

Amtron Technology, Inc.

Industrial SATA III Solid State Drive  
UD Series  
Product Data Sheet

|           |   |           |
|-----------|---|-----------|
| <b>1.</b> | <b>Introduction .....</b>                 | <b>5</b>  |
| 1.1.      | General Description .....                 | 5         |
| 1.2.      | Block Diagram.....                        | 5         |
| <b>2.</b> | <b>Product Specifications.....</b>        | <b>6</b>  |
| <b>3.</b> | <b>Environmental Specifications .....</b> | <b>9</b>  |
| 3.1.      | Environmental Conditions .....            | 9         |
| 3.1.1.    | Temperature and Humidity .....            | 9         |
| 3.1.2.    | Shock .....                               | 10        |
| 3.1.3.    | Vibration .....                           | 10        |
| 3.1.4.    | Drop .....                                | 10        |
| 3.1.5.    | Bending.....                              | 10        |
| 3.1.6.    | Torque .....                              | 10        |
| 3.1.7.    | Electrostatic Discharge (ESD).....        | 11        |
| 3.2.      | MTBF .....                                | 11        |
| 3.3.      | Certification .....                       | 11        |
| 3.4.      | Compliance .....                          | 11        |
| <b>4.</b> | <b>Electrical Specifications .....</b>    | <b>12</b> |
| 4.1.      | Supply Voltage .....                      | 12        |
| 4.2.      | Power Consumption.....                    | 12        |
| <b>5.</b> | <b>Interface.....</b>                     | <b>14</b> |
| 5.1.      | Pin Assignment and Descriptions .....     | 14        |
| <b>6.</b> | <b>Supported Commands.....</b>            | <b>15</b> |
| 6.1.      | ATA Command List .....                    | 15        |
| 6.2.      | Identify Device Data.....                 | 16        |
| <b>7.</b> | <b>Physical Dimension .....</b>           | <b>21</b> |
| <b>8.</b> | <b>Terminology .....</b>                  | <b>22</b> |
| <b>9.</b> | <b>Part Number Decoder.....</b>           | <b>23</b> |

## Revision History

| Revision | Draft Date | History   |
|----------|------------|---|
| 1.0      | 2014-05-23 | New release   |
| 1.1      | 2014-11-11 | Modify Part number (PN) decoder   |
| 1.2      | 2016-04-06 | Add capacity information, performance and power consumption for each capacity |
| 1.3      | 2017-01-03 | Add Flash combination for 32GB capacity                                       |

## Product Overview

- **Capacity**
  - SLC: 1GB up to 64GB
  - MLC: 4GB up to 256GB
  - pSLC: 2GB up to 128GB
- **SATA Interface**
  - SATA Revision 3.0
  - SATA 1.5Gbps, 3Gbps, and 6Gbps interface
- **Flash Interface**
  - Flash Type: SLC,MLC and pSLC
- **Performance**
  - Read: up to 500 MB/s
  - Write: up to 195 MB/s
- **Power Consumption<sup>Note1</sup>**
  - Active mode: < 2000mW
  - Idle mode: < 330mW
  - DEVSLP mode: < 5mW
- **TBW (Terabyte Written)**
  - SLC: 3448 TBW for 64GB
  - MLC: 635 TBW for 256GB
  - pSLC: 3176 TBW for 128GB
- **MTBF**
  - SLC: 3,000,000 hours
  - MLC: 2,000,000 hours
  - pSLC: 2,500,000 hours
- **Advanced Flash Management**
  - Static and Dynamic Wear Leveling
  - Bad Block Management
  - TRIM
  - SMART
  - Over-Provision
- **Low Power Management**
  - DEVSLP Mode (Optional)
  - DIPM/HIPM Mode
- **Temperature Range**
  - Operation (Standard): 0°C ~ 70°C
  - Operation (Wide): -40°C ~ 85°C
  - Storage: -40°C ~ 85°C
- **Compliant**
  - RoHS
  - CE & FCC

### Notes:

1. Please see Power Consumption" for details.

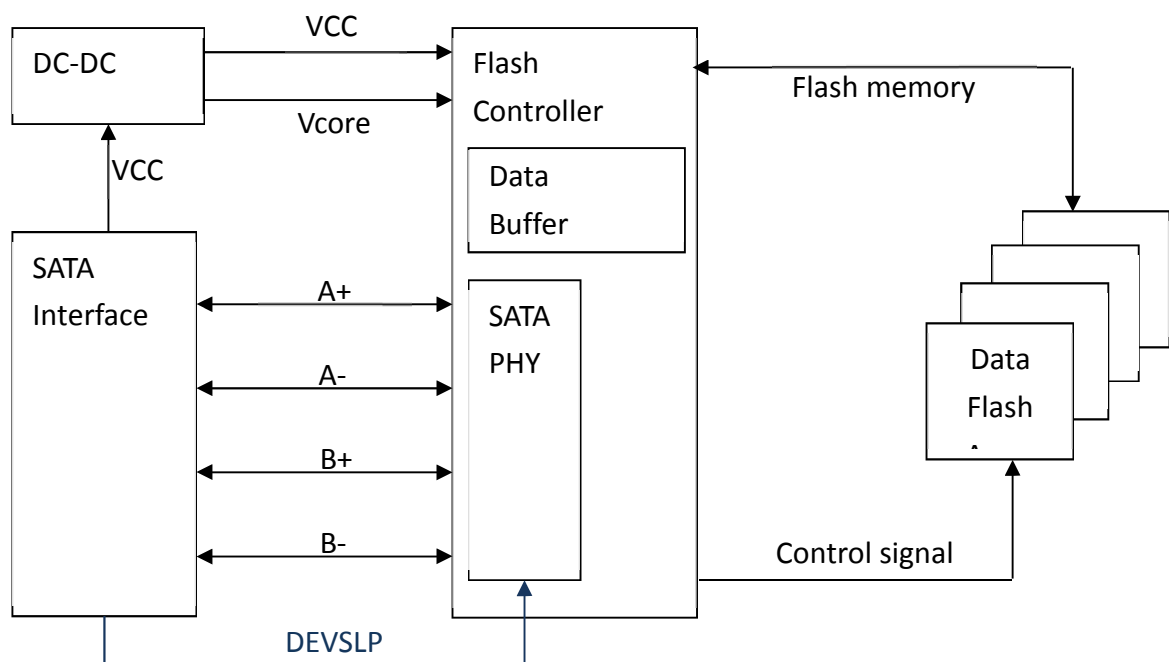
## 1. INTRODUCTION



### 1.1. General Description

Amtron 2.5" SATA Solid State Disk (SSD) delivers all the advantages of flash disk technology with Serial ATA III interface, including being fully compliant with standard 2.5-inch form factor, providing low power consumption compared to traditional hard drive and hot-swapping when removing/replacing/upgrading flash disks. The device is designed based on the standard 7-pin interface for data segment and 15-pin for power segment, as well as operating at a maximum operating frequency of 300MHz with 40MHz external crystal. Its capacity could provide a wide range up to 256GB application.

### 1.2. Block Diagram



2.5" SATA SSD Block Diagram

## 2. PRODUCT SPECIFICATIONS



- **Capacity**
  - SLC: From 1GB up to 64GB (support 48-bit addressing mode)
  - MLC: From 4GB up to 256GB (support 48-bit addressing mode)
  - pSLC: From 2GB up to 128GB (support 48-bit addressing mode)
- **Electrical/Physical Interface**
  - SATA Interface
    - ◆ Compliant with SATA Revision 3.0
    - ◆ Compatible with SATA 1.5Gbps, 3Gbps and 6Gbps interface
    - ◆ Support power management
    - ◆ Support expanded register for SATA protocol 48 bits addressing mode
    - ◆ Embedded BIST function for SATA PHY for low cost mass production
- **Supported NAND Flash**
  - Toshiba SLC and MLC, Toggle1.0 and Toggle2.0
  - Supports SLC large block 4K, 8K/page NAND flash
  - Supports MLC large block 16K/page NAND flash
- **ECC Scheme**
  - Up to 72 bits / 1K Byte
- **UART function**
- **GPIO**
- **Support SMART and TRIM commands**
- **Capacity Information**

| Capacity | Cylinders | Heads | Sectors | Total Sectors | User Data Size              |
|----------|-----------|-------|---------|---------------|-----------------------------|
| 1GB      | 1,959     | 16    | 63      | 1,974,672     | Depended on file management |
| 2GB      | 3,897     | 16    | 63      | 3,928,176     |                             |
| 4GB      | 7,773     | 16    | 63      | 7,835,184     |                             |
| 8GB      | 15,525    | 16    | 63      | 15,649,200    |                             |
| 16GB     | 16,383    | 16    | 63      | 31,277,232    |                             |
| 32GB     | 16,383    | 16    | 63      | 62,533,296    |                             |
| 64GB     | 16,383    | 16    | 63      | 125,045,424   |                             |
| 128GB    | 16,383    | 16    | 63      | 250,069,680   |                             |
| 256GB    | 16,383    | 16    | 63      | 500,118,192   |                             |

● Performance

■ SLC:

| Capacity | Flash Structure | Flash Type | Sequential  |              |
|----------|-----------------|------------|-------------|--------------|
|          |                 |            | Read (MB/s) | Write (MB/s) |
| 1GB      | 1GB x 1         | 32nm, TSOP | 30          | 20           |
| 2GB      | 1GB x 2         | 32nm, TSOP | 65          | 40           |
| 4GB      | 1GB x 4         | 32nm, TSOP | 130         | 75           |
|          | 4GB x 1         | 24nm, TSOP | 30          | 25           |
| 8GB      | 2GB x 4         | 32nm, TSOP | 130         | 85           |
|          | 4GB x 2         | 24nm, TSOP | 65          | 50           |
| 16GB     | 4GB x 4         | 24nm, TSOP | 130         | 95           |
| 32GB     | 8GB x 4         | 24nm, TSOP | 130         | 100          |
| 64GB     | 16GB x 4        | 24nm, TSOP | 130         | 100          |

■ MLC:

| Capacity | Flash Structure | Flash Type | Sequential  |              |
|----------|-----------------|------------|-------------|--------------|
|          |                 |            | Read (MB/s) | Write (MB/s) |
| 4GB      | 4GB x 1         | 15nm, TSOP | 115         | 55           |
| 8GB      | 4GB x 2         | 15nm, TSOP | 235         | 110          |
| 16GB     | 4GB x 4         | 15nm, TSOP | 430         | 175          |
| 32GB     | 8GB x 4         | 15nm, TSOP | 455         | 180          |
|          | 16GB x 2        |            | 235         | 110          |
| 64GB     | 16GB x 4        | 15nm, TSOP | 415         | 165          |
|          | 32GB x 2        | 15nm, BGA  | 475         | 175          |
| 128GB    | 32GB x 4        | 15nm, BGA  | 495         | 180          |
| 256GB    | 32GB x 8        | 15nm, BGA  | 495         | 180          |

■ pSLC:

| Capacity | Flash Structure | Flash Type | Sequential  |              |
|----------|-----------------|------------|-------------|--------------|
|          |                 |            | Read (MB/s) | Write (MB/s) |
| 2GB      | 4GB x 1         | 15nm, TSOP | 120         | 55           |
| 4GB      | 4GB x 2         | 15nm, TSOP | 240         | 110          |
| 8GB      | 4GB x 4         | 15nm, TSOP | 475         | 150          |
| 16GB     | 8GB x 4         | 15nm, TSOP | 500         | 180          |
|          | 16GB x 2        |            | 240         | 110          |
| 32GB     | 16GB x 4        | 15nm, TSOP | 500         | 175          |
|          | 32GB x 2        | 15nm, BGA  | 500         | 185          |
| 64GB     | 32GB x 4        | 15nm, BGA  | 500         | 195          |
| 128GB    | 32GB x 8        | 15nm, BGA  | 500         | 180          |

Notes:

1. The performance was estimated based on Toshiba SLC and 15nm MLC NAND flash.
2. Performance may differ according to flash configuration and platform.
3. The table above is for reference only.

- **TBW (Terabytes Written)**

- **SLC:**

| Capacity | Flash Structure | TBW  |
|----------|-----------------|------|
| 1GB      | 1GB x 1         | 53   |
| 2GB      | 1GB x 2         | 107  |
| 4GB      | 1GB x 4         | 213  |
| 8GB      | 2GB x 4         | 427  |
| 16GB     | 4GB x 4         | 862  |
| 32GB     | 8GB x 4         | 1708 |
| 64GB     | 16GB x 4        | 3448 |

- **MLC:**

| Capacity | Flash Structure      | TBW |
|----------|----------------------|-----|
| 4GB      | 4GB x 1              | 9   |
| 8GB      | 4GB x 2              | 19  |
| 16GB     | 4GB x 4              | 39  |
| 32GB     | 8GB x 4              | 79  |
| 64GB     | 16GB x 4<br>32GB x 2 | 158 |
| 128GB    | 32GB x 4             | 317 |
| 256GB    | 32GB x 8             | 635 |

- **pSLC:**

| Capacity | Flash Structure      | TBW  |
|----------|----------------------|------|
| 2GB      | 4GB x 1              | 49   |
| 4GB      | 4GB x 2              | 99   |
| 8GB      | 4GB x 4              | 198  |
| 16GB     | 8GB x 4              | 397  |
| 32GB     | 16GB x 4<br>32GB x 2 | 794  |
| 64GB     | 32GB x 4             | 1588 |
| 128GB    | 32GB x 8             | 3176 |

**Notes:**

1. Samples were built using Toshiba SLC and 15nm MLC NAND flash.
2. TBW may differ according to flash configuration and platform.
3. The endurance of SSD could be estimated based on user behavior, NAND endurance cycles, and write amplification factor. It is not guaranteed by flash vendor.



## 3. ENVIRONMENTAL SPECIFICATIONS



### 3.1. Environmental Conditions

#### 3.1.1. Temperature and Humidity

- Temperature:
  - ◆ Storage: -40°C to 85°C
  - ◆ Operational (Standard grade): 0°C to 70°C
  - ◆ Operational (Wide grade): -40°C to 85°C
- Humidity:
  - ◆ Standard grade: RH 90% under 40°C (operational)
  - ◆ Wide grade: RH 95% under 55°C (operational)

#### ■ High Temperature Test Condition

|                      | Temperature | Humidity | Test Time |
|----------------------|-------------|----------|-----------|
| Operation (Standard) | 70°C        | 0% RH    | 72 hours  |
| Operation (Wide)     | 85°C        | 0% RH    | 72 hours  |
| Storage (Standard)   | 85°C        | 0% RH    | 72 hours  |
| Storage (Wide)       | 85°C        | 0% RH    | 168 hours |

Result: No any abnormality is detected.

#### ■ Low Temperature Test Condition

|                      | Temperature | Humidity | Test Time |
|----------------------|-------------|----------|-----------|
| Operation (Standard) | 0°C         | 0% RH    | 72 hours  |
| Operation (Wide)     | -40°C       | 0% RH    | 72 hours  |
| Storage (Standard)   | -40°C       | 0% RH    | 72 hours  |
| Storage (Wide)       | -40°C       | 0% RH    | 168 hours |

Result: No any abnormality is detected.

#### ■ High Humidity Test Condition

|                      | Temperature | Humidity | Test Time |
|----------------------|-------------|----------|-----------|
| Operation (Standard) | 40°C        | 93% RH   | 24 hours  |
| Operation (Wide)     | 55°C        | 95% RH   | 72 hours  |
| Storage (Standard)   | 40°C        | 95% RH   | 72 hours  |
| Storage (Wide)       | 55°C        | 95% RH   | 96 hours  |

Result: No any abnormality is detected.

#### ■ Temperature Cycle Test

|                      | Temperature | Test Time | Cycle     |
|----------------------|-------------|-----------|-----------|
| Operation (Standard) | 0°C         | 30 min    | 10 cycles |
|                      | 70°C        | 30 min    |           |
| Operation (Wide)     | -40°C       | 30 min    | 20 cycles |
|                      | 85°C        | 30 min    |           |
| Storage (Standard)   | -40°C       | 30 min    | 10 cycles |
|                      | 85°C        | 30 min    |           |
| Storage (Wide)       | -40°C       | 30 min    | 50 cycles |
|                      | 85°C        | 30 min    |           |

Result: No any abnormality is detected.

### 3.1.2. Shock

■ Shock Specification

|             | Acceleration Force | Half Sin Pulse Duration |
|-------------|--------------------|-------------------------|
| Operational | 1500G              | 0.5ms                   |

Result: No any abnormality is detected when power on.

### 3.1.3. Vibration

■ Vibration Specification

|             | Condition              |                        | Vibration Orientation        |
|-------------|------------------------|------------------------|------------------------------|
|             | Frequency/Displacement | Frequency/Acceleration |                              |
| Operational | 20Hz~80Hz/1.52mm       | 80Hz~2000Hz/20G        | X, Y, Z axis/60 min for each |

Result: No any abnormality is detected when power on.

### 3.1.4. Drop

■ Drop Specification

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

Result: No any abnormality is detected when power on.

### 3.1.5. Bending

■ Bending Specification

|                 | Force | Action           |
|-----------------|-------|------------------|
| Non-operational | ≥ 50N | Hold 1min/5times |

Result: No any abnormality is detected when power on.

### 3.1.6. Torque

■ Torque Specification

|  | Force | Action |
|--|-------|--------|
|--|-------|--------|

|                 |                 |                  |
|-----------------|-----------------|------------------|
| Non-operational | 0.5N-m or 5 deg | Hold 1min/5times |
|-----------------|-----------------|------------------|

Result: No any abnormality is detected when power on.

### 3.1.7. Electrostatic Discharge (ESD)

■ Contact ESD Specification

| Device         | Capacity | Temperature | Relative Humidity | +/- 4KV   | Result |
|----------------|----------|-------------|-------------------|---|--------|
| HF3<br>2.5"SSD | 64GB     | 24.0°C      | 49% (RH)          | Device functions are affected, but EUT will be back to its normal or operational state automatically. | PASS   |

### 3.2. MTBF

MTBF, an acronym for Mean Time between Failures, is a measure of a device’s reliability. Its value represents the average time between a repair and the next failure. The measure is typically in units of hours. The higher the MTBF value, the higher the reliability of the device. The predicted result of Amtron 2.5" SATA SSD is up to 3,000,000 hours.

### 3.3. Certification

- RoHS
- CE / FCC

### 3.4. Compliance

- SATA III (SATA Rev. 3.0)
- Up to ATA/ATAPI-8 (Including S.M.A.R.T)

## 4. ELECTRICAL SPECIFICATIONS



### 4.1. Supply Voltage

| Parameter         | Rating |
|-------------------|--------|
| Operating Voltage | 5V     |

### 4.2. Power Consumption

#### ■ SLC

| Capacity | Flash Structure | Flash Type | Read | Write | Partial | Slumber | Idle | DEVSLP |
|----------|-----------------|------------|------|-------|---------|---------|------|--------|
| 1GB      | 1GB x 1         | 32nm, TSOP | 560  | 600   | 60      | 30      | 280  | 4.6    |
| 2GB      | 1GB x 2         | 32nm, TSOP | 650  | 690   | 60      | 30      | 280  | 4.6    |
| 4GB      | 1GB x 4         | 32nm, TSOP | 650  | 800   | 60      | 30      | 280  | 4.8    |
| 8GB      | 2GB x 4         | 32nm, TSOP | 850  | 990   | 60      | 30      | 280  | 4.8    |
| 16GB     | 4GB x 4         | 24nm, TSOP | 850  | 1000  | 60      | 30      | 280  | 4.8    |
| 32GB     | 8GB x 4         | 24nm, TSOP | 900  | 1200  | 60      | 30      | 280  | 4.8    |
| 64GB     | 16GB x 4        | 24nm, TSOP | 900  | 1200  | 60      | 30      | 280  | 4.8    |

Unit: mW

#### ■ MLC

| Capacity | Flash Structure | Flash Type | Read | Write | Partial | Slumber | Idle | DEVSLP |
|----------|-----------------|------------|------|-------|---------|---------|------|--------|
| 4GB      | 4GB x 1         | 15nm, TSOP | 705  | 690   | 35      | 55      | 280  | 4.9    |
| 8GB      | 4GB x 2         | 15nm, TSOP | 870  | 860   | 35      | 55      | 285  | 4.9    |
| 16GB     | 4GB x 4         | 15nm, TSOP | 1165 | 1040  | 65      | 44      | 325  | 4.9    |
| 32GB     | 8GB x 4         | 15nm, TSOP | 1350 | 1300  | 55      | 34      | 310  | 4.9    |
|          | 16GB x 2        |            | 1165 | 1040  | 65      | 44      | 325  | 4.9    |
| 64GB     | 16GB x 4        | 15nm, TSOP | 1250 | 1260  | 58      | 34      | 320  | 4.9    |
|          | 32GB x 2        | 15nm, BGA  | 1300 | 1400  | 50      | 30      | 310  | 4.9    |
| 128GB    | 32GB x 4        | 15nm, BGA  | 1550 | 1600  | 53      | 30      | 310  | 4.9    |
| 256GB    | 32GB x 8        | 15nm, BGA  | 1950 | 1700  | 65      | 45      | 320  | 4.9    |

Unit: mW

■ pSLC

| Capacity | Flash Structure | Flash Type | Read | Write | Partial | Slumber | Idle | DEVSLP |
|----------|-----------------|------------|------|-------|---------|---------|------|--------|
| 2GB      | 4GB x 1         | 15nm, TSOP | 720  | 700   | 52      | 33      | 280  | 4.9    |
| 4GB      | 4GB x 2         | 15nm, TSOP | 890  | 880   | 55      | 35      | 290  | 4.9    |
| 8GB      | 4GB x 4         | 15nm, TSOP | 1195 | 1050  | 50      | 35      | 285  | 4.9    |
| 16GB     | 8GB x 4         | 15nm, TSOP | 1300 | 1200  | 55      | 34      | 310  | 4.9    |
|          | 16GB x 2        |            | 1195 | 1050  | 50      | 35      | 285  | 4.9    |
| 32GB     | 16GB x 4        | 15nm, TSOP | 1300 | 1220  | 56      | 36      | 310  | 4.9    |
|          | 32GB x 2        | 15nm, BGA  | 1640 | 1420  | 50      | 30      | 280  | 4.9    |
| 64GB     | 32GB x 4        | 15nm, BGA  | 1500 | 1610  | 52      | 30      | 290  | 4.9    |
| 128GB    | 32GB x 8        | 15nm, BGA  | 1580 | 1650  | 55      | 35      | 290  | 4.9    |

Unit: mW

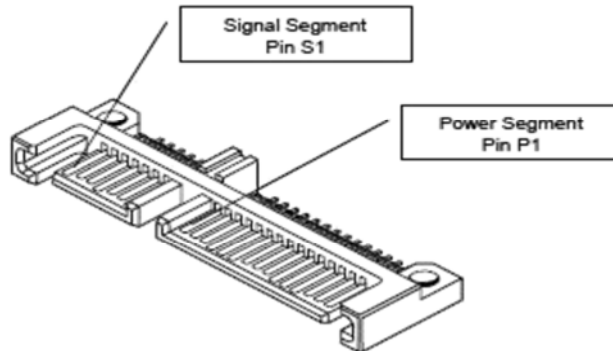
**NOTES:**

1. It's average value of power consumption based on 100% conversion efficiency.
2. The measured power voltage is 5V.
3. Samples were built using Toshiba NAND flash and measured under normal temperature.
4. Sequential R/W is measured while testing 4000MB sequential R/W 5 times by CrystalDiskMark. DEVSLP is measured while entering device sleep mode for 5 minutes.
5. Power Consumption may differ according to flash configuration, SDR configuration, or platform.

## 5. INTERFACE



### 5.1. Pin Assignment and Descriptions



| Signal Segment Pin Assignment | Pin Number     | Function                         |
|-------------------------------|----------------|----------------------------------|
|                               | S1             | GND                              |
|                               | S2             | A+ (Differential Signal Pair A)  |
|                               | S3             | A – (Differential Signal Pair A) |
|                               | S4             | GND                              |
|                               | S5             | B – (Differential Signal Pair B) |
|                               | S6             | B+ (Differential Signal Pair B)  |
|                               | S7             | GND                              |
| Power Segment Pin Assignment  | Pin Number     | Function                         |
|                               | P1             | Not Used (3.3V)                  |
|                               | P2             | Not Used (3.3V)                  |
|                               | P3             | DEVSLP                           |
|                               | P4             | GND                              |
|                               | P5             | GND                              |
|                               | P6             | GND                              |
|                               | P7             | 5V pre-charge                    |
|                               | P8             | 5V                               |
|                               | P9             | 5V                               |
|                               | P10            | GND                              |
|                               | P11            | Reserved                         |
|                               | P12            | GND                              |
|                               | P13            | Not Used (12V pre-charge)        |
|                               | P14            | Not Used (12V)                   |
| P15                           | Not Used (12V) |                                  |

## 6. SUPPORTED COMMANDS



### 6.1. ATA Command List

| Code    | Description                       | Code | Description               |
|---------|-----------------------------------|------|---------------------------|
| 00h     | NOP                               | 97h  | IDLE                      |
| 06h     | Data Set Management               | 98h  | CHECK POWER MODE          |
| 10h-1Fh | Recalibrate                       | 99h  | SLEEP                     |
| 20h     | Read Sectors                      | B0h  | SMART                     |
| 21h     | Read Sectors without Retry        | B1h  | DEVICE CONFIGURATION      |
| 24h     | Read Sectors EXT                  | C4h  | Read Multiple             |
| 25h     | Read DMA EXT                      | C5h  | Write Multiple            |
| 27h     | Read Native Max Address EXT       | C6h  | Set Multiple Mode         |
| 29h     | Read Multiple EXT                 | C8h  | Read DMA                  |
| 2Fh     | Read Log EXT                      | C9h  | Read DMA without Retry    |
| 30h     | Write Sectors                     | CAh  | Write DMA                 |
| 31h     | Write Sectors without Retry       | CBh  | Write DMA without Retry   |
| 34h     | Write Sectors EXT                 | CEh  | Write Multiple FUA EXT    |
| 35h     | Write DMA EXT                     | E0h  | Standby Immediate         |
| 37h     | Set Native Max Address EXT        | E1h  | Idle Immediate            |
| 38h     | CFA WRITE SECTORS WITHOUT ERASE   | E2h  | Standby                   |
| 39h     | Write Multiple EXT                | E3h  | Idle                      |
| 3Dh     | Write DMA FUA EXT                 | E4h  | Read Buffer               |
| 3Fh     | Write Long EXT                    | E5h  | Check Power Mode          |
| 40h     | Read Verify Sectors               | E6h  | Sleep                     |
| 41h     | Read Verify Sectors without Retry | E7h  | Flush Cache               |
| 42h     | Read Verify Sectors EXT           | E8h  | Write Buffer              |
| 45h     | WRITE UNCORRECTABLE EXT           | EAh  | Flush Cache EXT           |
| 60h     | Read FPDMA Queued                 | ECh  | Identify Device           |
| 61h     | Write FPDMA Queued                | EFh  | Set Features              |
| 70h-7Fh | Seek                              | F1h  | Security Set Password     |
| 90h     | Execute Device Diagnostic         | F2h  | Security Unlock           |
| 91h     | Initialize Device Parameters      | F3h  | Security Erase Prepare    |
| 92h     | Download Microcode                | F4h  | Security Erase Unit       |
| 93h     | DOWNLOAD MICROCODE DMA            | F5h  | Security Freeze Lock      |
| 94h     | STANDBY IMMEDIATE                 | F6h  | Security Disable Password |
| 95h     | IDLE IMMEDIATE                    | F8h  | Read Native Max Address   |
| 96h     | STANDBY                           | F9h  | Set Max Address           |

## 6.2. Identify Device Data

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

| Word  | F: Fixed<br>V: Variable<br>X: Both | Default Value | Description   |
|-------|------------------------------------|---------------|---|
| 0     | F                                  | 0040h         | General configuration bit-significant information                             |
| 1     | X                                  | <b>*1</b>     | Obsolete – Number of logical cylinders  |
| 2     | V                                  | 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   | V                                  | 00000000h     | Reserved for assignment by the Compact Flash Association                      |
| 9     | X                                  | 0000h         | Retired   |
| 10-19 | F                                  | Varies        | Serial number (20 ASCII characters)   |
| 20-21 | X                                  | 0000h         | Retired   |
| 22    | X                                  | 0000h         | Obsolete  |
| 23-26 | F                                  | Varies        | Firmware revision (8 ASCII characters)  |
| 27-46 | F                                  | Varies        | Model number (xxxxxxxx)   |
| 47    | F                                  | 8010h         | 7:0- Maximum number of sectors transferred per interrupt on MULTIPLE commands |
| 48    | F                                  | 4000h         | Trusted Computing feature set options(not support)                            |
| 49    | F                                  | 2F00h         | Capabilities  |
| 50    | F                                  | 4000h         | Capabilities  |
| 51-52 | X                                  | 000000000h    | Obsolete  |
| 53    | F                                  | 0007h         | Words 88 and 70:64 valid  |
| 54    | X                                  | <b>*1</b>     | 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                                  | <b>*2</b>     | Obsolete – Current capacity in sectors  |
| 59    | F                                  | 0110h         | Number of sectors transferred per interrupt on MULTIPLE commands              |
| 60-61 | F                                  | <b>*3</b>     | Maximum number of sector ( 28bit LBA mode)                                    |
| 62    | X                                  | 0000h         | Obsolete  |
| 63    | F                                  | 0407h         | Multi-word DMA modes supported/selected                                       |
| Word  | F: Fixed                           | Default Value | Description   |



|             | <b>V: Variable</b><br><b>X: Both</b> |                        |   |
|-------------|--------------------------------------|------------------------|---|
| 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                                    | 0100h                  | Additional Supported (support download microcode DMA)   |
| 70          | F                                    | 0000h                  | Reserved  |
| 71-74       | F                                    | 0000000000000000<br>0h | Reserved for the IDENTIFY PACKET DEVICE command   |
| 75          | F                                    | 001Fh                  | Queue depth   |
| 76          | F                                    | 670eh                  | Serial SATA capabilities  |
| 77          | F                                    | 0084h                  | Serial ATA Additional Capabilities  |
| 78          | F                                    | 014Ch                  | Serial ATA features supported   |
| 79          | V                                    | 0040h                  | Serial ATA features enabled   |
| 80          | F                                    | 07F8h                  | Major Version Number  |
| 81          | F                                    | 0000h                  | Minor Version Number  |
| 82          | F                                    | 346bh                  | Command set supported   |
| 83          | F                                    | 7d09h                  | Command set supported   |
| 84          | F                                    | 6063h                  | Command set/feature supported extension   |
| 85          | V                                    | 3469h                  | Command set/feature enabled   |
| 86          | V                                    | bc01h                  | Command set/feature enabled   |
| 87          | V                                    | 6063h                  | Command set/feature default   |
| 88          | V                                    | 003Fh                  | Ultra DMA Modes   |
| 89          | F                                    | 0001h                  | Time required for security erase unit completion  |
| 90          | F                                    | 001Eh                  | Time required for Enhanced security erase completion  |
| 91          | V                                    | 0000h                  | Current advanced power management value   |
| 92          | V                                    | 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. |
| <b>Word</b> | <b>F: Fixed</b>                      | <b>Default Value</b>   | <b>Description</b>  |

|             | <b>V: Variable<br/>X: Both</b> |  |   |
|-------------|--------------------------------|--|---|
| 94          | V                              | 0000h  | Vendor's recommended and actual acoustic management value         |
| 95          | F                              | 0000h  | Stream Minimum Request Size                                       |
| 96          | V                              | 0000h  | Streaming Transfer Time – DMA                                     |
| 97          | V                              | 0000h  | Streaming Access Latency – DMA and PIO                            |
| 98-99       | F                              | 0000h  | Streaming Performance Granularity                                 |
| 100-103     | V                              | <b>*4</b>  | Maximum user LBA for 48 bit Address feature set                   |
| 104         | V                              | 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                              | 0000000000000000<br>0h                                 | Unique ID   |
| 112-115     | F                              | 0000000000000000<br>0h                                 | Reserved  |
| 116         | V                              | 0000h  | Reserved  |
| 117-118     | F                              | 00000000h  | Words per logical Sector  |
| 119         | F                              | 4014h  | Supported settings  |
| 120         | F                              | 4014h  | Command set/Feature Enabled/Supported                             |
| 121-126     | F                              | 0h   | Reserved  |
| 127         | F                              | 0h   | Removable Media Status Notification feature set support           |
| 128         | V                              | 0021h  | Security status   |
| 129-140     | X                              | 0h   | Vendor specific   |
| 141         | X                              | 0001h  | Vendor specific   |
| 142-159     | X                              | 0h   | Vendor specific   |
| 160         | F                              | 0h   | Compact Flash Association (CFA) power mode 1                      |
| 161-167     | X                              | 0h   | Reserved for assignment by the CFA                                |
| 168         | F                              | 3h 2.5 inch<br>4h 1.8 inch<br>5h Less than 1.8<br>inch | Device Nominal Form Factor  |
| <b>Word</b> | <b>F: Fixed</b>                | <b>Default Value</b>                                   | <b>Description</b>  |

|         | <b>V: Variable</b><br><b>X: Both</b> |                         |   |
|---------|--------------------------------------|-------------------------|---|
| 169     | F                                    | 0001h                   | DATA SET MANAGEMENT command is supported  |
| 170-173 | F                                    | 0h                      | Additional Product Identifier   |
| 174-175 |                                      | 0h                      | Reserve   |
| 176-205 | V                                    | 0h                      | Current media serial number   |
| 206     | F                                    | 0h                      | SCT Command Transport   |
| 207-208 | F                                    | 0h                      | Reserved  |
| 209     | F                                    | 4000h                   | Alignment of logical blocks within a physical block                                   |
| 210-211 | V                                    | 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 |                                      | 0000h                   | NV Cache relate (not support)   |
| 217     | F                                    | 0001h                   | Non-rotating media device   |
| 218     | F                                    | 0h                      | Reserved  |
| 219     | F                                    | 0h                      | NV Cache relate (not support)   |
| 220     | V                                    | 0h                      | Write read verify feature set current mode  |
| 221     |                                      | 0h                      | Reserved  |
| 222     | F                                    | 107Fh                   | Transport major version number  |
| 223     | F                                    | 0h                      | Transport minor version number  |
| 224-229 |                                      | 0h                      | reserved  |
| 230-233 |                                      | 0h                      | Extend number of user addressable sectors   |
| 234     |                                      | 0001h                   | Minimum number of 512-byte data blocks per<br>DOWNLOAD MICROCODE command for mode 03h |
| 235     |                                      | 0080h                   | Maximum number of 512-byte data blocks per<br>DOWNLOAD MICROCODE command for mode 03h |
| 236-254 | F                                    | 0h                      | Reserved  |
| 255     | X                                    | XXA5h<br>XX is variable | Integrity word (Checksum and Signature)   |

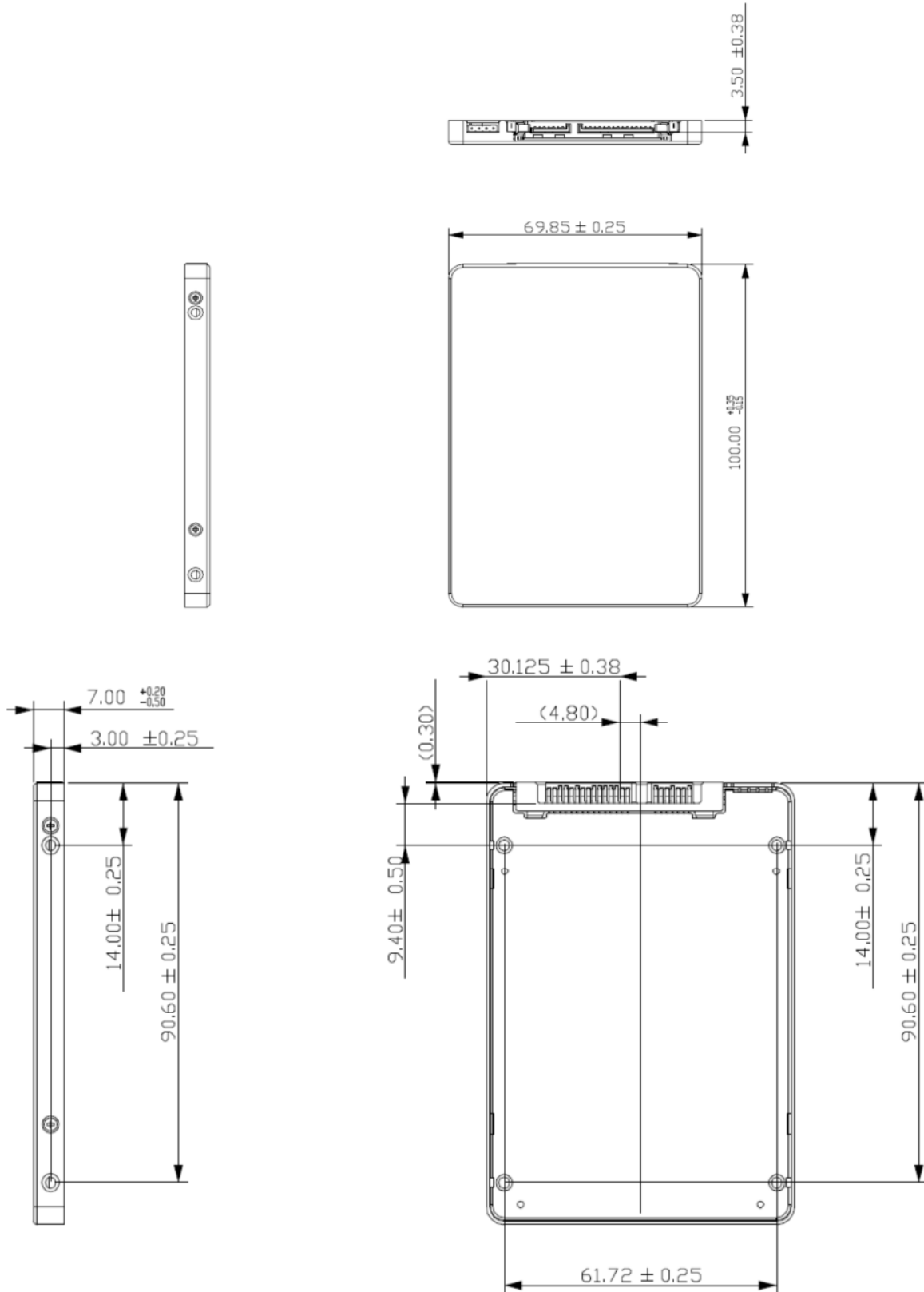
■ List of Device Identification for Each Capacity

| Capacity<br>(GB) | *1<br>(Word 1/Word 54) | *2<br>(Word 57–58) | *3<br>(Word 60–61) | *4<br>(Word 100–103) |
|------------------|------------------------|--------------------|--------------------|----------------------|
| 1                | 7A7h                   | 1E2190h            | 1E2190h            | 1E2190h              |
| 2                | F39h                   | 3BF070h            | 3BF070h            | 3BF070h              |
| 4                | 1E5Dh                  | 778E30h            | 778E30h            | 778E30h              |
| 8                | 3CA5h                  | EEC9B0h            | EEC9B0h            | EEC9B0h              |
| 16               | 3FFFh                  | FBFC10h            | 1DD40B0h           | 1DD40B0h             |
| 32               | 3FFFh                  | FBFC10h            | 3BA2EB0h           | 3BA2EB0h             |
| 64               | 3FFFh                  | FBFC10h            | 7740AB0h           | 7740AB0h             |
| 128              | 3FFFh                  | FBFC10h            | EE7C2B0h           | EE7C2B0h             |
| 256              | 3FFFh                  | FBFC10h            | FFFFFFFFh          | 1DCF32B0h            |

## 7. PHYSICAL DIMENSION



Dimension: 100.10mm(L) x 69.85mm(W) x 7.00mm(H)



## 8. TERMINOLOGY



The following table is to list out the acronyms that have been applied throughout the document.

| Term       | Definitions  |
|------------|--|
| ATTO       | Commercial performance benchmark application       |
| DEVSLP     | Device Sleep Mode                                  |
| DIPM       | Device initiated power management                  |
| HIPM       | Host initiated power management                    |
| LBA        | Logical block addressing                           |
| MB         | Mega-byte  |
| MTBF       | Mean time between failures                         |
| NCQ        | Native command queue                               |
| SATA       | Serial advanced technology attachment              |
| SDR        | Synchronous dynamic access memory                  |
| S.M.A.R.T. | Self-monitoring, analysis and reporting technology |
| SSD        | Solid state disk                                   |

## 9. PART NUMBER DECODER



SFD-2UDX<sup>7</sup>X<sup>8</sup>X<sup>9</sup>X<sup>10</sup>X<sup>11</sup>X<sup>12</sup>X<sup>13</sup>X<sup>14</sup>

| X <sup>1</sup> X <sup>2</sup> X <sup>3</sup> | X <sup>4</sup> | X <sup>5</sup> X <sup>6</sup> | X <sup>7</sup> X <sup>8</sup> X <sup>9</sup> X <sup>10</sup>   | X <sup>11</sup>  | X <sup>12</sup> | X <sup>13</sup> X <sup>14</sup> |
|--|----------------|-------------------------------|--|--|-----------------|---------------------------------|
| SFD  | 2              | UD                            | 001G                      032G<br>002G                      064G<br>004G                      128G<br>008G                      256G<br>016G | C: SLC Standard (0°C ~ +70°C)<br>I: SLC Industrial (-40°C ~ +85°C)<br>K: MLC Standard (0°C ~ +70°C)<br>M: MLC Industrial (-40°C ~ +85°C)<br>P: pSLC Standard (0°C ~ +70°C)<br>F: pSLC Industrial (-40°C ~ +85°C) | 4               | Blank                           |

X<sup>13</sup>X<sup>14</sup>

Blank: Standard