

**Industrial SATAⅢ mSATA**  
**Solid State Drive A-Series**  
**データシート**

株式会社アドテック

## Revision History

| Revision | Description  | Date        |
|----------|--------------|-------------|
| V0.1     | New released | April, 2019 |

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# 1. Product Description

## 1.1. Product Overview

ADTEC SATAⅢ mSATA SSD is the storage device based on NAND flash memory technology. This product complies with Serial ATA standard interface and suitable for data storage media and code storage device for embedded system and boot disk. By using **mSATA SSD Module**, it is possible to operate good performance for the systems, which have SATA interface. With small form factor, the applicable appliance can add or install SATA storage device on its Mother Board or Complete set.

## 1.2. Product Features

- Small form factor refers to the MO-300 specification which established by JEDEC.
- Memory Capacities  
MLC: 64GB/ 128GB/ 256GB/ 512GB  
aMLC: 32GB/ 64GB/ 128GB/ 256GB
- High performance and reliability.
- Support DDR3/DDR3L External DRAM Buffer.
- Build-in Global Wear-leveling and Hardware BCH ECC capable of correcting errors up to 66 bit/1KB.
- Management for long data retention.
- Compliant with SATA III 6.0Gbps (backward compatible to 3 Gb/s 1.5 G/s)
- Operating as Boot Disk.
- Support S. M. A. R. T. & Trim command.
- Noiseless and stable installation to system.
- Resistant to shock and vibration.
- Supports Bad Block Management.
- Fully Compliant with RoHS directive.
- CE and FCC Compatibility

### 1.3. Specifications

|                                  |  |
|----------------------------------|--|
| <b>Interface</b>                 | SATAIII 6Gb/s compatible   |
| <b>NAND Flash Type</b>           | MLC/aMLC   |
| <b>Controller</b>                | SM2246EN   |
| <b>Form Factor</b>               | MO-300   |
| <b>Connector Type</b>            | mSATA (52 pin)   |
| <b>External DRAM Buffer</b>      | Yes  |
| <b>Capacity</b>                  | MLC: 64GB / 128GB / 256GB / 512GB<br>aMLC: 32GB / 64GB / 128GB / 256GB   |
| <b>Power Consumption(Max)</b>    | Idle: 0.379W, Active: 2.31W  |
| <b>Temperature</b>               | Operating Temperature:<br>Normal Temperature: 0°C ~ +70°C<br>Wide Temperature: -40°C ~ +85°C<br>Storage Temperature: -55°C ~ +95°C |
| <b>Humidity</b>                  | 0°C~55°C /10~95%, non-condensing   |
| <b>TRIM</b>                      | Yes  |
| <b>S.M.A.R.T(Health Monitor)</b> | Yes  |
| <b>Vibration(Operating)</b>      | 20GPeak, 10 ~ 2000Hz   |
| <b>Shock</b>                     | 1500G,0.5ms  |
| <b>Dimension(L x W x H)</b>      | 50.95 x 30.00 x 3.90mm   |

Table 1: mSATA SSD Specifications

### 1.4. Performance

#### MLC

| Capacity              | 64GB      | 128GB     | 256GB     | 512GB     |
|-----------------------|-----------|-----------|-----------|-----------|
| Sequential Read(Max)  | 440MB/sec | 445MB/sec | 481MB/sec | 480MB/sec |
| Sequential Write(Max) | 75MB/sec  | 135MB/sec | 300MB/sec | 332MB/sec |

#### aMLC

| Capacity              | 32GB      | 64GB      | 128GB     | 256GB     |
|-----------------------|-----------|-----------|-----------|-----------|
| Sequential Read(Max)  | 485MB/sec | 485MB/sec | 492MB/sec | 495MB/sec |
| Sequential Write(Max) | 255MB/sec | 300MB/sec | 380MB/sec | 430MB/sec |

\*Performance may vary based on SSD capacity, hardware test platform, test software, operating system and other system variables.

Table 2: mSATA SSD Performance

## 1.5. TBW (Tera Bytes Written)

| Capacity | TBW(MLC) | TBW(aMLC) |
|----------|----------|-----------|
| 32GB     | —        | 320TB     |
| 64GB     | 96TB     | 641TB     |
| 128GB    | 192TB    | 1282TB    |
| 256GB    | 384TB    | 2564TB    |
| 512GB    | 769TB    | —         |

Table 3: mSATA SSD TBW

## 1.6. System Requirement

The Host system which is connected to mSATA SSD should meet system requirements at minimum.

### 1.6.1. Power Requirement

| Item          | Symbol | Rating                       | Unit |
|---------------|--------|------------------------------|------|
| Input voltage | VIN    | +3.3DC $\pm$ 5% 500mA (max.) | V    |

Table 4: mSATA SSD Power Requirement

### 1.6.2. Operating System

- Windows family.
- Linux family.
- DOS or embedded system.

### 1.6.3. Interface

- miniPCIe Interface.

## 2. Detailed Specification

### 2.1. Physical Specifications

#### 2.1.1. Overview

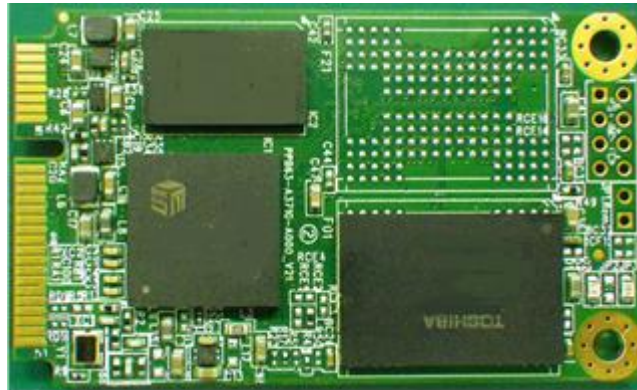


Figure 1: mSATA SSD Overview Diagram

#### 2.1.2. Dimension

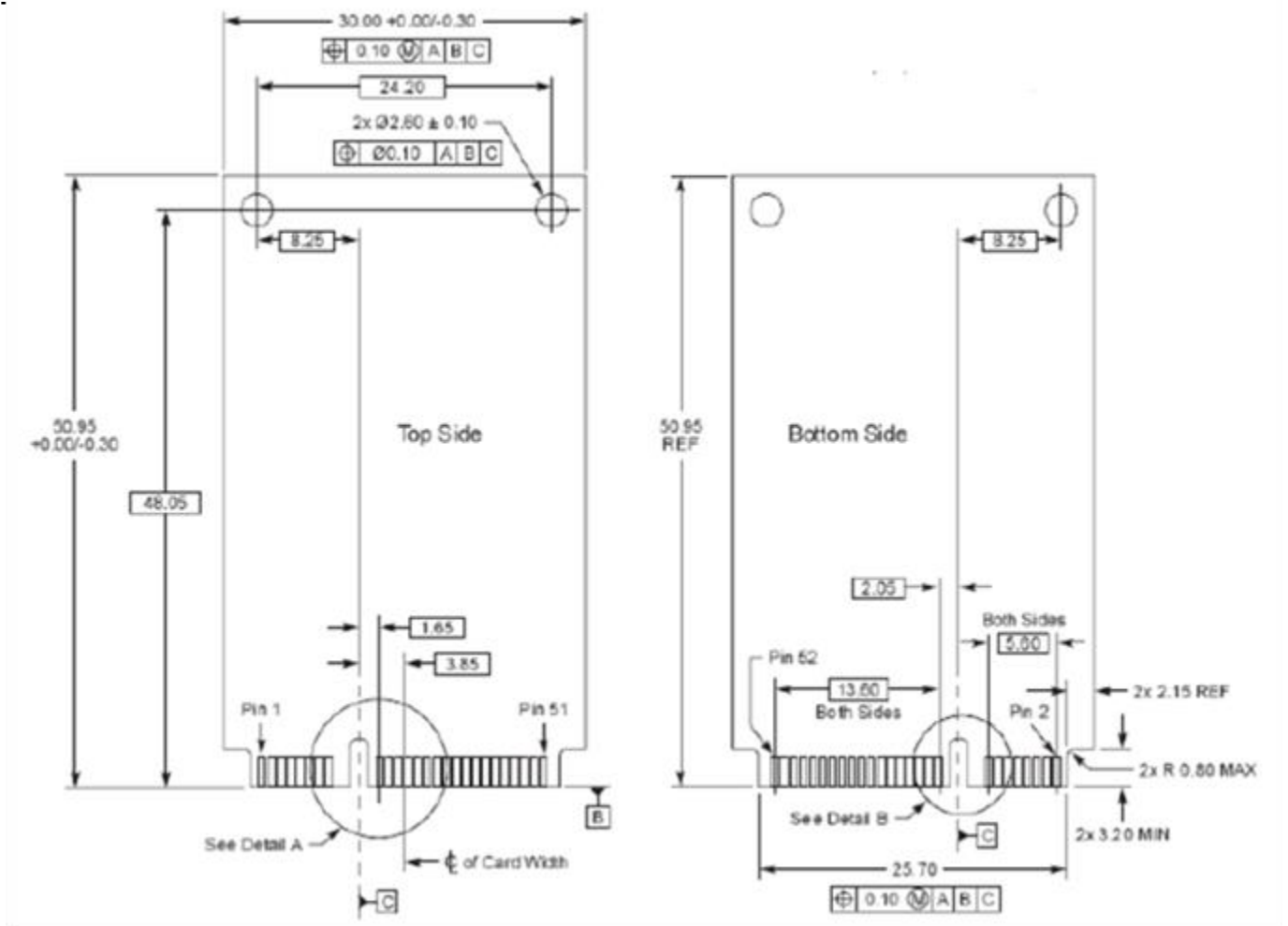


Figure 2: mSATA SSD Module Dimensions

| Parameter | Specifications   |
|-----------|------------------|
| Width     | 30.00mm ± 0.30mm |
| Length    | 50.95mm ± 0.30mm |
| Height    | 3.90mm ± 0.30mm  |

Table 5: mSATA SSD Module Physical Dimension

## 2.2. Electronic Specifications

### 2.2.1. Product Definition

mSATA SSD Module is designed to operate and work as Data or Code Storage device by NAND Flash Memory and its Controller through Serial ATA Standard Interface to Host Systems.

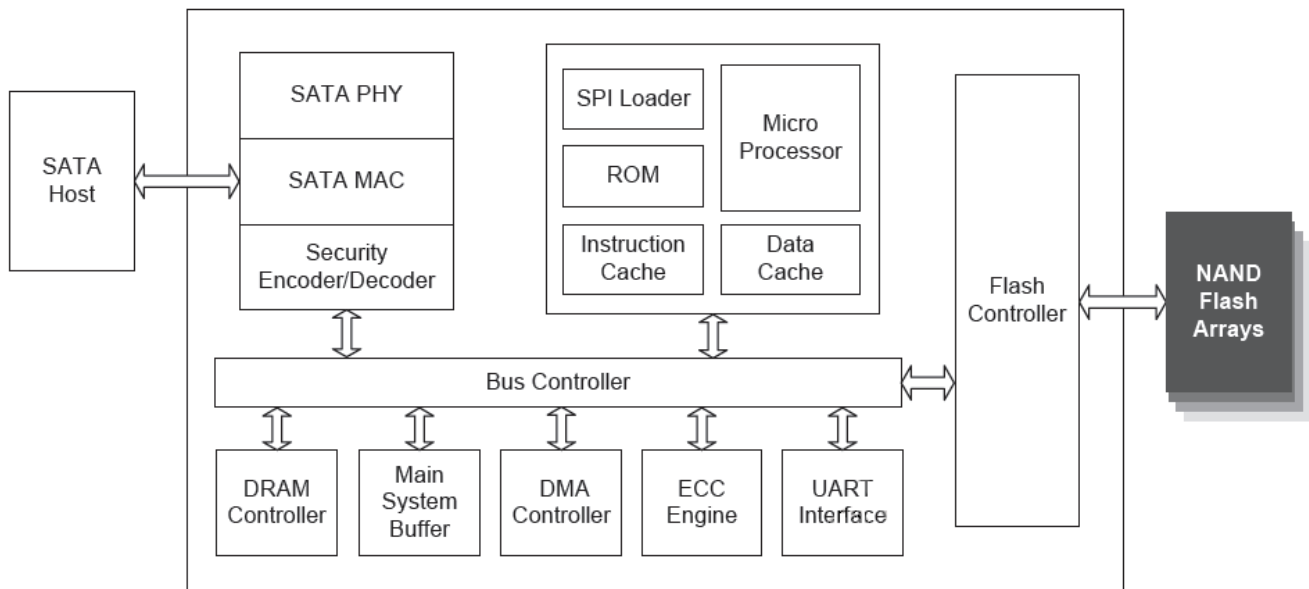


Figure 3: mSATA SSD Block Diagram



### 2.2.2. Pin Signal Assignment

The signals assigned for Serial ATA applications are described in Table 6.

| Pin definition     | Pin No.                                 |
|--------------------|---|
| GND                | 4,9,15,18,21,26,27,29,34,35,37,40,43,50 |
| 3V3 power+in       | 2,24,39,41,52                           |
| SATA Txn           | 25                                      |
| SATA Txp           | 23                                      |
| SATA Rxn           | 31                                      |
| SATA Rxp           | 33                                      |
| Presence Detection | 51                                      |
| DA/DSS             | 49                                      |

| Signal Name        | Pin # | Pin # | Signal Name |
|--------------------|-------|-------|-------------|
| Presence Detection | 51    | 52    | +3.3V       |
| DA/DSS             | 49    | 50    | GND         |
| NC                 | 47    | 48    | NC          |
| NC                 | 45    | 46    | NC          |
| GND                | 43    | 44    | NC          |
| +3.3V              | 41    | 42    | NC          |
| +3.3V              | 39    | 40    | GND         |
| GND                | 37    | 38    | NC          |
| GND                | 35    | 36    | NC          |
| +A – RX-           | 33    | 34    | GND         |
| -A – RX-           | 31    | 32    | NC          |
| GND                | 29    | 30    | NC          |
| GND                | 27    | 28    | NC          |
| -B – TX-           | 25    | 26    | GND         |
| +B – TX-           | 23    | 24    | +3.3V       |
| GND                | 21    | 22    | NC          |
| NC                 | 19    | 20    | NC          |
| NC                 | 17    | 18    | GND         |
| GND                | 15    | 16    | NC          |
| NC                 | 13    | 14    | NC          |
| NC                 | 11    | 12    | NC          |
| GND                | 9     | 10    | NC          |
| NC                 | 7     | 8     | NC          |
| NC                 | 5     | 6     | NC          |
| NC                 | 3     | 4     | GND         |
| NC                 | 1     | 2     | +3.3V       |

Table 6: mSATA SSD connector pin definition



Figure 4: mSATA SSD Connector Pin Assignment

## 2.3. Support ATA Commands

ATA Command Set summarizes the ATA command set with the paragraphs that follow describing the individual commands and the task file for each.

| Command                             | Code       | Protocol          |
|-------------------------------------|------------|-------------------|
| <b>General Feature Set</b>          |            |                   |
| Execute Drive Diagnostic            | 90h        | Device diagnostic |
| Flush Cache                         | E7h        | Non-data          |
| Identify Device                     | ECh        | PIO data-in       |
| Initialize Drive Parameters         | 91h        | Non-data          |
| Read DMA                            | C8h        | DMA               |
| Read Log Ext                        | 2Fh        | PIO data-in       |
| Read Multiple                       | C4h        | PIO data-in       |
| Read Sector(s)                      | 20h        | PIO data-in       |
| Read Verify Sector(s)               | 40h or 41h | Non-data          |
| Set Feature                         | EFh        | Non-data          |
| Set Multiple Mode                   | C6h        | Non-data          |
| Write DMA                           | CAh        | DMA               |
| Write Multiple                      | C5h        | PIO data-out      |
| Write Sector(s)                     | 30h        | PIO data-out      |
| NOP                                 | 00h        | Non-data          |
| Read Buffer                         | E4h        | PIO data-in       |
| Write Buffer                        | E8h        | PIO data-out      |
| <b>Power Management Feature Set</b> |            |                   |
| Check Power Mode                    | E5h or 98h | Non-data          |
| Idle                                | E3h or 97h | Non-data          |
| Idle Immediate                      | E1h or 95h | Non-data          |
| Sleep                               | E6h or 99h | Non-data          |
| Standby                             | E2h or 96h | Non-data          |
| Standby Immediate                   | E0h or 94h | Non-data          |
| <b>Security Mode Feature Set</b>    |            |                   |
| Security Set Password               | F1h        | PIO data-out      |
| Security Unlock                     | F2h        | PIO data-out      |
| Security Erase Prepare              | F3h        | Non-data          |
| Security Erase Unit                 | F4h        | PIO data-out      |
| Security Freeze Lock                | F5h        | Non-data          |
| Security Disable Password           | F6h        | PIO data-out      |

| Command                                | Code | Protocol     |
|--|------|--------------|
| <b>SMART Feature Set</b>               |      |              |
| SMART Disable Operations               | B0h  | Non-data     |
| SMART Enable/Disable Autosave          | B0h  | Non-data     |
| SMART Enable Operations                | B0h  | Non-data     |
| SMART Execute OFF-LINE Immediate       | B0h  | Non-data     |
| SMART Read Data                        | B0h  | PIO data-in  |
| SMART Read Threshold                   | B0h  | PIO data-in  |
| SMART Return Status                    | B0h  | Non-data     |
| SMART Save Attribute Values            | B0h  | Non-data     |
| <b>Host Protected Area Feature Set</b> |      |              |
| Read Native Max Address                | F8h  | Non-data     |
| Set Max Address                        | F9h  | Non-data     |
| Set Max Set Password                   | F9h  | PIO data-out |
| Set Max Lock                           | F9h  | Non-data     |
| Set Max Freeze Lock                    | F9h  | Non-data     |
| Set Max Unlock                         | F9h  | PIO data-out |
| <b>48-bit Address Feature Set</b>      |      |              |
| Flush Cache Ext                        | EAh  | Non-data     |
| Read Sector(s) Ext                     | 24h  | PIO data-in  |
| Read DMA Ext                           | 25h  | DMA          |
| Read Multiple Ext                      | 29h  | PIO data-in  |
| Read Native Max Address Ext            | 27h  | Non-data     |
| Read Verify Sector(s) Ext              | 42h  | Non-data     |
| Set Max Address Ext                    | 37h  | Non-data     |
| Write DMA Ext                          | 35h  | DMA          |
| Write Multiple Ext                     | 39h  | PIO data-out |
| Write Sector(s) Ext                    | 34h  | PIO data-out |
| <b>NCQ Feature Set</b>                 |      |              |
| Read FPDMA Queued                      | 60h  | DMA Queued   |
| Write FPDMA Queued                     | 61h  | DMA Queued   |
| <b>Others</b>                          |      |              |
| Data Set Management                    | 06h  | DMA          |
| Seek                                   | 70h  | Non-data     |

Table 7: ATA Command List

## 2.4. Shock & Vibration

| Reliability      | Test Conditions                | Reference Standards |
|------------------|--------------------------------|---------------------|
| Vibration        | 10Hz to 2KHz, 20G, 3 axes      | IEC 60068-2-6       |
| Mechanical Shock | Duration: 0.5ms, 1500G, 3 axes | IEC 60068-2-27      |

Table 8: Shock/Vibration Testing for mSATA SSD

## 2.5. Error Detection and Correction

Highly sophisticated Error Correction Code algorithms are implemented. The ECC unit consists of the Parity Unit (parity-byte generation) and the Syndrome Unit (syndrome-byte computation). This unit implements an algorithm that can correct 66 bits per 1024 bytes in an ECC block. Code-byte generation during write operations, as well as error detection during read operation, is implemented on the fly without any speed penalties.

## 2.6. Wear-Leveling

Flash memory can be erased within a limited number of times. This number is called the erase cycle limit or write endurance limit and is defined by the flash array vendor. The erase cycle limit applies to each individual erase block in the flash device.

mSATA uses a static wear-leveling algorithm to ensure that consecutive writes of a specific sector are not written physically to the same page/block in the flash. This spreads flash media usage evenly across all pages, thereby extending flash lifetime.

## 2.7. Bad Blocks Management

Bad Blocks are blocks that contain one or more invalid bits whose reliability are not guaranteed. The Bad Blocks may be presented while the SSD is shipped, or may generate during the life time of the SSD. When the Bad Blocks is detected, it will be flagged, and not be used anymore. The SSD implement Bad Blocks management and replacement, Error Correct Code to avoid data error occurred. The functions will be enabled automatically to transfer data from Bad Blocks to spare blocks, and correct error bit. After the reserved block less than 10 of each channel, the SSD will be locked, and cannot be read and written anymore. Host can send a vendor ATA command to unlock the SSD for backup data or system from SSD.

## 2.8. Mean Time between Failures (MTBF)

**Failure Rate:** The total number of failures within an item population, divided by the total number of life units expended by that population, during a particular measurement interval under stated condition.

**Mean Time between Failures (MTBF):** A basic measure of reliability for repairable items: The mean number of life units during which all parts of the item perform within their specified limits, during a particular measurement interval under stated conditions.

| Product   | Condition                 | MTBF (Hours) |
|-----------|---------------------------|--------------|
| mSATA SSD | Telcordia SR-332 GB, 25°C | >2,000,000   |

Table 9: mSATA SSD MTBF

## 2.9. Endurance

- Data Retention: 10 years.
- Flash Endurance: MLC: 3,000 P/E Cycle  
aMLC:20,000 P/E Cycle
- Wear-Leveling Algorithm: Support.
- Bad Blocks Management: Support.
- Error Correct Code: Support.

## 2.10. Transfer Mode

- mSATA SSD support following transfer mode:
  - Serial ATA I 1.5Gbps
  - Serial ATA II 3.0Gbps
  - Serial ATA III 6.0Gbps

## 3. Installation Requirements

### 3.1. mSATA Pin Directions

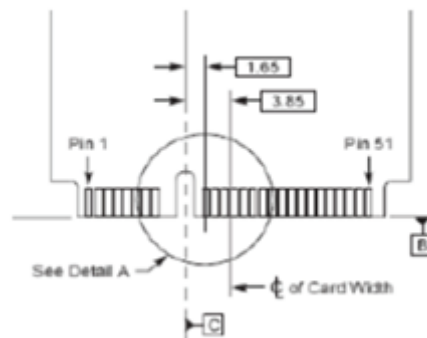


Figure 5: Signal Segment and Power Segment

### 3.2. Electrical Connections for mSATA

A Serial ATA device may be either directly connected to a host or connected to a host through a cable. For connection via cable, the cable should be no longer than 1 meter. The SATA interface has a separate connector for the power supply. Please refer to the pin description for further details.

### 3.3. Device Drive

No additional device drives are required. The mSATA can be configured as a boot device.

## 4. Ordering Information

| P/N            | Capacity | Remark                                    |
|----------------|----------|---|
| CMS64GMCTJFSVG | 64GB     | Toshiba MLC 15nm BGA Type<br>Normal Temp  |
| CMS12GMCTJFSVG | 128GB    |   |
| CMS25GMCTJFSVG | 256GB    |   |
| CMS51GMCTKFSVG | 512GB    |   |
| CMS64GMITJFSVG | 64GB     | Toshiba MLC 15nm BGA Type<br>Wide Temp    |
| CMS12GMITJFSVG | 128GB    |   |
| CMS25GMITJFSVG | 256GB    |   |
| CMS51GMITKFSVG | 512GB    |   |
| CMS32GACTJFSVG | 32GB     | Toshiba aMLC 15nm BGA Type<br>Normal Temp |
| CMS64GACTJFSVG | 64GB     |   |
| CMS12GACTJFSVG | 128GB    |   |
| CMS25GACTKFSVG | 256GB    |   |
| CMS32GAITJFSVG | 32GB     | Toshiba aMLC 15nm BGA Type<br>Wide Temp   |
| CMS64GAITJFSVG | 64GB     |   |
| CMS12GAITJFSVG | 128GB    |   |
| CMS25GAITKFSVG | 256GB    |   |