

Amtron Technology, Inc.

Industrial Grade M.2 2280 SATA SSD

AC Series

Product Datasheet

V1.7

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1. INTRODUCTION



1.1. Description

Amtron industrial AC series M.2 2280 PCIe SSD is designed with the Serial ATA I/II/III interface and is fully compliant with the standard *Next Generation Form Factor* (NGFF). The M.2 2280 SATA Drive is designed to operate at a maximum operating frequency of 400MHz with 25MHz external crystal and can reach up to 550MB/s read and 530MB/s write high performance based on Kioxia 3D TLC NAND flash. These M.2 SATA modules are offered in standard temperature grade (0°C to +70°C) and wide temperature grade (-40°C to +85°C). The memory capacities are available from 120GB to 1920GB.

1.2. Product Features

- M.2 2280-D2-B-M form factor
- SATA 3.1
- RoHS compliant [Lead free]
- 3D Triple Level Cell (TLC) NAND Flash
- Capacity from 120GB up to 1920GB
- High speed:
Read 550 MB/s max., Write 530 MB/s max.
- Endure severe thermal and dynamic environments
- Very low power consumption
- MTBF > 2,000,000 hours *
- Support SMART command
- Controlled Bill of Materials (BOM)

***Note:** Lower MTBF is expected for higher capacity drives. To be conservative, the lowest MTBF is reported in this document

1.3. Product Overview

- **Form Factor**
 - M.2 2280-M
- **SATA Interface**
 - SATA Revision 3.1
 - SATA 1.5Gbps, 3Gbps, and 6Gbps
- **Capacity**
 - 120GB up to 1920GB
- **Flash Interface**
 - Flash Type: 3D TLC BGA
 - Up to 4 pcs of BGA132/152 flash
 - Up to 2pcs of BGA272 flash ⁴
- **Performance**
 - Read up to 550 MB/s
 - Write up to 530 MB/s
- **Reliability**
 - MTBF ¹ > 2,000,000 hours
 - Uncorrectable Bit Error Rate (UBER) < 1 sector per 10¹⁶ bits read
- **Power Consumption** ²
 - Active mode: < 3,000 mW
 - Idle mode: < 1,200 mW
- **ECC**
 - LDPC / RAID ECC
 - Low density parity check code (>120bit/Kbytes)
- **Compliant**
 - RoHS
- **Advanced Flash Management**
 - Advanced Wear Leveling
 - Bad Block Management
 - TRIM
 - SMART
 - Over-Provision
- **Temperature Range** ³
 - Operation (standard): 0°C to 70°C
 - Operation (wide): -40°C to 85° C
 - Storage: -40°C to 85°C
- **Features Support List**
 - AES/TCG OPAL ⁴ (optional)
 - Thermal throttling
 - End to end data path protection
 - Quick Erase
 - Power Loss Protection (optional) ⁵
- **Safety Certification**
 - ISO 9001
 - ISO 14001
 - ISO 45001
 - ISO 27001
- **EMI Compliant**
 - EN55032, CISPR 32 (CE)
 - AS/NZS CISPR 32 (CE)
 - ANSI C63.4 (FCC)
 - CNS 13438 (BSMI)
 - VCCI-CISPR 32 (VCCI)

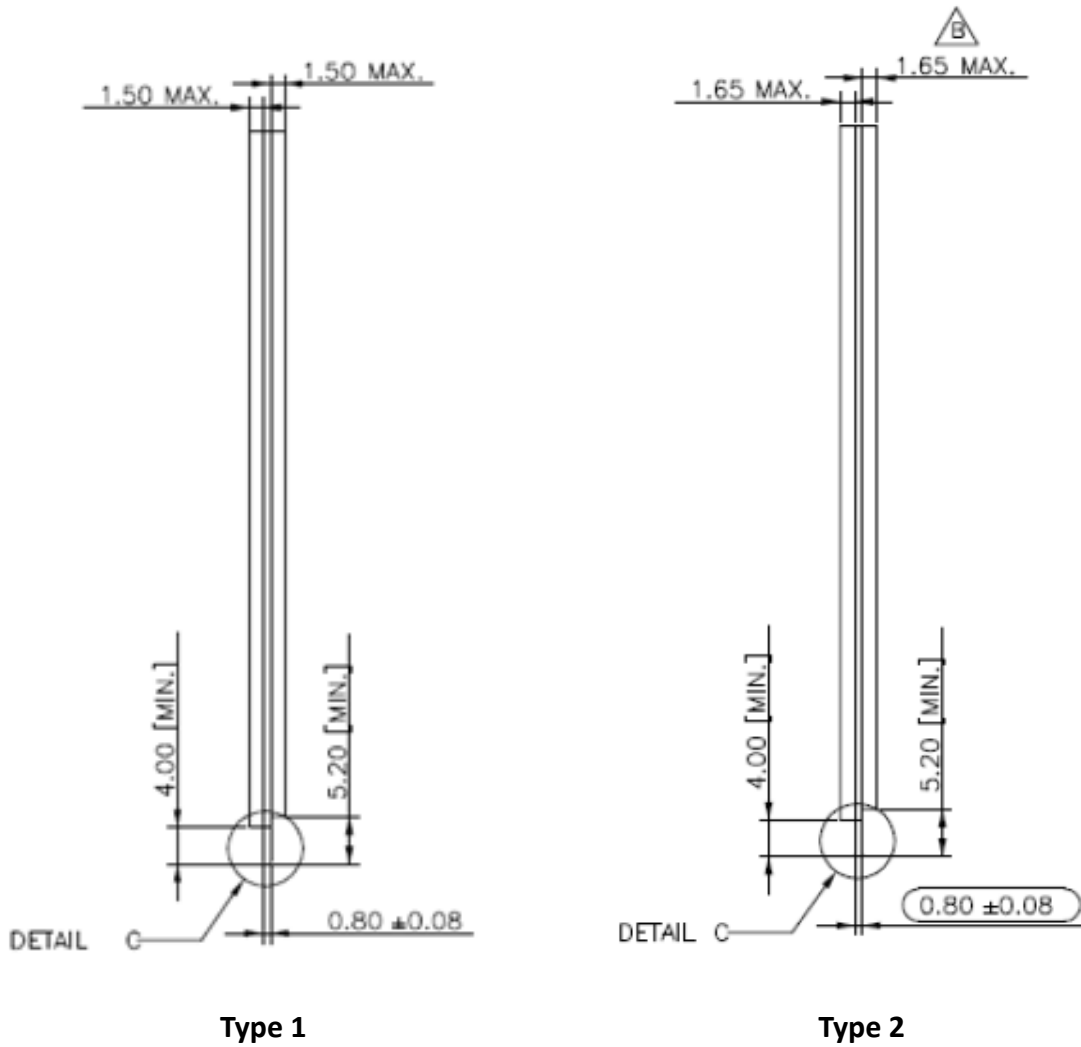
Note:

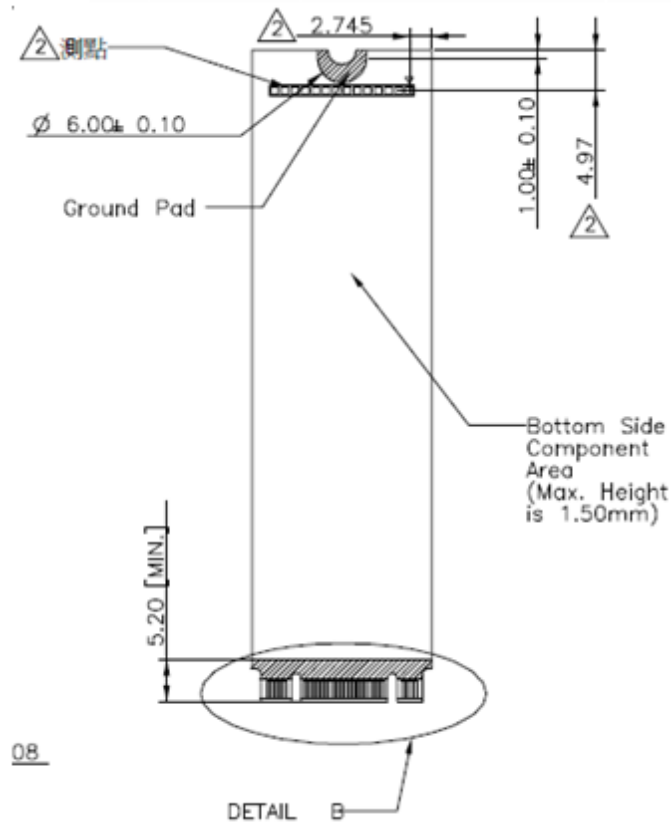
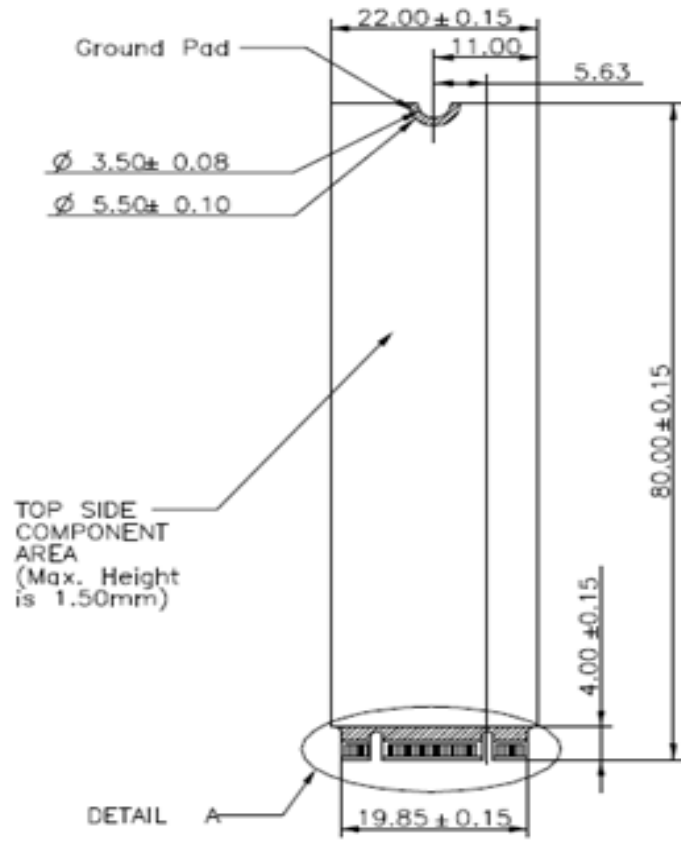
1. **MTBF** (mean time between failures) is a measure of how reliable a hardware product is.
2. See Section 4.2 “Power Consumption” for details.
3. The operation temperature means the case temperature, in which can be detected via the SMART.
4. OPAL + AES is supported by separate firmware version. Further information available upon request.
5. Power Loss Protection PCBA and only support 120GB to 960GB.

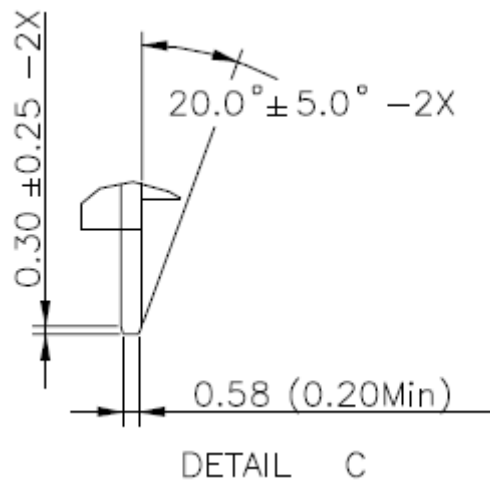
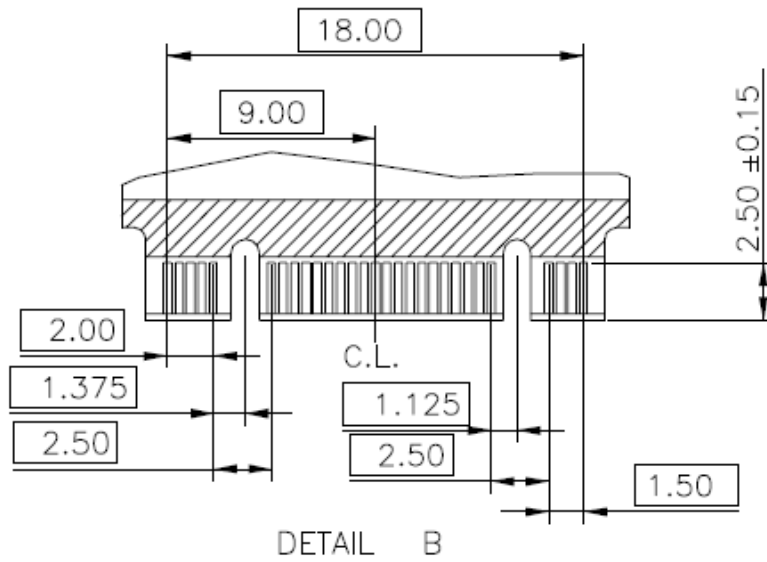
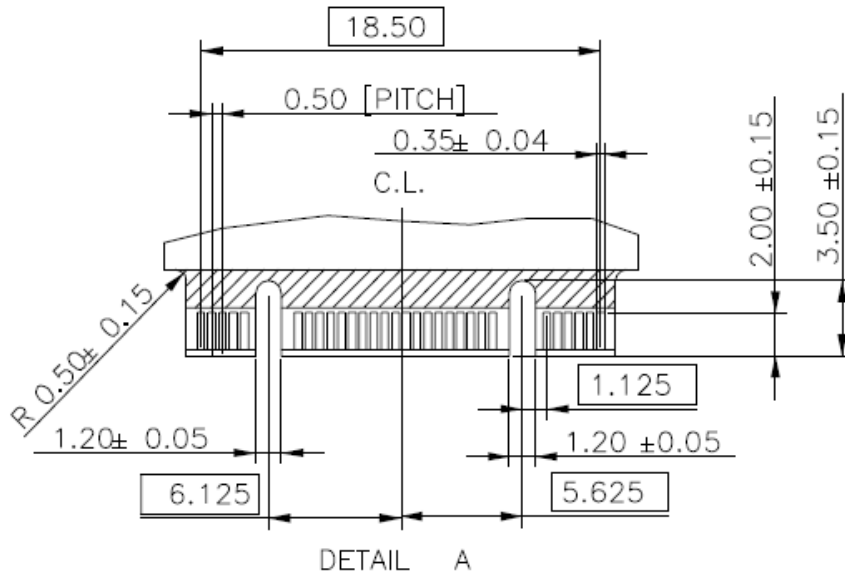
1.4. Product Dimension

Type1. Dimension (double side): 80mm(L) x 22mm(W) x 3.8mm(H)

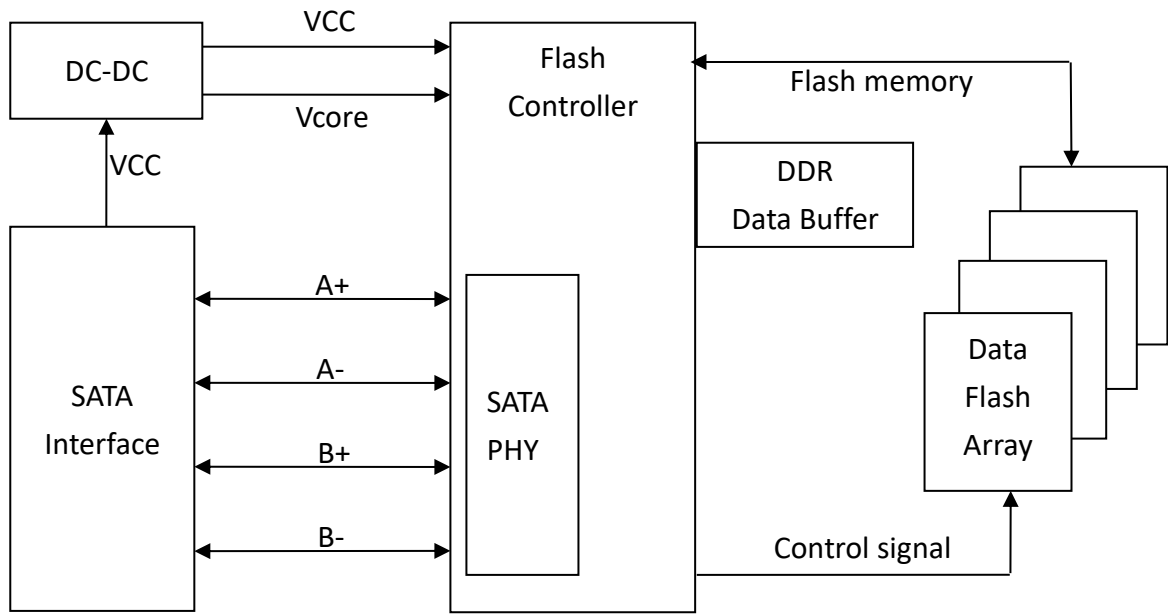
Type2. Dimension (double side): 80mm(L) x 22mm(W) x 4.1mm(H) for PLP PCBA







1.5. Block Diagram



M.2 2280 PCIe SSD Block Diagram

2. PRODUCT SPECIFICATIONS



2.1. Specifications

- **Capacity**
 - 120GB up to 1920GB
- **Electrical/Physical Interface**
 - SATA Interface
 - Compliant with SATA Revision 3.1
 - Compatible with SATA 1.5Gbps, 3Gbps and 6Gbps interface
 - Not Support LPM for Industrial grade product.
 - Support expanded register for SATA protocol 48 bits addressing mode
- **Support Hardware Quick Erase function (Optional)**
- **Support Hardware Power Loss Protection (Optional)**
 - Protect data loss, even the last data, during write process when power sudden off.
 - Add-on Polymer Tantalum Capacitors hold-up several milliseconds to keep DRAM data write to NAND Flash.

2.2. Device Capacity

| Capacity | IDEMA Standard | | User Data Size |
|----------|---------------------|---------------------|-----------------------------|
| | 512Bytes/Sector | 4KBytes/Sector | |
| | Total Sectors (LBA) | Total Sectors (LBA) | |
| 120GB | 234,441,648 | 29,305,206 | Depended on file management |
| 240GB | 468,862,128 | 58,607,766 | |
| 480GB | 937,703,088 | 117,212,886 | |
| 960GB | 1,875,385,008 | 234,423,126 | |
| 1920GB | 3,750,748,848 | 468,843,606 | |

Notes:

1. 1 Gigabyte (GB) is equal to 1,000,000,000 Bytes; 1 sector is equal to 512 Bytes.
2. The calculation is following IDEMA Standard.
3. The total actual user data size of the SSD may be less than device capacity due to SSD format, SSD partition, operating system.

EX: OS shows 223.57GB (NTFS) with 240GB SSD.

2.3. Performance

■ Bics3 Sequential Read/Write Performance

| Capacity | Flash Structure | Flash Type | Sequential (MB/s) | |
|----------|-----------------|--------------------------------|-------------------|-------|
| | | | Read | Write |
| 120GB | 128GB x 1 | Bics3, BGA272 ^{Note5} | 550 | 170 |
| 240GB | 64GB x 4 | Bics3, BGA152 | 550 | 320 |
| | 128GB x 2 | Bics3, BGA272 ^{Note5} | 550 | 340 |
| 480GB | 128GB x 4 | Bics3, BGA152 | 550 | 500 |
| | 256GB x 2 | Bics3, BGA272 ^{Note5} | 550 | 500 |
| 960GB | 256GB x 4 | Bics3, BGA152 | 550 | 520 |
| | 512GB x 2 | Bics3, BGA272 ^{Note5} | 550 | 500 |
| 1920GB | 512GB x 4 | Bics3, BGA152 | 550 | 520 |

■ Bics4 Sequential Read/Write Performance

| Capacity | Flash Structure | Flash Type | Sequential (MB/s) | |
|----------|-----------------|-----------------|-------------------|-------|
| | | | Read | Write |
| 240GB | 64GB x 4 | BGA, Bics4, DDP | 550 | 370 |
| 480GB | 128GB x 4 | BGA, Bics4, QDP | 550 | 500 |
| 960GB | 256GB x 4 | BGA, Bics4, QDP | 550 | 530 |
| 1920GB | 512GB x 4 | BGA, Bics4, ODP | 550 | 530 |

■ Bics5 Sequential Read/Write Performance

| Capacity | Flash Structure | Flash Type | Sequential (MB/s) | |
|----------|-----------------|-----------------|-------------------|-------|
| | | | Read | Write |
| 240GB | 128GB x 2 | BGA, Bics5, DDP | 550 | 150 |
| 480GB | 128GB x 4 | BGA, Bics5, DDP | 550 | 340 |
| 960GB | 256GB x 4 | BGA, Bics5, QDP | 550 | 530 |
| 1920GB | 512GB x 4 | BGA, Bics5, ODP | 550 | 530 |

Notes:

1. The performance was measured CrystalDiskMark5.0x64 with SATA 6Gbps host and test data size is 1GB
2. The performance was estimated based on Kioxia BiCS TLC NAND flash.
3. Performance may differ according to flash configuration and platform.
4. Performance specification is under that Thermal Throttling has not worked yet.
5. For Power Loss Protection (PLP) function.

■ **Bics3 Random Read/Write Performance**

| Capacity | Flash Structure | Flash Type | 4KB Random (IOPS) | |
|----------|-----------------|-----------------|-------------------|--------|
| | | | Read | Write |
| 120GB | 64GB x 2 | Bics3, BGA, DDP | 50,000 | 45,000 |
| 240GB | 64GB x 4 | Bics3, BGA, DDP | 98,000 | 70,000 |
| 480GB | 128GB x 4 | Bics3, BGA, QDP | 98,000 | 82,000 |
| 960GB | 256GB x 4 | Bics3, BGA, ODP | 98,000 | 82,000 |
| 1920GB | 512GB x 4 | Bics3, BGA, ODP | 98,000 | 88,000 |

■ **Bics4 Random Read/Write Performance**

| Capacity | Flash Structure | Flash Type | 4KB Random (IOPS) | |
|----------|-----------------|-----------------|-------------------|--------|
| | | | Read | Write |
| 240GB | 64GB x 4 | BGA, Bics4, DDP | 91,000 | 84,000 |
| 480GB | 128GB x 4 | BGA, Bics4, QDP | 98,000 | 85,000 |
| 960GB | 256GB x 4 | BGA, Bics4, QDP | 98,000 | 89,000 |
| 1920GB | 512GB x 4 | BGA, Bics4, ODP | 98,000 | 89,000 |

■ **Bics5 Random Read/Write Performance**

| Capacity | Flash Structure | Flash Type | 4KB Random (IOPS) | |
|----------|-----------------|-----------------|-------------------|--------|
| | | | Read | Write |
| 240GB | 128GB x 2 | BGA, Bics5, DDP | 47,000 | 38,000 |
| 480GB | 128GB x 4 | BGA, Bics5, DDP | 92,000 | 85,000 |
| 960GB | 256GB x 4 | BGA, Bics5, QDP | 98,000 | 88,000 |
| 1920GB | 512GB x 4 | BGA, Bics5, ODP | 98,000 | 88,000 |

Notes:

1. The performance was measured IOmeter v1.1.0 with QD32 for 4KB random read/write test. (Total test file is 8GB)
2. The performance was estimated based on Kioxia BiCS TLC NAND flash.
3. Performance may differ according to flash configuration and platform.
4. Performance specification is under that Thermal Throttling has not worked yet.

2.4. POR/SPOR Standby Ready Time

- **Bics3 POR/SPOR Ready Time**

| Capacity | POR ready time | | SPOR ready time | |
|----------|----------------|------|-----------------|--------|
| | Typ. | Max. | Typ. | Max. |
| 240GB | 240 | 300 | 3,200 | 8,400 |
| 480GB | 260 | 300 | 3,900 | 8,400 |
| 960GB | 260 | 400 | 5,100 | 8,400 |
| 1920GB | 300 | 400 | 6,100 | 13,000 |

Unit: ms

- **Bics3 POR/SPOR Ready Time (Power Loss Protection enable)**

| Capacity | POR ready time | | SPOR ready time | |
|----------|----------------|-------|-----------------|-------|
| | Typ. | Max. | Typ. | Max. |
| 120GB | 2,500 | 3,500 | 4,500 | 6,400 |
| 240GB | 2,500 | 3,500 | 4,500 | 6,400 |
| 480GB | 2,500 | 3,500 | 4,500 | 6,400 |
| 960GB | 2,500 | 3,500 | 4,500 | 6,400 |

Unit: ms

- **Bics4 POR/SPOR Ready Time**

| Capacity | POR ready time | | SPOR ready time | |
|----------|----------------|------|-----------------|--------|
| | Typ. | Max. | Typ. | Max. |
| 240GB | 240 | 260 | 1,780 | 2,640 |
| 480GB | 260 | 290 | 2,250 | 5,380 |
| 960GB | 240 | 290 | 2,060 | 4,120 |
| 1920GB | 260 | 280 | 5,310 | 11,060 |

Unit: ms

- **Bics5 POR/SPOR Ready Time**

| Capacity | POR ready time | | SPOR ready time | |
|----------|----------------|------|-----------------|-------|
| | Typ. | Max. | Typ. | Max. |
| 240GB | 300 | 310 | 1,700 | 2,700 |
| 480GB | 300 | 310 | 2,000 | 3,000 |
| 960GB | 300 | 310 | 2,500 | 4,000 |
| 1920GB | 350 | 400 | 4,600 | 8,600 |

Unit: ms

Notes:

1. POR/SPOR stands for following:

(a.) POR: Power On Ready. (The ready time variation depends on data recover size.)

(b.) SPOR: Power On Ready after Sudden Power Off. (The ready time variation depends on data recover size.)

2. POR/SPOR ready time stands for following:

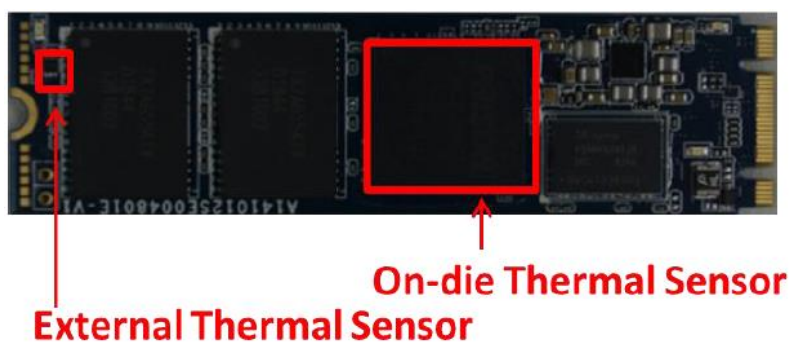
Power on Time: From Power On to SSD response after drive ready.

3. All the POR/SPOR data are testing by internal Pattern System. These data will be affected by different platforms and conditions.

2.5. Thermal Throttling

The purpose of thermal throttling is to prevent any components in a SSD from over-heating during read and write operations. The controller is designed with an on-die thermal sensor and with its accuracy, firmware can apply different levels of throttling to achieve the purpose of protection efficiently and proactively via S.M.A.R.T. reading.

- **SSD Configuration:**
 - Example 480GB SSD: (BiCS3 512Gb x 2CE) x 4pcs BGA132/152, total 8CE
 - CE = Chip Enable pins, max CE = All 8CE enabled. Total CE numbers depends on SSD configuration
- **Purpose of Thermal Throttling:**
 - In order to keep the optimal performance in the safe range of the temperature.
- **Thermal sensors:**
 - We have external thermal sensor & on-die thermal sensor (internal controller) to detect temperature. There is 1pcs external thermal sensor on PCB, the position depends on different form factor (The thermal sensor is shown below. The picture is for reference only).
 - External thermal sensor would detect flash temperature; On-die thermal sensor detect controller temperature.



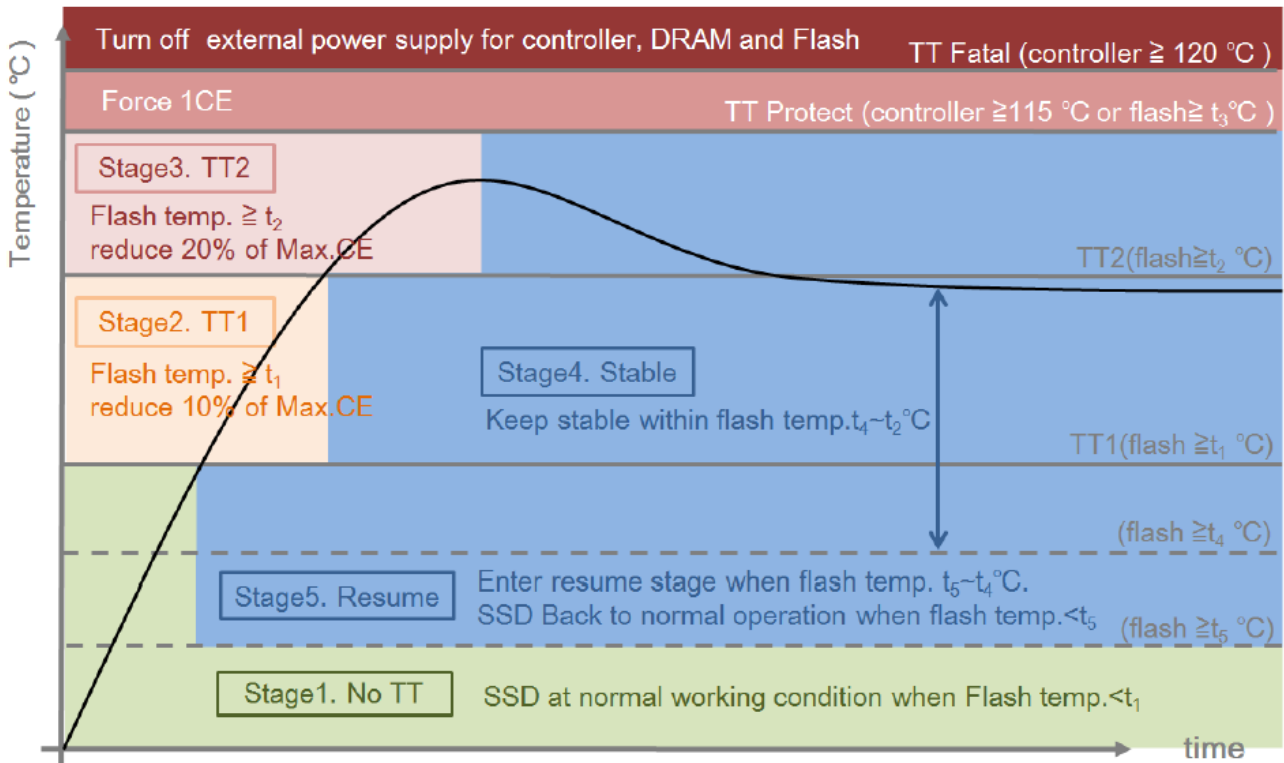


Figure 2-1 Thermal Throttling Schematic

| | Operation temp. of Normal-temp. grade: 0-70°C | Operation temp. of Wide-temp. grade: -40-85°C |
|----------------------|---|---|
| t₁ | 68°C | 82°C |
| t₂ | 70°C | 85°C |
| t₃ | 80°C | 95°C |
| t₄ | 64°C | 78°C |
| t₅ | 60°C | 74°C |

Notes:

1. TT shown on Figure 2-1 means "Thermal Throttling".
2. CE = Chip Enable.
3. temp. = temperature

2.6. TCG Opal 2.0 (Optional)

The Opal specification is a set of specifications for self-encrypting drives published by the Trusted Computing Group (TCG), a non-profit organization that develops, defines, and promotes standards and specifications for secure computing. The Opal Security Subsystem Class (SSC) 2.0 defines the details of data management in storage devices and the classes authority for data access, and secures data from theft and tampering by unauthorized persons who are able to gain access to the storage device or host system.

TCG Opal 2.0 Main Features:

- AES 256-bit Hardware Self Encryption

- Deploy Storage Device & Take Ownership:

The Storage Device is integrated into its target system and ownership transferred by setting or changing the Storage Device's owner credential.

- Activate or Enroll Storage Device:

LBA ranges are configured and data encryption and access control credentials (re)generated and/or set on the Storage Device. Access control is configured for LBA range unlocking.

- Lock & Unlock Storage Device:

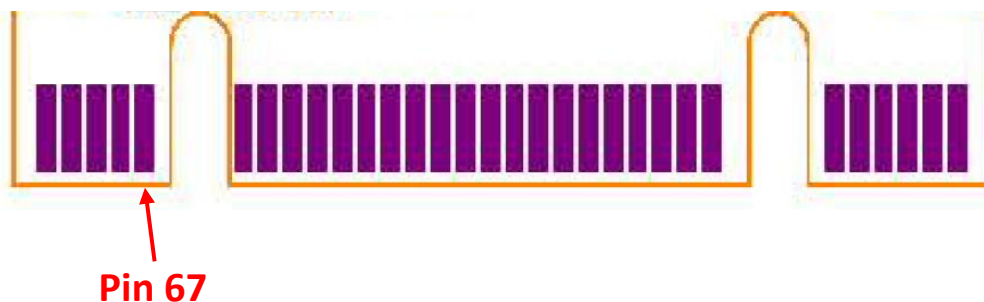
Unlocking of one or more LBA ranges by the host and locking of those ranges under host control via either an explicit lock or implicit lock triggered by a reset event. MBR shadowing provides a mechanism to boot into a secure pre-boot authentication environment to handle device unlocking.

- Repurpose & End-of-Life:

Erasement of data within one or more.

2.7. Quick Erase Function (Optional)

The Quick Erase is a special feature to allow users to erase user data which used on finger pin67. When this feature is triggered (**Low Trigger**), the SSD controller will write all “0x00” to wipe all the data except firmware area, and the SSD will return to its factory default setting. This feature is particularly useful for emergent circumstances to quickly erase user data.



2.8. TWB (Terabytes Written)

| Capacity | Flash Type | TBW |
|----------|------------|------|
| 120GB | Bics3 | 188 |
| 240GB | Bics3 | 378 |
| 480GB | Bics3 | 794 |
| 960GB | Bics3 | 1580 |
| 1920GB | Bics3 | 3118 |
| 240GB | Bics4 | 355 |
| 480GB | Bics4 | 825 |
| 960GB | Bics4 | 1697 |
| 1920GB | Bics4 | 3413 |
| 240GB | Bics5 | 285 |
| 480GB | Bics5 | 700 |
| 960GB | Bics5 | 1600 |
| 1920GB | Bics5 | 3260 |

Notes:

1. TBW is measured by JEDEC Client 219A workload and calculated with PE count = 3000.
2. TBW may differ according to flash configuration and platform.
3. The SSD supports trim function. If Operation System does not support trim command, performance and TBW will be affected. (Like certain Windows OS, Linux kernel version before 2.6.33, other OS please

reference each own user manual)

4. The endurance of SSD could be estimated based on user behavior, NAND endurance cycles, and write amplification factor.

2.9. UBER

| Capacity | UBER |
|----------------|---|
| 120GB ~ 1920GB | < 1 sector per 10 ¹⁶ bits read |

Notes:

1. UBER (Uncorrectable Bit Error Rates) means the uncorrectable error per bits read.
2. UBER = FER (fail rate) / Data Size (user data bit).
3. FER = uncorrectable ECC frame number / total ECC frame number.
4. The LDPC for Kioxia BiCS TLC ECC capability > 120bit/KB.

2.10. MTBF

MTBF (mean time between failures) is a measure of how reliable a hardware product is. Its value represents the average time between a failure repair and the next failure. The unit of MTBF is typically in hours. The higher the MTBF value, the higher the reliability of the product. Please note that a lower MTBF is expected for higher capacity drives. To be conservative, the lowest MTBF is reported in this document. The MTBF calculated in this document is based on a software tool, Relx 7.3 . The predicted MTBF for Amtron AC series M.2 SATA SSD is >2,000,000 hours

3. ENVIRONMENTAL SPECIFICATIONS



3.1. Environmental Conditions

3.1.1. Temperature and Humidity

| | Mode | Min. | Max. | Unit |
|------------------------|----------------------|------|------|------|
| Temperature Ranges | Operation (Standard) | 0 | 70 | °C |
| | Operation (Wide) | -40 | 85 | °C |
| | Storage | -40 | 85 | °C |
| Humidity | Operation | 5 | 95 | % |
| | Storage | 5 | 95 | % |
| Temperature Cycle Test | Operation (Standard) | 0 | 70 | °C |
| | Operation (Wide) | -40 | 85 | °C |
| | Storage | -40 | 85 | °C |

Notes:

1. The operation temperature means the case temperature, in which can be detected via the S.M.A.R.T. Airflow is suggested and it will allow device to be operated at appropriate temperature for each component during heavy workloads environment.

3.1.2. Shock

■ Shock Specification

| | Acceleration Force |
|-----------------|--------------------|
| Non-Operational | 1500G |
| Operational | 1500G |

3.1.3. Vibration

■ Vibration Specification

| | Condition | |
|-----------------|------------------------|------------------------|
| | Frequency/Displacement | Frequency/Acceleration |
| Non-Operational | 20Hz~80Hz/1.52mm | 80Hz~2000Hz/20G |

3.1.4. Drop

■ Drop Specification

| | Height of Drop | Number of Drop |
|-----------------|----------------|---------------------|
| Non-operational | 80cm free fall | 6 face of each unit |

3.1.5. Bending

■ Bending Specification

| | Force | Action |
|-----------------|-------|------------------|
| Non-operational | ≥ 20N | Hold 1min/5times |

3.1.6. Electrostatic Discharge (ESD)

| Specification | +/- 4KV |
|--|---|
| EN 55024, CISPR 24 EN 61000-4-2 and IEC 61000-4-2 | Device functions are affected, but EUT will be back to its normal or operational state automatically. |

3.1.7. EMI Compliance

| Specification |
|---|
| EN 55032, CISPR 32 (CE) AS/NZS CISPR 32 (CE) ANSI C63.4 (FCC) VCCI-CISPR 32 (VCCI) CNS 13438 (BSMI) UL |

3.2. Certification & Compliance

- RoHS

4. ELECTRICAL SPECIFICATIONS



4.1. Supply Voltage

| Parameter | Rating |
|---------------------|---------------|
| Operating Voltage | 3.3V ± 5% |
| Rise Time (Max/Min) | 100ms / 0.1ms |
| Fall Time (Max/Min) | 5s / 10ms |
| Min. off Time | 1s |

Notes:

1. Minimum time between power removed from SSD ($V_{cc} < 100$ mV) and power re-applied to the drive.
2. Ensure the voltage of each power domain in SSD has enough time to discharge less than 0.1V.
3. Rise Time during from 10% to 90% of 3.3V.
4. Fall Time during from 90% to 10% of 3.3V.

4.1. Power Consumption

| Capacity | Flash Structure | Flash Type | Read | Write | Idle |
|----------|-----------------|--------------------------------|------|-------|------|
| 120GB | 128GB x 1 | Bics3, BGA272 ^{Note6} | 2000 | 2000 | 800 |
| 240GB | 64GB x 4 | Bics3, BGA152 | 1400 | 1500 | 800 |
| | 128GB x 2 | Bics3, BGA272 ^{Note6} | 2000 | 2000 | 1000 |
| 480GB | 128GB x 4 | Bics3, BGA152 | 1500 | 1800 | 800 |
| | 256GB x 2 | Bics3, BGA272 ^{Note6} | 2000 | 2200 | 1000 |
| 960GB | 256GB x 4 | Bics3, BGA152 | 1500 | 2000 | 900 |
| | 512GB x 2 | Bics3, BGA272 ^{Note6} | 2000 | 2200 | 1000 |
| 1920GB | 512GB x 4 | Bics3, BGA152 | 1600 | 2100 | 900 |
| 240GB | 64GB x 4 | BGA, Bics4, DDP | 1850 | 2200 | 1100 |
| 480GB | 128GB x 4 | BGA, Bics4, QDP | 1850 | 2400 | 1100 |
| 960GB | 256GB x 4 | BGA, Bics4, QDP | 2100 | 2800 | 1200 |
| 1920GB | 512GB x 4 | BGA, Bics4, ODP | 2100 | 2800 | 1200 |
| 240GB | 128GB x 2 | BGA, Bics5, DDP | 1900 | 2000 | 1200 |
| 480GB | 128GB x 4 | BGA, Bics5, DDP | 1900 | 2500 | 1200 |
| 960GB | 256GB x 4 | BGA, Bics5, QDP | 1900 | 2800 | 1200 |
| 1920GB | 512GB x 4 | BGA, Bics5, ODP | 2000 | 3000 | 1200 |

Unit: mW

Notes:

1. The average value of power consumption is achieved based on 100% conversion efficiency.
2. The measured power voltage is 3.3V.
3. Samples were built using Kioxia BiCS TLC NAND flash and measured under normal temperature.
4. Sequential R/W is measured while testing 1GB sequential R/W 5 times by CrystalDiskMark.
5. Power Consumption may differ according to flash configuration and platform.
6. For Power Loss Protection (PLP) function.

5. INTERFACE



5.1. Pin Assignment and Descriptions

The follow table defines the signal assignment of the internal NGFF connector for SSD usage

| Pin # | SATA Pin | Description |
|-------|----------------------------|---|
| 1 | CONFIG_3 = GND | Ground |
| 2 | 3.3V | Supply pin |
| 3 | GND | Ground |
| 4 | 3.3V | Supply pin |
| 5 | N/C | No Connect |
| 6 | N/C | No Connect |
| 7 | N/C | No Connect |
| 8 | N/C | No Connect |
| 9 | N/C or GND ^{Note} | No Connect or Ground |
| 10 | DAS/DSS# (O) (OD) | Status indicators via LED devices that will be provided by the system Active Low. A pulled-up LED with series current limiting resistor should allow for 9mA when On. |
| 11 | N/C | No Connect |
| 12 | Module Key | |
| 13 | Module Key | |
| 14 | Module Key | |
| 15 | Module Key | |
| 16 | Module Key | |
| 17 | Module Key | |
| 18 | Module Key | |
| 19 | Module Key | |
| 20 | N/C | No Connect |
| 21 | CONFIG_0 = GND | 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 |
| Pin # | SATA Pin | Description |

| | | |
|--------------|------------------------|---|
| 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 | DEVSLP (I) (0/3.3V) | Device Sleep, Input. When driven high the host is informing the SSD to enter a low power state |
| 39 | GND | Ground |
| 40 | N/C | No Connect |
| 41 | SATA-B+ | SATA differential signals in the SATA specification |
| 42 | N/C | No Connect |
| 43 | SATA-B- | SATA differential signals in the SATA specification |
| 44 | N/C | No Connect |
| 45 | GND | Ground |
| 46 | N/C | No Connect |
| 47 | SATA-A- | SATA differential signals in the SATA specification |
| 48 | N/C | No Connect |
| 49 | SATA-A+ | SATA differential signals in the SATA specification |
| 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 | Reserved for MFG Data | Manufacturing Data line. Used for SSD manufacturing only. Not used in normal operation. Pins should be left N/C in platform Socket. |
| 57 | GND | Ground |
| 58 | Reserved for MFG Clock | Manufacturing Clock line. Used for SSD manufacturing only. Not used in normal operation. Pins should be left N/C in platform Socket |
| Pin # | SATA Pin | Description |
| 59 | Module Key | |

| | | |
|----|---------------------|--|
| 60 | Module Key | |
| 61 | Module Key | |
| 62 | Module Key | |
| 63 | Module Key | |
| 64 | Module Key | |
| 65 | Module Key | |
| 66 | Module Key | |
| 67 | N/C | No Connect Reserved for Quick Erase function (Low Active) |
| 68 | SUSCLK (I) (0/3.3V) | No Connect |
| 69 | CONFIG_1 = GND | Ground |
| 70 | 3.3V | Supply pin |
| 71 | GND | Ground |
| 72 | 3.3V | Supply pin |
| 73 | GND | Ground |
| 74 | 3.3V | Supply pin |
| 75 | CONFIG_2 = GND | Ground |

Note: N/C for Socket 2, and GND for Socket 3.

6. SUPPORTED COMMANDS



6.1. ATA Command List

| Op Code | Support | Description | Op Code | Support | Description | |
|---------|---------|-------------------------------|---------|---------|-------------|--|
| 00h | Y | NOP | B6h | 12h | - | NV Cache: QUERY NV CACHE PINNED SET DMA EXT |
| 03h | - | CFA REQUEST EXTENDED ERROR | B6h | 13h | - | NV Cache: QUERY NV CACHE MISSES DMA EXT |
| 06h | Y | DATA SET MANAGEMENT | B6h | 14h | - | NV Cache: FLUSH NV CACHE |
| 08h | - | DEVICE RESET | C4h | | Y | READ MULTIPLE |
| 0Bh | - | REQUEST SENSE DATA EXT | C5h | | Y | WRITE MULTIPLE |
| 10h | Y | RECALIBRATE | C6h | | Y | SET MULTIPLE MODE |
| 11h-1Fh | - | RECALIBRATE | C7h | | - | READ DMA QUEUED |
| 20h | Y | READ SECTOR(S) | C8h | | Y | READ DMA |
| 21h | Y | READ SECTOR(S) WITHOUT RETRY | C9h | | Y | READ DMA WITHOUT RETRY |
| 22h | - | READ LONG | CAh | | Y | WRITE DMA |
| 23h | - | READ LONG WITHOUT RETRY | CBh | | Y | WRITE DMA WITHOUT RETRY |
| 24h | Y | READ SECTOR(S) EXT | CCh | | - | WRITE DMA QUEUED |
| 25h | Y | READ DMA EXT | CDh | | - | CFA WRITE MULTIPLE WITHOUT ERASE |
| 26h | - | READ DMA QUEUED EXT | CEh | | Y | WRITE MULTIPLE FUA EXT |
| 27h | Y | READ NATIVE MAX ADDRESS EXT | D1h | | - | CHECK MEDIA CARD TYPE |
| 29h | Y | READ MULTIPLE EXT | DAh | | - | GET MEDIA STATUS |
| 2Ah | - | READ STREAM DMA EXT | DEh | | - | MEDIA LOCK |
| 2Bh | - | READ STREAM EXT | DFh | | - | MEDIA UNLOCK |
| 2Fh | Y | READ LOG EXT | E0h | | Y | STANDBY IMMEDIATE |
| 30h | Y | WRITE SECTOR(S) | E1h | | Y | IDLE IMMEDIATE |
| 31h | Y | WRITE SECTOR(S) WITHOUT RETRY | E2h | | Y | STANDBY |
| 32h | - | WRITE LONG | E3h | | Y | IDLE |
| 33h | - | WRITE LONG WITHOUT RETRY | E4h | | Y | READ BUFFER |

| | | | | | |
|-----|---|----------------------|-----|---|------------------|
| 34h | Y | WRITE SECTOR(S) EXT | E5h | Y | CHECK POWER MODE |
| 35h | Y | WRITE DMA EXT | E6h | Y | SLEEP |
| 36h | - | WRITE DMA QUEUED EXT | E7h | Y | FLUSH CACHE |
| 37h | Y | SET MAX ADDRESS EXT | E8h | Y | WRITE BUFFER |

| Op Code | Support | Description | Op Code | | Support | Description | |
|---------|---------|-------------------------------------|---------|-----|---------|---|--|
| 38h | - | CFA WRITE SECTORS WITHOUT ERASE | E9h | | Y | READ BUFFER DMA | |
| 39h | Y | WRITE MULTIPLE EXT | EAh | | Y | FLUSH CACHE EXT | |
| 3Ah | - | WRITE STREAM DMA EXT | EBh | | Y | WRITE BUFFER DMA | |
| 3Bh | - | WRITE STREAM EXT | ECh | | Y | IDENTIFY DEVICE | |
| 3Ch | - | WRITE VERIFY | EDh | | - | MEDIA EJECT | |
| 3Dh | Y | WRITE DMA FUA EXT | EEh | | - | IDENTIFY DEVICE DMA | |
| 3Eh | - | WRITE DMA QUEUED FUA EXT | EFh | 01h | - | SET FEATURES: Enable 8-bit PIO transfer mode (CFA feature set only) | |
| 3Fh | Y | WRITE LOG EXT | EFh | 02h | Y | SET FEATURES: Enable write cache | |
| 40h | Y | READ VERIFY SECTOR(S) | EFh | 03h | Y | SET FEATURES: Set transfer mode based on value in Count field | |
| 41h | Y | READ VERIFY SECTOR(S) WITHOUT RETRY | EFh | 05h | Y | SET FEATURES: Enable advanced power management | |
| 42h | Y | READ VERIFY SECTOR(S) EXT | EFh | 06h | - | SET FEATURES: Enable Power-Up In Standby feature set | |
| 44h | - | Reserved | EFh | 07h | - | SET FEATURES: Power-Up In Standby feature set device spin-up | |
| 45h | O | WRITE UNCORRECTABLE EXT | EFh | 0Ah | - | SET FEATURES: Enable CFA power mode 1 | |
| 47h | Y | READ LOG DMA EXT | EFh | 0Bh | - | SET FEATURES: Enable Write-Read-Verify feature set | |
| 50h | - | FORMAT TRACK | EFh | 10h | 01h | - | SET FEATURES: Enable use of Serial ATA feature |

| | | | | | | | |
|-----|---|--------------------|-----|-----|-----|---|--|
| 51h | - | CONFIGURE STREAM | EFh | 10h | 02h | Y | SET FEATURES: Enable DMA Setup FIS Auto-Activate optimization |
| 57h | Y | WRITE LOG DMA EXT | EFh | 10h | 03h | Y | SET FEATURES: Enable Device-initiated interface power state (DIPM) transitions |
| 60h | Y | READ FPDMA QUEUED | EFh | 10h | 04h | - | SET FEATURES: Enable use of Serial ATA feature |
| 61h | Y | WRITE FPDMA QUEUED | EFh | 10h | 05h | - | SET FEATURES: Enable use of Serial ATA feature |
| 70h | Y | SEEK | EFh | 10h | 06h | O | SET FEATURES: Enable Software Settings Preservation (SSP) |

| Op Code | Support | Description | Op Code | | | Support | Description |
|---------|---------|--------------------------------------|---------|-----|-----|---------|--|
| 71-76h | - | SEEK | EFh | 10h | 07h | Y | SET FEATURES: Enable Device Automatic Partial to Slumber transitions |
| 77h | Y | SET DATE AND TIME EXT | EFh | 10h | 09h | O | SET FEATURES: Enable Device Sleep |
| 78h | Y | ACCESSIBLE MAX ADDRESS CONFIGURATION | EFh | 42h | | - | SET FEATURES: Enable Automatic Acoustic Management feature set |
| 79-7Fh | - | SEEK | EFh | 43h | | - | SET FEATURES: Set Maximum Host Interface Sector Times |
| 87h | - | CFA TRANSLATE SECTOR | EFh | 44h | | - | SET FEATURES: Vendor Specific ECC byte |
| 90h | Y | EXECUTE DEVICE DIAGNOSTIC | EFh | 55h | | Y | SET FEATURES: Disable read look-ahead feature |
| 91h | Y | INITIALIZE DEVICE PARAMETERS | EFh | 5Dh | | - | SET FEATURES: Enable release interrupt |
| 92h | Y | DOWNLOAD MICROCODE | EFh | 5Eh | | - | SET FEATURES: Enable service interrupt |
| 93h | Y | DOWNLOAD MICROCODE DMA | EFh | 5Fh | | - | SET FEATURES: Enable NDRQ Feature |

| | | | | | | | |
|-----|---|------------------------|-----|-----|-----|--|---|
| 94h | - | STANDBY IMMEDIATE | EFh | 66h | Y | SET FEATURES: Disable reverting to power-on defaults | |
| 95h | - | IDLE IMMEDIATE | EFh | 81h | - | SET FEATURES: Disable 8-bit PIO transfer mode (CFA feature set only) | |
| 96h | - | STANDBY | EFh | 82h | Y | SET FEATURES: Disable write cache | |
| 97h | - | IDLE | EFh | 85h | Y | SET FEATURES: Disable advanced power management | |
| 98h | - | CHECK POWER MODE | EFh | 86h | - | SET FEATURES: Disable Power-Up In Standby feature set | |
| 99h | - | SLEEP | EFh | 8Ah | - | SET FEATURES: Disable CFA power mode | |
| A0h | - | PACKET | EFh | 8Bh | - | SET FEATURES: Disable Write-Read-Verify feature set | |
| A1h | - | IDENTIFY PACKET DEVICE | EFh | 90h | 01h | - | SET FEATURES: Disable use of Serial ATA feature |
| A2h | - | SERVICE | EFh | 90h | 02h | Y | SET FEATURES: Disable DMA Setup FIS Auto-Activate optimization |

| Op Code | | Support | Description | Op Code | | | Support | Description |
|---------|-----|---------|-----------------------------------|---------|-----|-----|---------|---|
| B0h | D0h | Y | SMART: READ DATA | EFh | 90h | 03h | Y | SET FEATURES: Disable Device-initiated interface power state (DIPM) transitions |
| B0h | D1h | Y | SMART: READ ATTRIBUTE THRESHOLDS | EFh | 90h | 04h | - | SET FEATURES: Disable use of Serial ATA feature |
| B0h | D2h | Y | SMART: ENABLE/DISABLE AUTOSAVE | EFh | 90h | 05h | - | SET FEATURES: Disable use of Serial ATA feature |
| B0h | D3h | Y | SMART: SAVE ATTRIBUTE VALUES | EFh | 90h | 06h | Y | SET FEATURES: Disable Software Settings Preservation (SSP) |
| B0h | D4h | Y | SMART: EXECUTE OFF-LINE IMMEDIATE | EFh | 90h | 07h | Y | SET FEATURES: Disable Device Automatic Partial to Slumber transitions |
| B0h | D5h | Y | SMART: READ LOG | EFh | 90h | 09h | O | SET FEATURES: Disable |

| | | | | | | | | |
|------------|----------|---|--|----------|----------|----------|-------------------------------|--|
| h | h | | | h | h | h | | Device Sleep |
| B0h | D6h | Y | SMART: WRITE LOG | EFh | AAh | | Y | SET FEATURES: Enable read look-ahead feature |
| B0h | D8h | Y | SMART: ENABLE OPERATIONS | EFh | BBh | | - | SET FEATURES: Default ECC byte |
| B0h | D9h | Y | SMART: DISABLE OPERATIONS | EFh | C2h | | - | SET FEATURES: Disable Automatic Acoustic Management feature set |
| B0h | DAh | Y | SMART: RETURN STATUS | EFh | C3h | | - | SET FEATURES: Enable/Disable the Sense Data Reporting feature set |
| B0h | DBh | Y | SMART: ENABLE/DISABLE AUTOMATIC OFF-LINE | EFh | CCh | | Y | SET FEATURES: Enable reverting to power-on defaults |
| B0h | E0h | - | SMART: Vendor specific | EFh | DDh | | - | SET FEATURES: Disable release interrupt |
| B1h | C0h | Y | DEVICE CONFIGURATION: RESTORE | EFh | DEh | | - | SET FEATURES: Disable SERVICE interrupt |
| B1h | C1h | Y | DEVICE CONFIGURATION: FREEZE LOCK | EFh | DFh | | - | SET FEATURES: Disable NDRQ Feature |
| B1h | C2h | Y | DEVICE CONFIGURATION: IDENTIFY | F1h | | Y | SECURITY SET PASSWORD | |
| B1h | C3h | Y | DEVICE CONFIGURATION: SET | F2h | | Y | SECURITY UNLOCK | |
| B1h | C4h | Y | DEVICE CONFIGURATION: IDENTIFY DMA | F3h | | Y | SECURITY ERASE PREPARE | |
| B1h | C5h | Y | DEVICE CONFIGURATION: SET DMA | F4h | | Y | SECURITY ERASE UNIT | |

| Op Code | | Support | Description | Op Code | | Support | Description |
|------------|-------|---------|--------------------------------------|---------|-----|---------|----------------------------------|
| B4h | 0000h | O | SANITIZE DEVICE: SANITIZE STATUS EXT | F5h | | Y | SECURITY FREEZE LOCK |
| B4h | 0011h | O | SANITIZE DEVICE: CRYPTO SCRAMBLE EXT | F6h | | Y | SECURITY DISABLE PASSWORD |
| B4h | 0012h | O | SANITIZE DEVICE: BLOCK ERASE EXT | F8h | | Y | READ NATIVE MAX ADDRESS |
| B4h | 0014h | O | SANITIZE DEVICE: OVERWRITE EXT | F9h | 00h | Y | SET MAX: SET MAX ADDRESS |

| | | | | | | | |
|------------|-------|---|---|------------|------------|---|--|
| B4h | 0020h | O | SANITIZE DEVICE: SANITIZE FREEZE LOCK EXT | F9h | 01h | Y | SET MAX: SET MAX PASSWORD |
| B4h | 0040h | O | SANITIZE DEVICE: SANITIZE ANTIFREEZE LOCK EXT | F9h | 02h | Y | SET MAX: SET MAX LOCK |
| B6h | 00h | - | NV Cache: SET NV CACHE POWER MODE EXT | F9h | 03h | Y | SET MAX: SET MAX UNLOCK |
| B6h | 01h | - | NV Cache: RETURN FROM NV CACHE POWER MODE EXT | F9h | 04h | Y | SET MAX: SET MAX FREEZE LOCK |
| B6h | 10h | - | NV Cache: ADD LBA(S) TO NV CACHE PINNED SET DMA EXT | F9h | 05h | Y | SET MAX: SET MAX SET PASSWORD DMA |
| B6h | 11h | - | NV Cache: REMOVE LBA(S) FROM NV CACHE PINNED SET DMA EXT | F9h | 06h | Y | SET MAX: SET MAX UNLOCK DMA |

Notes:

“Y” means “Support”.

“O” means “Option, default not support”.

“-” means “Not support”.

6.2. Identify Device Data

The following table details the sector data returned by the IDENTIFY DEVICE command.

The following table details the sector data returned by the IDENTIFY DEVICE command of ATA8-ACS4 SPEC.

| Word | F: Fixed V: Variable X: retired/obsolete /reserved | Default Value | Description |
|-------|--|---------------|---|
| 0 | F | 0040h | General configuration bit-significant information |
| 1 | X | *1 | Obsolete – Number of logical cylinders |
| 2 | F | C837h | Specific configuration |
| 3 | X | 0010h | Obsolete – Number of logical heads (16) |
| 4-5 | X | 00000000h | Retired |
| 6 | X | 003Fh | Obsolete – Number of logical sectors per logical track (63) |
| 7-8 | X | 00000000h | Reserved for assignment by the Compact Flash Association |
| 9 | X | 0000h | Retired |
| 10-19 | V | Varies | Serial number (20 ASCII characters) |
| 20-21 | X | 0000h | Retired |
| 22 | X | 0000h | Obsolete |
| 23-26 | V | Varies | Firmware revision (8 ASCII characters) |
| 27-46 | V | Varies | Model number (xxxxxxx) |
| 47 | F | 8010h | 7:0- Maximum number of sectors transferred per interrupt on MULTIPLE commands |
| 48 | F | 4000h | Reserved |
| 49 | F | 2F00h | Capabilities |
| 50 | F | 4000h | Capabilities |
| 51-52 | X | 00000000h | Obsolete |
| 53 | F | 0007h | Words 88 and 70:64 valid |
| 54 | X | *1 | Obsolete – Number of logical cylinders |
| 55 | X | 0010h | Obsolete – Number of logical heads (16) |
| 56 | X | 003Fh | Obsolete – Number of logical sectors per track (63) |
| 57-58 | X | *2 | Obsolete – Current capacity in sectors |
| 59 | F | 0110h | Number of sectors transferred per interrupt on MULTIPLE commands |
| 60-61 | V | *3 | Maximum number of sector (28bit LBA mode) |
| 62 | X | 0000h | Obsolete |
| 63 | F | 0407h | Multi-word DMA modes supported/selected |

| Word | F: Fixed V: Variable X: retired/obsolete /reserved | Default Value | Description |
|-------|--|-----------------------|---|
| 64 | F | 0003h | PIO modes supported |
| 65 | F | 0078h | Minimum Multiword DMA transfer cycle time per word |
| 66 | F | 0078h | Manufacturer's recommended Multiword DMA transfer cycle time |
| 67 | F | 0078h | Minimum PIO transfer cycle time without flow control |
| 68 | F | 0078h | Minimum PIO transfer cycle time with IORDY flow control |
| 69 | F | 1F00h | Additional Supported |
| 70 | X | 0000h | Reserved |
| 71-74 | X | 000000000000 0000h | Reserved for the IDENTIFY PACKET DEVICE command |
| 75 | F | 001Fh | Queue depth |
| 76 | F | 850Eh | Serial SATA capabilities |
| 77 | F | 0006h | Supported Serial ATA Phy speed |
| 78 | F | 004Ch | Serial ATA features supported |
| 79 | F | 0040H | Serial ATA features enabled |
| 80 | F | 0FF8h | Major Version Number |
| 81 | F | 0000h | Minor Version Number |
| 82 | F | 746Bh | Command set supported |
| 83 | F | 7D01h | Command set supported |
| 84 | F | 4163h | Command set/feature supported extension |
| 85 | F | 7469h | Command set/feature supported or enabled |
| 86 | F | BC01h | Command set/feature supported or enabled |
| 87 | F | 4163h | Command set/feature supported or enabled |
| 88 | F | 007Fh | Ultra DMA Modes |
| 89 | F | 000Ah | Time required for Normal Erase mode SECURITY ERASE UNIT command |
| 90 | F | 001Eh | Time required for an Enhanced Erase mode SECURITY ERASE UNIT command |
| 91 | F | 0000h | Current advanced power management value |
| 92 | F | FFFEh | Master Password Revision Code |
| 93 | F | 0000h | Hardware reset result. The contents of the bits (12:0) of this word can be changed only during the execution of hardware reset. |

| Word | F: Fixed V: Variable X: retired/obsolete /reserved | Default Value | Description |
|---------|--|-----------------------|---|
| 94 | X | 0000h | Vendor's recommended and actual acoustic management value |
| 95 | F | 0000h | Stream Minimum Request Size |
| 96 | F | 0000h | Streaming Transfer Time – DMA |
| 97 | F | 0000h | Streaming Access Latency – DMA and PIO |
| 98-99 | F | 0000h | Streaming Performance Granularity |
| 100-103 | V | *4 | Maximum user LBA for 48 bit Address feature set |
| 104 | F | 0000h | Streaming Transfer Time – PIO |
| 105 | F | 0008h | Maximum number of 512-byte blocks per DATA SET MANAGEMENT command |
| 106 | F | 4000h | Physical sector size/Logical sector size |
| 107 | F | 0000h | Inter-seek delay for ISO-7779 acoustic testing in microseconds |
| 108-111 | F | Varies | Reserved |
| 112-115 | X | 000000000000 0000h | Reserved |
| 116 | X | 0000h | Reserved |
| 117-118 | F | 00000000h | Words per logical Sector |
| 119 | F | 401Ch | Supported settings |
| 120 | F | 401Ch | Command set/Feature Enabled/Supported |
| 121-126 | X | 0h | Reserved |
| 127 | X | 0h | Obsolete |
| 128 | F | 0021h | Security status |
| 129-159 | V | Varies | Vendor specific |
| 160 | X | 0h | Compact Flash Association (CFA) power mode 1 |
| 161-167 | X | 0h | Reserved for assignment by the CFA |
| 168 | V | Varies | Device Nominal Form Factor |
| 169 | F | 0001h | DATA SET MANAGEMENT command is supported |
| 170-173 | F | 0h | Additional Product Identifier |
| 174-175 | X | 0h | Reserve |
| 176-205 | F | 0h | Current media serial number |
| 206 | F | 0039h | SCT Command Transport(|
| Word | F: Fixed V: Variable | Default Value | Description |

| | X: retired/obsolete /reserved | | |
|---------|-------------------------------------|-------------------------|--|
| 207-208 | X | 0h | Reserved |
| 209 | F | 4000h | Alignment of logical blocks within a physical block |
| 210-211 | F | 0000h | Write-Read-Verify Sector Count Mode 3 (not support) |
| 212-213 | F | 0000h | Write-Read-Verify Sector Count Mode 2 (not support) |
| 214-216 | X | 0000h | NV Cache relate (not support) |
| 217 | F | 0001h | Non-rotating media device |
| 218 | X | 0h | Reserved |
| 219 | X | 0h | NV Cache relate (not support) |
| 220 | V | 0h | Write read verify feature set current mode |
| 221 | X | 0h | Reserved |
| 222 | F | 10FFh | Transport major version number |
| 223 | F | 0h | Transport minor version number |
| 224-229 | X | 0h | reserved |
| 230-233 | F | 0h | Extend number of user addressable sectors |
| 234 | F | 0001h | Minimum number of 512-byte data blocks per DOWNLOAD MICROCODE command for mode 03h |
| 235 | F | FFFEh | Maximum number of 512-byte data blocks per DOWNLOAD MICROCODE command for mode 03h |
| 236-242 | X | 0h | Reserved |
| 243 | X | 0000h | Reserved |
| 244-254 | X | 0h | Reserved |
| 255 | F | XXA5h XX is variable | Integrity word (Checksum and Signature) |

■ List of Device Identification for Each Capacity

| Capacity (GB) | *1 (Word 1/Word 54) | *2 (Word 57–58) | *3 (Word 60–61) | *4 (Word 100–103) |
|------------------|------------------------|--------------------|--------------------|----------------------|
| 120 | 3FFFh | FBFC10h | 0FFFFFFFh | DF94BB0h |
| 240 | 3FFFh | FBFC10h | 0FFFFFFFh | 1BF244B0h |
| 480 | 3FFFh | FBFC10h | 0FFFFFFFh | 37E436B0 |
| 960 | 3FFFh | FBFC10h | 0FFFFFFFh | 6FC81AB0h |
| 1920 | 3FFFh | FBFC10h | 0FFFFFFFh | DF8FE2B0h |

6.3. SMART Attributes

| Attribute ID | Description |
|--------------|---|
| 01h | Number of Accumulation of Uncorrectable Error. |
| 09h | Power on Hours Count. |
| 0Ch | Drive Power Cycle Count (number of accumulation of power on/off cycles) |
| A8h | SATA PHY Error Count (Only record from power on, when power off this value will clear to zero. These values include all PHY error count, ex data FIS CRC, code error, disparity error, command FIS CRC.....) |
| AAh | Bad Block Count (early bad count and later bad count) |
| ADh | Erase Count (max. erase count and average erase count) |
| C0h | Number of Unexpected Power Loss |
| C2h | Temperature |
| DAh | Number of Accumulation CRC Error (read/write data FIS CRC error) |
| E7h | SSD Life Remaining |
| F1h | Host Write(GB) |

7. ACRONYMS



| Acronym | Definition |
|---------|---|
| AES | Advanced Encryption Standard |
| APST | Autonomous Power State Transition |
| ASPM | Active States Power Management |
| ATTO | Commercial performance benchmark application |
| CC | Conformal Coating |
| DDR | Double Data Rate (SDRAM) |
| DEVSLP | Device Sleep Mode |
| DIPM | Device Initiated Power Management |
| HIPM | Host Initiated Power Management |
| LBA | Logical Block Addressing |
| MTBF | Mean Time Between Failures |
| NCQ | Native Command Queue |
| NVMe | Non-Volatile Memory Express |
| OPAL | Open Physics Abstraction Layer |
| PCBA | Printed Circuit Board Assembly |
| PCIe | PCI Express / Peripheral Component Interconnect Express |
| PLP | Power Loss Protection |
| PSID | Physical Security ID |
| SATA | Serial Advanced Technology Attachment |
| SMART | Self-Monitoring, Analysis and Reporting Technology |
| SSD | Solid State Drive |
| TLC | Triples Level Cell |

8. PART NUMBER DECODER



M2P80-ACX¹X²X³X⁴X⁵X⁶X⁷X⁸

| Item | Series | Capacity | NAND Flash & Temperature Grade | Option |
|--|-----------|---|--|-------------------------------|
| | | X ¹ X ² X ³ X ⁴ X ⁵ | X ⁶ | X ⁷ X ⁸ |
| M2S80 | AC | 0120G (120GB) 0240G (240GB) 0480G (480GB) 0960G (960GB) 1920G (1920GB) | A : 3D TLC , Standard (0°C to +70°C) B : 3D TLC , Wide (-40°C to +85°C) | See below |
| <p>X⁷ X⁸ (Reserved for specific requirement)</p> <p>Blank: Standard</p> <p>06: Conformal Coating (CC)</p> <p>27: Quick Erase with connector pin</p> <p>31: AES + OPAL</p> <p>32: PLP+ AES +OPAL</p> <p>39: Quick Erase with connector pin + AES + OPAL</p> <p>43: AES + OPAL+ CC</p> | | | | |