

RoHS Compliant

ATA Flash Drive 257-M

Product Specifications (Toshiba 15nm)

March 29, 2016

Version 1.2



Apacer Technology Inc.

1F, No.32, Zhongcheng Rd., Tucheng Dist., New Taipei City, Taiwan, R.O.C

Tel: +886-2-2267-8000 Fax: +886-2-2267-2261

www.apacer.com

Features:

- **Standard ATA/IDE Bus Interface**
 - ATA command set compatible
 - ATA operating mode supports up to:
 - PIO Mode-4
 - Multiword DMA Mode-2
 - Ultra DMA Mode-6
- **Connector Type**
 - 44-pin male
- **Power Consumption***
 - Supply voltage: 5V
 - Active mode: 400 mA
 - Idle mode: 20 mA
- **Performance***
 - Sustained read: Up to 100 MB/sec
 - Sustained write: Up to 90 MB/sec
- **Capacity**
 - 32, 64, 128, 256 GB
- **NAND Flash Type: MLC**
- **Temperature Range**
 - Operation:
 - Standard: 0°C to 70°C
 - Extended: -40°C to 85°C
 - Storage: -40°C to 100°C
- **Flash Management**
 - Advanced wear-leveling algorithms
 - S.M.A.R.T.
 - Built-in hardware ECC: 72bit/1KB
 - Flash block management
 - Power failure management
- **ATA Secure Erase**
- **Master/Slave Jumper Setting**
- **RoHS Compliant**

*The values presented in Performance and Power consumption are typical and may vary depending on various settings and platforms.

Table of Contents

| | |
|---|-----------|
| 1. General Description | 3 |
| 2. Functional Block | 3 |
| 3. Pin Assignments..... | 4 |
| 3.1 Pin Definitions..... | 4 |
| 3.2 Jumper Setting | 5 |
| 4. Product Specifications..... | 6 |
| 4.1 Capacity Specifications | 6 |
| 4.2 Performance Specifications..... | 6 |
| 4.3 Environmental Specifications | 6 |
| 5. Flash Management | 7 |
| 5.1 Advanced Wear-Leveling Algorithms | 7 |
| 5.2 S.M.A.R.T. | 7 |
| 5.3 Built-in Hardware ECC | 7 |
| 5.4 Flash Block Management..... | 7 |
| 5.5 Power Failure Management | 8 |
| 6. Software Interface | 9 |
| 6.1 Command Set..... | 9 |
| 6.2 ATA Secure Erase..... | 9 |
| 7. Electrical Specifications | 10 |
| 8. Physical Characteristics..... | 11 |
| 9. Product Ordering Information..... | 12 |
| 9.1 Product Code Designations..... | 12 |
| 9.2 Valid Combinations..... | 13 |
| 9.2.1 Standard Temperature..... | 13 |
| 9.2.2 Extended Temperature..... | 13 |

1. General Description

Apacer's ATA-Flash Drive (AFD) is a high-performance, solid state drive (SSD) designed to replace a conventional IDE hard disk drive. AFD supports standard ATA/IDE protocol and can be plugged into a standard IDE connector commonly found in desktop or portable PCs. It is more rugged, reliable and power-efficient compared to the mechanical hard drive and is designed for use in rugged laptops, military devices, thin clients, Point of Sale (POS) terminals, telecom, medical instruments, surveillance systems and industrial PCs. AFD also offers users selectable Master/Slave operation through an external jumper setting. Apacer AFD Series is the best instant replacement for high-maintenance HDD where reliability is a major concern.

AFD includes a built-in microcontroller and file management firmware that communicates through with the ATA standard interfaces. AFD is designed to work at 5 Volts, support the standard ATA/IDE protocol up to PIO Mode-4, Multiword DMA Mode-2, and Ultra DMA Mode-6 interfaces, and use a standard ATA driver that fits to most of the mainstream operating systems.

Featuring technologies as Advanced Wear-leveling algorithms, S.M.A.R.T, Enhanced Data Integrity, Power Failure Management, and ATA Secure Erase, the AFD device assures users of security in storage applications.

2. Functional Block

The ATA-Flash Drive (AFD) includes the ATA controller and flash media, as well as the ATA standard interface. Figure 2-1 shows the functional block diagram.

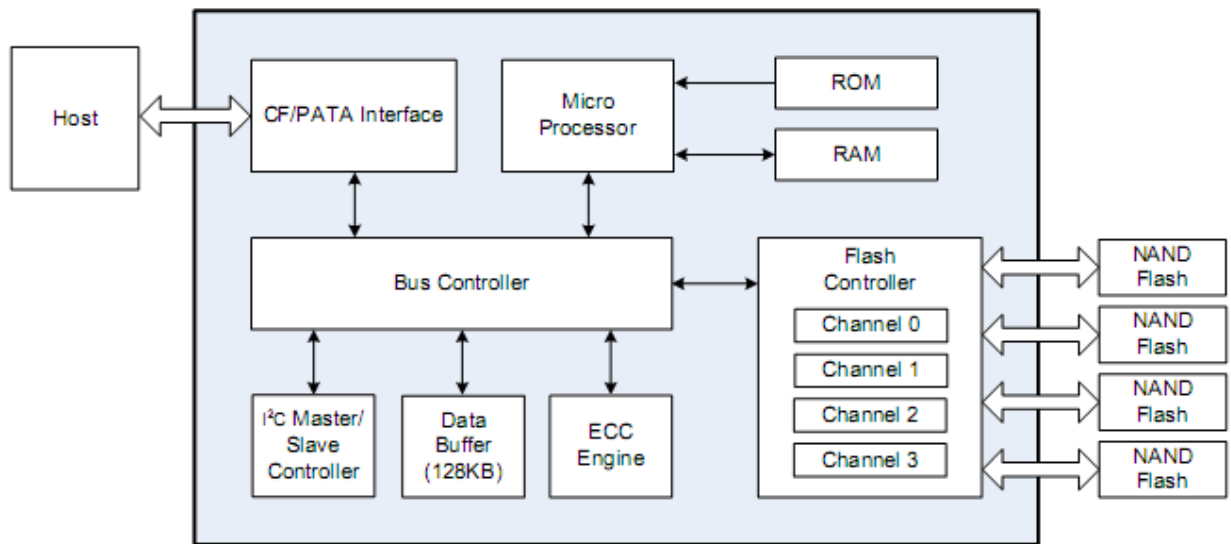


Figure 2-1 Functional Block Diagram

3. Pin Assignments

3.1 Pin Definitions

Table 3-1 lists the pin assignments with respective signal names for the 44-pin configuration. A “#” suffix indicates the active low signal. The pin type can be input, output or input/output.

Figure 3-1 44-pin Connector

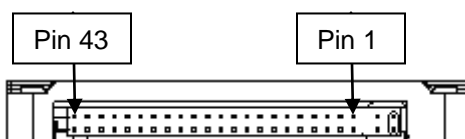


Table 3-1 Pin Assignments for the 44-Pin Configuration

| Pin No. | Signal Name | Pin Type | Pin No. | Signal Name | Pin Type |
|---------|-------------------------------|----------|---------|-------------|----------|
| 1 | RESET# | I | 2 | GND | - |
| 3 | D7 | I/O | 4 | D8 | I/O |
| 5 | D6 | I/O | 6 | D9 | I/O |
| 7 | D5 | I/O | 8 | D10 | I/O |
| 9 | D4 | I/O | 10 | D11 | I/O |
| 11 | D3 | I/O | 12 | D12 | I/O |
| 13 | D2 | I/O | 14 | D13 | I/O |
| 15 | D1 | I/O | 16 | D14 | I/O |
| 17 | D0 | I/O | 18 | D15 | I/O |
| 19 | GND | - | 20 | NC | - |
| 21 | DMARQ | O | 22 | GND | - |
| 23 | IOWR# | I | 24 | GND | - |
| 25 | IORD# HDMARDY# HSTROBE# | I | 26 | GND | - |
| 27 | IORDY DDMARDY# DSTROBE | O | 28 | CSEL | I |
| 29 | DMACK# | I | 30 | GND | - |
| 31 | INTRQ | O | 32 | IOCS16# | O |
| 33 | A1 | I | 34 | PDIAG# | I/O |
| 35 | A0 | I | 36 | A2 | I |
| 37 | CS1FX# | I | 38 | CS3FX# | I |
| 39 | DASP# | I/O | 40 | GND | - |
| 41 | VDD | - | 42 | VDD | - |
| 43 | GND | - | 44 | NC | - |

3.2 Jumper Setting



4. Product Specifications

4.1 Capacity Specifications

Capacity specifications of the ATA-Flash Drive (AFD) list out unformatted, out-of-box capacity information.

Table 4-1 Capacity Specifications

| Capacity | Total bytes* | Cylinders** | Heads | Sectors | Max LBA |
|----------|-----------------|-------------|-------|---------|-------------|
| 32 GB | 32,017,047,552 | 16383 | 16 | 63 | 62,533,296 |
| 64 GB | 64,023,257,088 | 16383 | 16 | 63 | 125,045,424 |
| 128 GB | 128,035,676,160 | 16383 | 16 | 63 | 250,069,680 |
| 256 GB | 256,060,514,304 | 16383 | 16 | 63 | 500,118,192 |

*Display of total bytes varies from file systems.

**Notes: 1 GB = 1,000,000,000 bytes; 1 sector = 512 bytes.

LBA count addressed in the table above indicates total user storage capacity and will remain the same throughout the lifespan of the device. However, the total usable capacity of the SSD is most likely to be less than the total physical capacity because a small portion of the capacity is reserved for device maintenance usages.

4.2 Performance Specifications

Performance of the ATA-Flash Drive is listed in Table 4-2.

Table 4-2 Performance Specifications

| Capacity | 32 GB | 64 GB | 128 GB | 256 GB |
|-------------------------------|-------|-------|--------|--------|
| Performance | | | | |
| Sustained read (MB/s) | 100 | 100 | 100 | 100 |
| Sustained write (MB/s) | 40 | 75 | 75 | 90 |

Note: Performance varies from flash configurations or host system configurations.

4.3 Environmental Specifications

Environmental specifications of the ATA-Flash Drive follow the standards of MIL-STD-810F.

Table 4-3 Environmental Specifications

| Item | Criteria |
|----------------------------------|--|
| Non-Operating Temperature | -40°C to 100°C |
| Operating Temperature | 0°C to 70°C (Standard); -40°C to 85°C (Extended) |
| Vibration* | Sine wave: 15(G), 10~2000(Hz); X, Y, Z axis |
| Shock* | 1,500(G), 0.5(ms), ±X, ±Y, ±Z axis |

*Non-operating

5. Flash Management

5.1 Advanced Wear-Leveling Algorithms

Flash memory devices differ from Hard Disk Drives (HDDs) in terms of how blocks are utilized. For HDDs, when a change is made to stored data, like erase or update, the controller mechanism on HDDs will perform overwrites on blocks. On the other hand, NAND flash storage adopt flash as their primary media. Unlike HDDs, flash blocks cannot be overwritten and each P/E cycle wears down the lifespan of blocks gradually. Repeatedly program/erase cycles performed on the same memory cells will eventually cause some blocks to age faster than others. This would bring flash storages to their end of service term earlier. Wear leveling is an important mechanism that level out the wearing of blocks so that the wearing-down of blocks can be almost evenly distributed. This will increase the lifespan of SSDs. Commonly used wear leveling types are Static and Dynamic.

5.2 S.M.A.R.T.

S.M.A.R.T. is an acronym for Self-Monitoring, Analysis and Reporting Technology, an open standard allowing disk drives to automatically monitor their own health and report potential problems. It protects the user from unscheduled downtime by monitoring and storing critical drive performance and attributes parameters. Ideally, this should allow taking proactive actions to prevent impending drive failure.

Apacer devices use the standard SMART command B0h to read data out from the drive to activate our SMART feature that complies with the ATA/ATAPI specifications. Based on the SFF-8035i Rev. 2.0 specifications, SMART Attribute IDs shall include Initial bad block count, Bad block count, Spare block count, Maximum erase count, Average erase count and Power cycle. When the SMART Utility running on the host, it analyzes and reports the disk status to the host before the device reaches in critical condition.

5.3 Built-in Hardware ECC

The properties of NAND flash memory make it ideal for applications that require high integrity while operating in challenging environments. The integrity of data to NAND flash memory is generally maintained through ECC algorithms. This ATA-Flash Drive is programmed with a hardware ECC engine which correct up to 72 bits per 1KB.

5.4 Flash Block Management

Current process technology is unable to guarantee total reliability of NAND flash memory array. When a flash memory device leaves factory, it comes with a highly minimal number of initial bad block during production or out-of-factory as there is no currently known technology that produce flash chips free of bad blocks. On the other hand, bad blocks may develop during program/erase cycles. When host performs program/erase command on a block, bad block may appear in Status Register. Since bad blocks are inevitable, the solution is to keep them in control. Apacer flash devices are programmed with ECC, block mapping technique and S.M.A.R.T to reduce invalidity or error. Once bad blocks are detected, data in those blocks will be transferred to free blocks and error will be corrected by designated algorithms.

5.5 Power Failure Management

Power Failure Management plays a crucial role when experiencing unstable power supply. Power disruption may occur when users are storing data into the SSD. In this urgent situation, the controller would run multiple write-to-flash cycles to store the metadata for later block rebuilding. This urgent operation requires about several milliseconds to get it done. At the next power up, the firmware will perform a status tracking to retrieve the mapping table and resume previously programmed NAND blocks to check if there is any incompleteness of transmission.

6. Software Interface

6.1 Command Set

Table 6-1 Command Set

| Code | Command | Code | Command |
|------|------------------------------|------|---------------------------|
| E5h | Check Power Mode | F6h | Security Disable Password |
| 92h | Download Microcode | F3h | Security Erase Prepare |
| 90h | Execute Device Diagnostic | F4h | Security Erase Unit |
| E7h | Flush Cache | F5h | Security Freeze Lock |
| EAh | Flush Cache EXT | F1h | Security Set Password |
| ECh | Identify Device | F2h | Security Unlock |
| A1h | Identify Packet Device | 70h | Seek |
| E3h | Idle | EFh | Set Features |
| E1h | Idle Immediate | F9h | Set Max* |
| 91h | Initialize Device Parameters | 91h | Set Max Address EXT |
| 00h | NOP | C6h | Set Multiple Mode |
| E4h | Read Buffer | E6h | Sleep |
| C8h | Read DMA | B0h | SMART |
| 25h | Read DMA EXT | E2h | Standby |
| C4h | Read Multiple | E0h | Standby Immediate |
| 29h | Read Multiple EXT | E8h | Write Buffer |
| F8h | Read Native Max Address | CAh | Write DMA |
| 27h | Read Native Max Address EXT | 35h | Write DMA EXT |
| 20h | Read Sector | C5h | Write Multiple |
| 24h | Read Sector EXT | 39h | Write Multiple EXT |
| 40h | Read Verify Sectors | 30h | Write Sector |
| 42h | Read Verify Sectors EXT | 34h | Write Sector EXT |
| 10h | Recalibrate | | |

*The command can be configured as "Set Max Lock", "Set Max Address", "Set Max Set Password", "Set Max Unlock" and "Set Max Freeze Lock", depending on the transfer mode in operation.

6.2 ATA Secure Erase

ATA Secure Erase is an ATA disk purging command currently embedded in most of the storage drives. Defined in ATA specifications, (ATA) Secure Erase is part of Security Feature Set that allows storage drives to erase all user data areas. The erase process usually runs on the firmware level as most of the ATA-based storage media currently in the market are built-in with this command. ATA Secure Erase can securely wipe out the user data in the drive and protects it from malicious attack.

7. Electrical Specifications

Table 7-1 Operating Voltage & Temperature

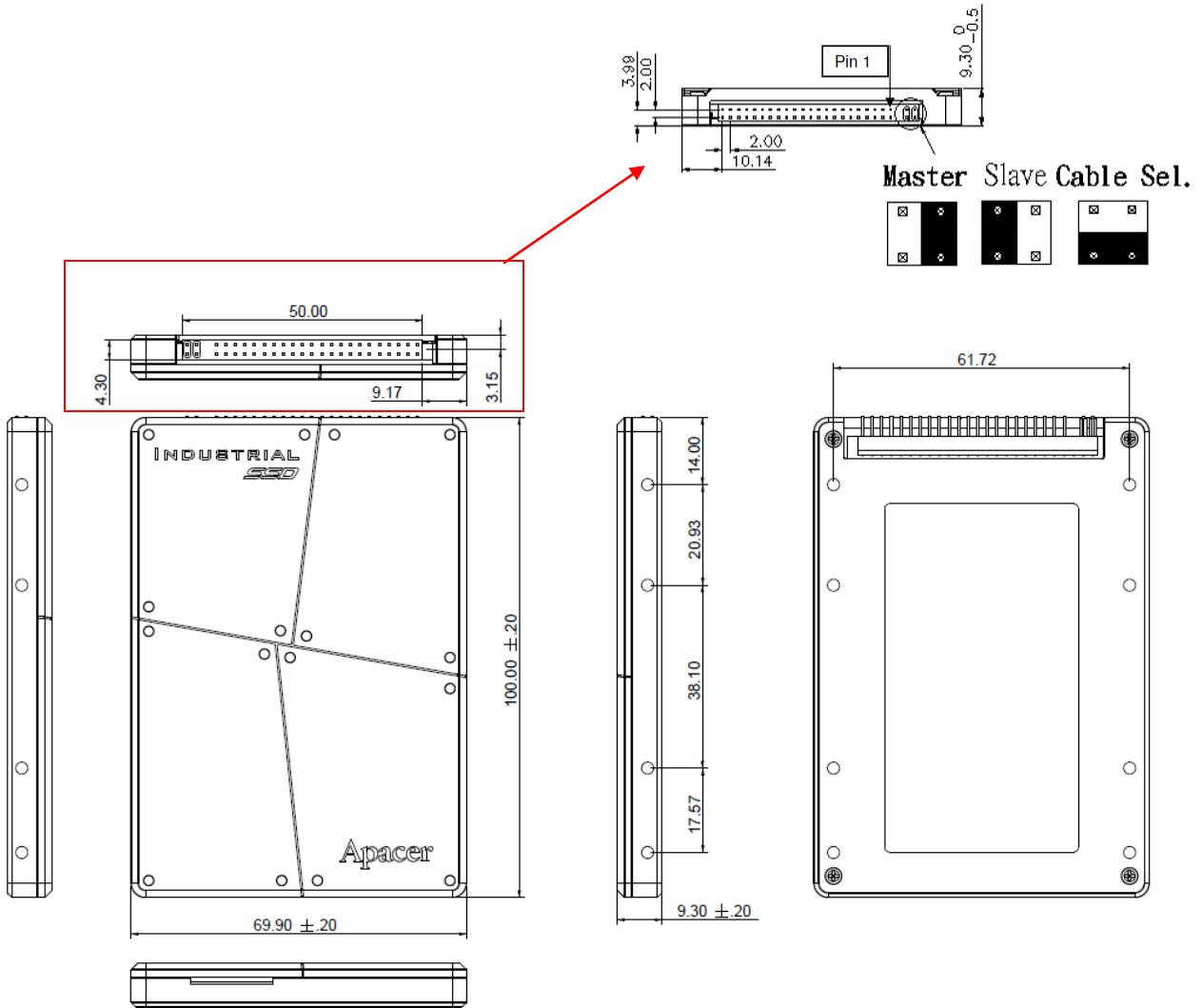
| | | |
|----------------------------|-----------------|---------------------|
| Ambient Temperature | Standard | 0°C to 70°C |
| | Extended | -40°C to 85°C |
| Operating voltage | | 5V± 5% (4.75-5.25V) |

Table 7-2 Power Consumption

| Modes \ Capacity | 32 GB | 64 GB | 128 GB | 256 GB |
|-------------------------|--------------|--------------|---------------|---------------|
| Active (mA) | 265 | 270 | 265 | 400 |
| Idle (mA) | 20 | 20 | 20 | 20 |

Note: Power consumption varies from flash configurations or host system configurations.

8. Physical Characteristics



9. Product Ordering Information

9.1 Product Code Designations



9.2 Valid Combinations

9.2.1 Standard Temperature

| Capacity | Model Number |
|----------|-----------------------|
| 32GB | AP-FD25C22E0032GS-5TM |
| 64GB | AP-FD25C22E0064GS-5TM |
| 128GB | AP-FD25C22E0128GS-5TM |
| 256GB | AP-FD25C22E0256GS-5TM |

9.2.2 Extended Temperature

| Capacity | Model Number |
|----------|------------------------|
| 32GB | AP-FD25C22E0032GS-W5TM |
| 64GB | AP-FD25C22E0064GS-W5TM |
| 128GB | AP-FD25C22E0128GS-W5TM |
| 256GB | AP-FD25C22E0256GS-W5TM |

Note: Valid combinations are those products in mass production or will be in mass production. Consult your Apacer sales representative to confirm availability of valid combinations and to determine availability of new combinations.

Revision History

| Revision | Date | Description | Remark |
|----------|-----------|--------------------------------------|--------|
| 1.0 | 1/6/2016 | Official release | |
| 1.1 | 2/25/2016 | Revised power consumption values | |
| 1.2 | 3/29/2016 | Revised product ordering information | |

Global Presence

| | |
|------------------------------|---|
| Taiwan (Headquarters) | Apacer Technology Inc. 1F., No.32, Zhongcheng Rd., Tucheng Dist., New Taipei City 236, Taiwan R.O.C. Tel: 886-2-2267-8000 Fax: 886-2-2267-2261 amtsales@apacer.com |
| U.S.A. | Apacer Memory America, Inc. 46732 Lakeview Blvd., Fremont, CA 94538 Tel: 1-408-518-8699 Fax: 1-510-249-9568 sa@apacerus.com |
| Japan | Apacer Technology Corp. 5F, Matsura Bldg., Shiba, Minato-Ku Tokyo, 105-0014, Japan Tel: 81-3-5419-2668 Fax: 81-3-5419-0018 jpservices@apacer.com |
| Europe | Apacer Technology B.V. Science Park Eindhoven 5051 5692 EB Son, The Netherlands Tel: 31-40-267-0000 Fax: 31-40-267-0000#6199 sales@apacer.nl |
| China | Apacer Electronic (Shanghai) Co., Ltd Room D, 22/FL, No.2, Lane 600, JieyunPlaza, Tianshan RD, Shanghai, 200051, China Tel: 86-21-6228-9939 Fax: 86-21-6228-9936 sales@apacer.com.cn |
| India | Apacer Technologies Pvt Ltd, Unit No.201, "Brigade Corner", 7 th Block Jayanagar, Yediyur Circle, Bangalore – 560082, India Tel: 91-80-4152-9061 Fax: 91-80-4170-0215 sales_india@apacer.com |

Данный компонент на территории Российской Федерации

Вы можете приобрести в компании MosChip.

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

<http://moschip.ru/get-element>

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru

moschip.ru_4

moschip.ru_6

moschip.ru_9