MB sequential R/W 5 times by CrystalDiskMark 6.0.2.

## 2.4 Environmental Specifications

### 2.4.1 Temperature Ranges

Table 6: Temperature range

| Temperature | Range          |
|-------------|----------------|
| Operating   | 0°C to +70°C   |
| Storage     | -55°C to +95°C |

### 2.4.2 Humidity

Relative Humidity: 95% under 40°C, non-condensing (Non-Operating).

## 2.4.3 Shock and Vibration

Table 7: Shock/Vibration Testing

| Reliability           | Test Conditions                 |
|-----------------------|---------------------------------|
| Vibration (Operating) | 20 G (peak-to-peak), 10 – 2K Hz |
| Shock (Operating)     | 1500 G, 0.5 ms, 3 axis          |

## 2.5 CE and FCC Compatibility

Conform to CE and FCC requirements.

## 2.6 RoHS Compliance

Fully compliant with RoHS directive.

## 2.7 Reliability

Table 8: Total Byte Written (Flash endurance 3,000 P/E cycles)

| Capacity | TBW* (Total Bytes Written)<br>Unit: TB |
|----------|----------------------------------------|
| 128GB    | 210                                    |
| 256GB    | 425                                    |
| 512GB    | 850                                    |
| 1TB      | 1700                                   |
| 2TB      | 3400                                   |

\*Tested under JESD218A endurance test method and JESD219A endurance workloads specification.

## 2.8 Transfer Mode

Team SSD support following transfer mode:

Serial ATA III 6.0Gbps

Serial ATA II 3.0Gbps

Serial ATA I 1.5Gbps

## 2.9 Pin Assignment

Table 9: Team M.2 SSD Pin Assignment

| Pin# | Name         | Description               | Pin# | Name         | Description                                                                                             |
|------|--------------|---------------------------|------|--------------|---------------------------------------------------------------------------------------------------------|
| 1    | GND          | Config_3=Ground           | 2    | 3.3V         | 3.3 Source                                                                                              |
| 3    | GND          | Ground                    | 4    | 3.3V         | 3.3 Source                                                                                              |
| 5    | N/C          | No connect                | 6    | N/C          | No connect                                                                                              |
| 7    | N/C          | No connect                | 8    | N/C          | No connect                                                                                              |
| 9    | N/C          | No connect                | 10   | DAS /DSS     | Device Activity Signal /<br>Disable Staggered Spinup                                                    |
| 11   | N/C          | No connect                | 12   | Module key B | Module key                                                                                              |
| 13   | Module key B | Module key                | 14   | Module key B |                                                                                                         |
| 15   | Module key B |                           | 16   | Module key B |                                                                                                         |
| 17   | Module key B |                           | 18   | Module key B |                                                                                                         |
| 19   | Module key B |                           | 20   | N/C          | No connect                                                                                              |
| 21   | GND          | Config_0=Ground           | 22   | N/C          | No connect                                                                                              |
| 23   | N/C          | No connect                | 24   | N/C          | No connect                                                                                              |
| 25   | N/C          | No connect                | 26   | N/C          | No connect                                                                                              |
| 27   | GND          | Ground                    | 28   | N/C          | No connect                                                                                              |
| 29   | N/C          | No connect                | 30   | N/C          | No connect                                                                                              |
| 31   | N/C          | No connect                | 32   | N/C          | No connect                                                                                              |
| 33   | GND          | Ground                    | 34   | N/C          | No connect                                                                                              |
| 35   | N/C          | No connect                | 36   | N/C          | No connect                                                                                              |
| 37   | N/C          | No connect                | 38   | CDI/DEVSLP   | Device Sleep, Input.<br>When driven high the host<br>is informing the SSD to<br>enter a low power state |
| 39   | GND          | Ground                    | 40   | N/C          | No connect                                                                                              |
| 41   | SATA-B+      | SATA differential signals | 42   | N/C          | No connect                                                                                              |

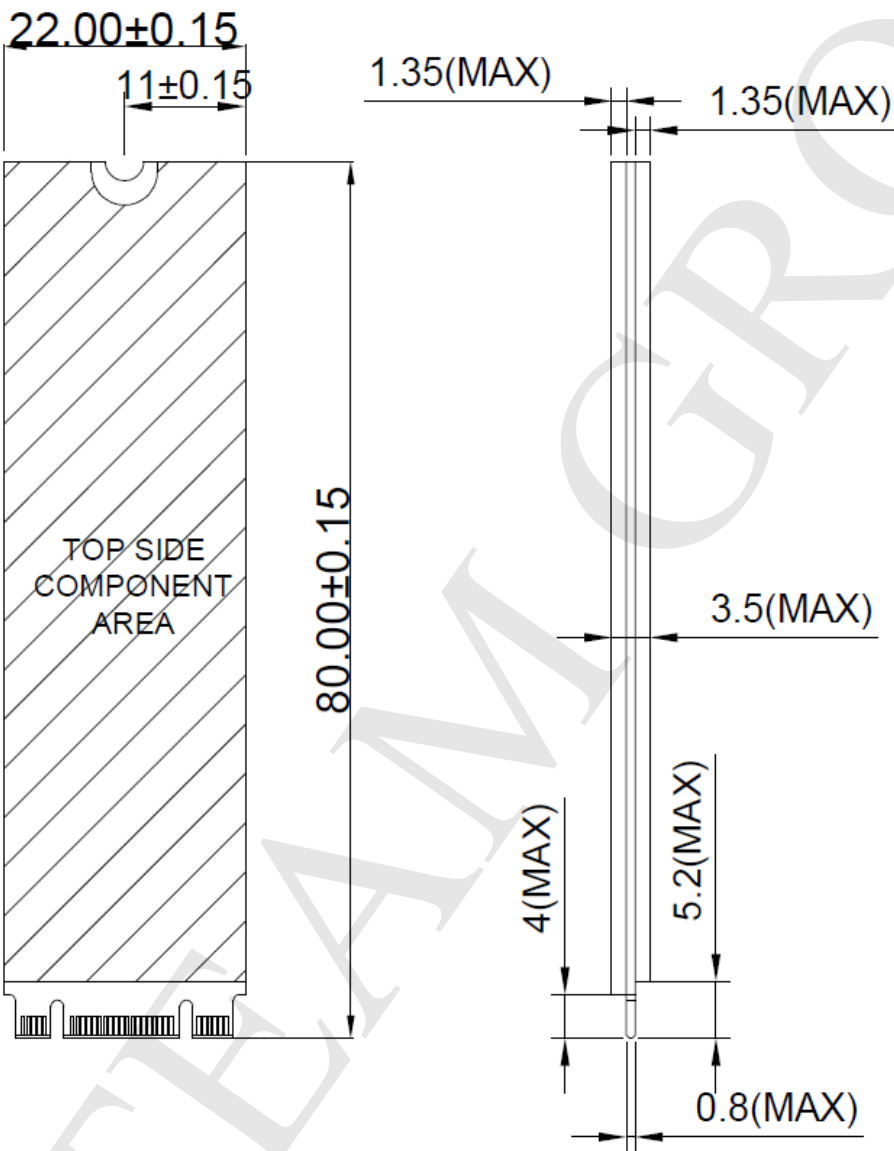
|    |              |                           |    |                    |                                                                                  |
|----|--------------|---------------------------|----|--------------------|----------------------------------------------------------------------------------|
| 43 | SATA-B-      | SATA differential signals | 44 | N/C                | No connect                                                                       |
| 45 | GND          | Ground                    | 46 | N/C                | No connect                                                                       |
| 47 | SATA-A-      | SATA differential signals | 48 | N/C                | No connect                                                                       |
| 49 | SATA-A+      | SATA differential signals | 50 | N/C                | No connect                                                                       |
| 51 | GND          | Ground                    | 52 | N/C                | No connect                                                                       |
| 53 | N/C          | No connect                | 54 | N/C                | No connect                                                                       |
| 55 | N/C          | No connect                | 56 | MFG1               | Reserved for SSD manufacturing only. Pins should be left N/C in platform Socket. |
| 57 | GND          | Ground                    | 58 | MFG2               | Reserved for SSD manufacturing only. Pins should be left N/C in platform Socket  |
| 59 | Module key M | Module key                | 60 | Module key M       | Module key                                                                       |
| 61 | Module key M |                           | 62 | Module key M       |                                                                                  |
| 63 | Module key M |                           | 64 | Module key M       |                                                                                  |
| 65 | Module key M |                           | 66 | Module key M       |                                                                                  |
| 67 | N/C          | No connect                | 68 | SUSCLK (I)(0/3.3V) | 32.768kHz clock supply input that is provided by the platform chipset            |
| 69 | GND          | Config_1=Ground           | 70 | 3.3V               | 3.3 Source                                                                       |
| 71 | GND          | Ground                    | 72 | 3.3V               | 3.3 Source                                                                       |
| 73 | GND          | Ground                    | 74 | 3.3V               | 3.3 Source                                                                       |
| 75 | GND          | Config_2=Ground           |    |                    |                                                                                  |

## 2.10 Mechanical Dimensions and Weight

Table 10: M.2 SSD Mechanical Dimensions and Weight

| Form Factor     | Height (mm) | Width (mm)       | Length (mm)      | Weight* (g) |
|-----------------|-------------|------------------|------------------|-------------|
| M.2 2280-D2-B-M | 3.5 (Max.)  | 22.00 (+/- 0.15) | 80.00 (+/- 0.15) | 8.6         |

\*Maximum capacity assembly approximate weight.



### 3. SMART Feature Set

Team SSD support the SMART command set and defines some vendor-specific data to report SMART attributes of SSD.

**Table 11: SMART command**

| Value | Command                    | Value | Reference Standards)     |
|-------|----------------------------|-------|--------------------------|
| D0h   | Read Data                  | D5h   | Read Log                 |
| D1h   | Read Attribute Threshold   | D6h   | Return Status            |
| D2h   | Enable/Disable Auto save   | D8h   | Enable SMART Operations  |
| D3h   | Save Attribute Values      | D9h   | Disable SMART Operations |
| D4h   | Execute OFF-LINE Immediate | DAh   | Return Status            |

**Table 12: SMART Attributes**

Team M.2 SSD series SMART data attributes are listed in following table.

| Attribute ID (hex) | Raw Attribute Value |     |    |     |    |    |    | Attribute Name                             |
|--------------------|---------------------|-----|----|-----|----|----|----|--------------------------------------------|
| 1 (01h)            | MSB                 | 00  | 00 | 00  | 00 | 00 | 00 | Raw Read Error Rate                        |
| 5 (05h)            | LSB                 | MSB | 00 | 00  | 00 | 00 | 00 | Reallocated Sector Count                   |
| 9 (09h)            | LSB                 |     |    | MSB | 00 | 00 | 00 | Power-on Hours                             |
| 12 (0Ch)           | LSB                 |     |    | MSB | 00 | 00 | 00 | Power Cycle Count                          |
| 160 (A0h)          | LSB                 |     |    | MSB | 00 | 00 | 00 | Uncorrectable sector count when read/write |
| 161 (A1h)          | LSB                 | MSB | 00 | 00  | 00 | 00 | 00 | Number of valid spare block                |
| 163 (A3h)          | LSB                 | MSB | 00 | 00  | 00 | 00 | 00 | Number of initial invalid block            |
| 164 (A4h)          | LSB                 | MSB | 00 | 00  | 00 | 00 | 00 | Total erase count                          |
| 165 (A5h)          | LSB                 |     |    | MSB | 00 | 00 | 00 | Maximum erase count                        |
| 166 (A6h)          | LSB                 |     |    | MSB | 00 | 00 | 00 | Minimum erase count                        |
| 167 (A7h)          | LSB                 |     |    | MSB | 00 | 00 | 00 | Average erase count                        |
| 168 (A8h)          | LSB                 |     |    | MSB | 00 | 00 | 00 | Max erase count of spec                    |
| 169 (A9h)          | LSB                 |     |    | MSB | 00 | 00 | 00 | Remain Life (percentage)                   |
| 175 (AFh)          | LSB                 |     |    | MSB | 00 | 00 | 00 | Program fail count in worst die            |
| 176 (B0h)          | LSB                 |     |    | MSB | 00 | 00 | 00 | Erase fail count in worst die              |
| 177 (B1h)          | LSB                 |     |    | MSB | 00 | 00 | 00 | Total wear level count                     |

|           |     |     |    |     |    |    |     |                                                |
|-----------|-----|-----|----|-----|----|----|-----|------------------------------------------------|
| 178 (B2h) | LSB | MSB | 00 | 00  | 00 | 00 | 00  | Runtime invalid block count                    |
| 181 (B5h) | LSB |     |    | MSB | 00 | 00 | 00  | Total program fail count                       |
| 182 (B6h) | LSB | MSB | 00 | 00  | 00 | 00 | 00  | Total erase fail count                         |
| 187 (BBh) | LSB |     |    | MSB | 00 | 00 | 00  | Uncorrectable error count                      |
| 192 (C0h) | LSB | MSB | 00 | 00  | 00 | 00 | 00  | Power-Off Retract Count                        |
| 194 (C2h) | MSB | 00  | 00 | 00  | 00 | 00 | 00  | Controlled temperature                         |
| 195 (C3h) | LSB |     |    | MSB | 00 | 00 | 00  | Hardware ECC recovered                         |
| 196 (C4h) | LSB |     |    | MSB | 00 | 00 | 00  | Reallocation event count                       |
| 198 (C6h) | LSB |     |    | MSB | 00 | 00 | 00  | Uncorrectable error count<br>off-line          |
| 199 (C7h) | LSB | MSB | 00 | 00  | 00 | 00 | 00  | UltraDMA CRC error count                       |
| 225 (E1h) | LSB |     |    |     |    |    | MSB | Total LBAs written<br>(each write unit = 32MB) |
| 232 (E8h) | LSB | MSB | 00 | 00  | 00 | 00 | 00  | Available reserved space                       |
| 241 (F1h) | LSB |     |    |     |    |    | MSB | Total LBAs written<br>(each write unit = 32MB) |
| 242 (F2h) | LSB |     |    |     |    |    | MSB | Total LBAs read<br>(each write unit = 32MB)    |

## 4. Ordering Information

| Capacity | Part Number    |
|----------|----------------|
| 128GB    | TE128GS745KM80 |
| 256GB    | TE256GS745KM80 |
| 512GB    | TE512GS745KM80 |
| 1TB      | TE1TS745KM80   |
| 2TB      | TE2TS745KM80   |

## 5. Part Number Rule

The part number rule is as below:

|    |      |      |   |     |
|----|------|------|---|-----|
| 1  | 2    | 3    | 4 | 5   |
| TE | XXXG | S745 | K | M80 |

1. **TE:** Team Group Embedded

4. **Flash Brand:**

- **K:** SanDisk

2. **Capacity:**

- **128G:** 128GB
- **256G:** 256GB
- **512G:** 512GB
- **1T:** 1TB
- **2T:** 2TB

5. **Model Type:**

- **M80:** M.2 2280

3. **Model Name:**

- **S745 Series**

# Revision History

| Version | Date       | Modification Content                             |
|---------|------------|--------------------------------------------------|
| 1.0     | 2022/04/25 | Initial Release                                  |
| 1.1     | 2023/11/30 | Remove Data Security & Feature Enhanced Security |
|         |            |                                                  |

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