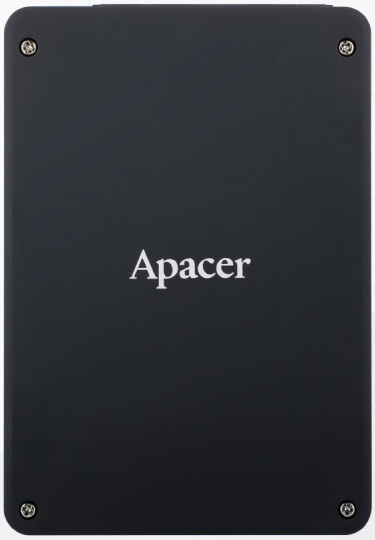
Apacer

RoHS Compliant

Serial ATA Flash Drive

Industrial SS210-25 Product Specifications



March 4, 2024

Version 2.7

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

Apacer

Specifications Overview:

- **Compliance with SATA Revision 3.1**
  - SATA 6 Gb/s interface
  - Backward compatible with SATA 1.5 and 3 Gb/s interfaces
  - ATA-8 command set
- **Capacity**
  - 8, 16, 32, 64, 128, 240 GB
- **Performance**[1]
  - Burst read/write: 600 MB/sec
  - Sequential read: Up to 530 MB/sec
  - Sequential write: Up to 445 MB/sec
  - Random read (4K): Up to 82,000 IOPS
  - Random write (4K): Up to 76,000 IOPS
- **Flash Management**
  - Built-in hardware ECC
  - Global Wear Leveling
  - Flash bad-block management
  - S.M.A.R.T.
  - Power Failure Management
  - Device Sleep
  - ATA Secure Erase
  - TRIM
- **NAND Flash Type:** SLC
- **MTBF:** >3,000,000 hours
- **Endurance (in Terabytes Written: TBW)**
  - 8 GB: 339 TBW
  - 16 GB: 612 TBW
  - 32 GB: 1,348 TBW
  - 64 GB: 2,819 TBW
  - 128 GB: 6,000 TBW
  - 240 GB: 12,122 TBW
- **Temperature Range**
  - Operating:
    - Standard: 0°C to 70°C
    - Wide: -40°C to 85°C
  - Storage: -55°C to 100°C
- **Supply Voltage**
  - 5V ± 5%
- **Power Consumption**[1]
  - Active mode (Max.): 475 mA
  - Idle mode: 75 mA
- **SATA Power Management Mode**
- **Connector Type**
  - 7-pin SATA signal connector
  - 15-pin SATA power connector
- **Reliability**
  - Thermal Sensor
- **Physical Characteristics**
  - Form factor: 2.5”
  - Dimensions with 7mm enclosure: 100.00 x 69.85 x 6.90, unit: mm
  - Dimensions with 9.5mm enclosure: 100.00 x 69.84 x 9.30, unit: mm
- **RoHS Compliant**

Note:
1. Varies from capacities. The values for performances and power consumptions presented are typical and may vary depending on flash configurations or platform settings. The term idle refers to the standby state of the device.

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1. General Description

Apacer's SS210-25 is a well-balanced solid-state disk (SSD) drive with standard form factor and great performance. Designed in SATA 6 Gb/s interface, the SSD provides full compliance with the SATA Revision 3.1 interface specifications and delivers exceptional read/write speed, making it the ideal companion for heavy-loading industrial or server operations.

SS210-25 is built with a powerful SATA controller that supports on-the-module ECC for error correction as well as efficient wear leveling scheme for extended lifespan. Moreover, SS210-25 is equipped with not only a built-in thermal sensor to monitor the temperature of the SSD via S.M.A.R.T health monitoring to prevent overheating. Operating under 6 Gb/s interface, SS210-25 is provided with Apacer latest S.M.A.R.T. that is primarily oriented for the latest SATA interface SSD, for drive lifetime monitoring and analysis. The drive also comes with various implementations including flash block management, ATA secure erase, power failure management, TRIM, Device Sleep, and power saving modes.

With exceptional performance and enhanced reliability, SS210-25 is definitely the ideal storage or cache solution for a variety of applications ranging from industrial, imaging, computing to enterprise markets.

2. Functional Block

Apacer SS210-25 includes a single-chip controller designed with a DRAM and flash media. The controller integrates the flash management unit to support multi-channel, multi-bank flash arrays. Figure 2-1 shows the functional block diagram.

Note: The actual number of NAND flash used on Apacer SS210-25 varies from capacities. The illustration is for reference only.

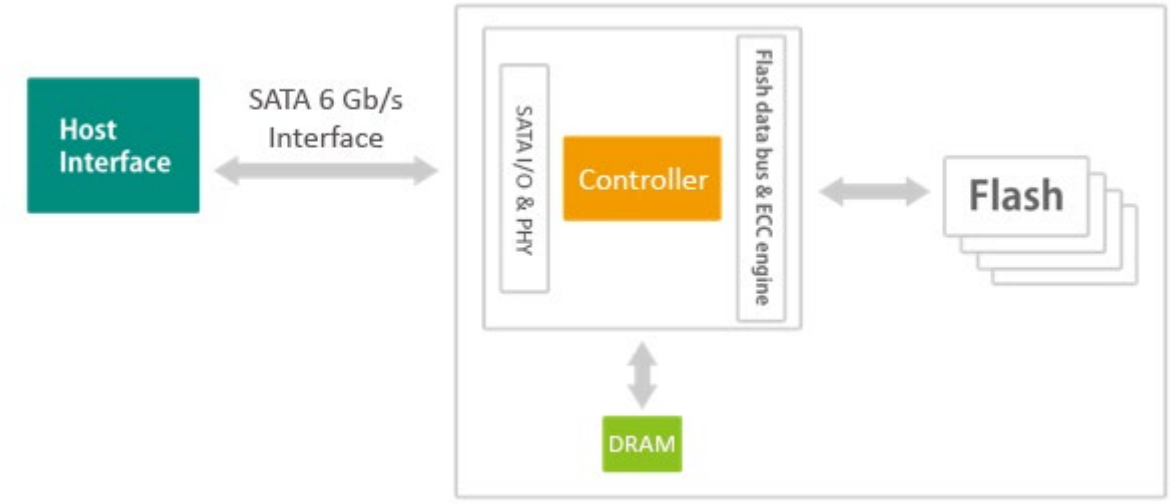


Figure 2-1 Functional Block Diagram

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3. Pin Assignments

Table 3-1 describes the signal segment, and Table 3-2, power segment.

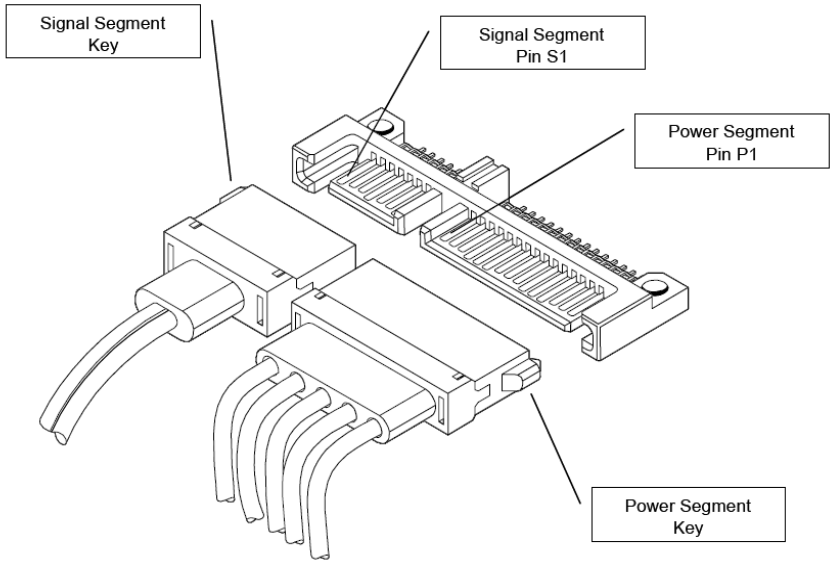


Figure 3-1 SATA Connectors

Table 3-1 Signal Segment

Pin	Type	Description
S1	GND	
S2	RxP	+ Differential Receive Signal
S3	RxN	- Differential Receive Signal
S4	GND	
S5	TxN	- Differential Transmit Signal
S6	TxP	+ Differential Transmit Signal
S7	GND	

Table 3-2 Power Segment

Pin	Signal/Description
P1	Unused (3.3V)
P2	Unused (3.3V)
P3	Device Sleep
P4	Ground
P5	Ground
P6	Ground
P7	5V
P8	5V
P9	5V
P10	Ground
P11	DAS
P12	Ground
P13	Unused (12V)
P14	Unused (12V)
P15	Unused (12V)

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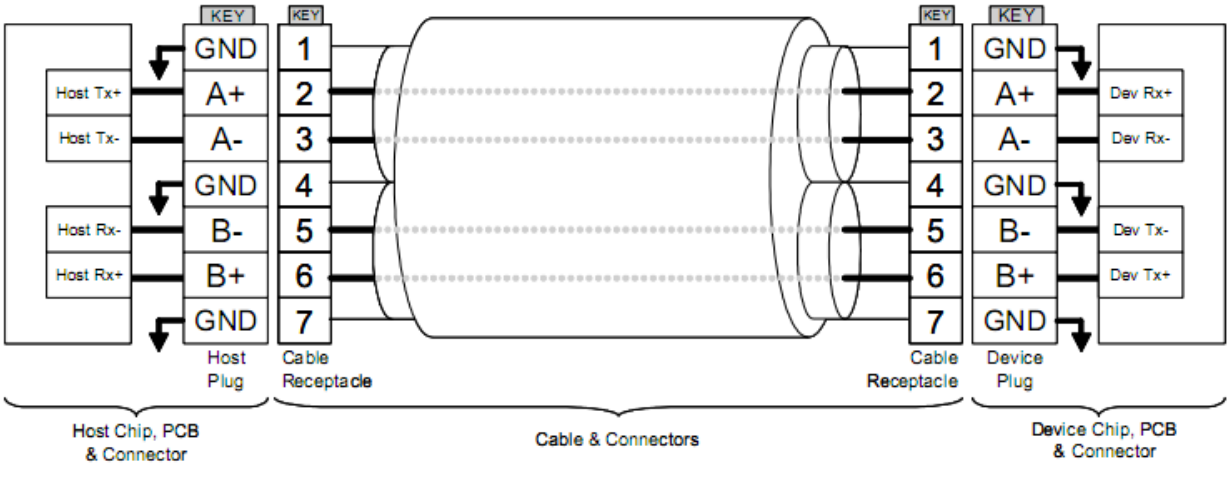


Figure 3-2 SATA Cable/Connector Connection Diagram

The connector on the left represents the Host with TX/RX differential pairs connected to a cable. The connector on the right shows the Device with TX/RX differential pairs also connected to the cable. Notice also the ground path connecting the shielding of the cable to the Cable Receptacle.

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4. Product Specifications

4.1 Capacity

Capacity specifications of SS210-25 are available as shown in Table 4-1. It lists the specific capacity and the default numbers of heads, sectors and cylinders for each product line.

Table 4-1 Capacity Specifications

Capacity	Total bytes	Cylinders	Heads	Sectors	Total LBA
8 GB	8,012,390,400	15,525	16	63	15,649,200
16 GB	16,013,942,784	16,383	16	63	31,277,232
32 GB	32,017,047,552	16,383	16	63	62,533,296
64 GB	64,023,257,088	16,383	16	63	125,045,424
128 GB	128,035,676,160	16,383	16	63	250,069,680
240 GB	240,057,409,536	16,383	16	63	468,862,128

Notes:
- Display of total bytes varies from operating systems.
- 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

Performance of SS210-25 is listed below in Table 4-2.

Table 4-2 Performance Specifications

Performance \ Capacity	8 GB	16 GB	32 GB	64 GB	128 GB	240 GB
Sequential Read (MB/s)	135	135	530	530	530	320
Sequential Write (MB/s)	105	115	270	440	445	440
4K Random Read (IOPS)	25,000	26,000	81,000	82,000	82,000	51,000
4K Random Write (IOPS)	6,000	17,000	62,000	73,000	76,000	74,000

Notes:
- Results may differ from various flash configurations or host system setting.
- Sequential read/write is based on CrystalDiskMark 5.2.1 with file size 1,000MB.
- Random read/write is measured using IOMeter with Queue Depth 32.

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4.3 Environmental

Environmental specifications of SS210-25 product are shown in Table 4-3.

Table 4-3 Environmental Specifications

Parameter	Type	Specifications
Temperature	Operating	0°C to 70°C (Standard); -40°C to 85°C (Wide)
	Non-operating	-55°C to 100°C
Vibration	Operating	7.69 GRMS, 20~2000 Hz/random (compliant with MIL-STD-810G)
	Non-operating	4.02 GRMS, 15~2000 Hz/random (compliant with MIL-STD-810G)
Shock	Operating	Acceleration, 50(G)/11(ms)/half sine (compliant with MIL-STD-202G)
	Non-operating	Acceleration, 1500(G)/0.5(ms)/half sine (compliant with MIL-STD-883K)

Note: This Environmental Specification table indicates the conditions for testing the device. Real world usages may affect the results.

4.4 Mean Time Between Failures (MTBF)

Mean Time Between Failures (MTBF) is predicted based on reliability data for the individual components in SS210-25. The prediction result for SS210-25 is more than 3,000,000 hours.

Note: The MTBF is predicated and calculated based on “Telcordia Technologies Special Report, SR-332, Issue 3” method.

4.5 Certification and Compliance

SS210-25 complies with the following standards:

- CE
- UKCA
- FCC
- RoHS
- MIL-STD-810F

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4.6 Endurance

The endurance of a storage device is predicted by TeraBytes Written based on several factors related to usage, such as the amount of data written into the drive, block management conditions, and daily workload for the drive. Thus, key factors, such as Write Amplifications and the number of P/E cycles, can influence the lifespan of the drive.

Table 4-4 Endurance Specifications

Capacity	TeraBytes Written
8 GB	339
16 GB	612
32 GB	1,348
64 GB	2,819
128 GB	6,000
240 GB	12,122

Notes:

- This estimation complies with JEDEC JESD-219, enterprise endurance workload of random data with payload size distribution.
- Flash vendor guaranteed SLC P/E cycle: 60K
- WAF may vary from capacity, flash configurations and writing behavior on each platform.
- 1 Terabyte = 1,024GB

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5. Flash Management

5.1 Error Correction/Detection

SS210-25 implements a hardware ECC scheme, based on the BCH algorithm. It can detect and correct up to 40 bits error in 1K bytes.

5.2 Bad Block Management

Current production technology is unable to guarantee total reliability of NAND flash memory array. When a flash memory device leaves factory, it comes with a minimal number of initial bad blocks during production or out-of-factory as there is no currently known technology that produce flash chips free of bad blocks. In addition, bad blocks may develop during program/erase cycles. Since bad blocks are inevitable, the solution is to keep them in control. Apacer flash devices are programmed with ECC, page 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.

5.3 Global Wear Leveling

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. 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 sooner. Global wear leveling is an important mechanism that levels out the wearing of all blocks so that the wearing-down of all blocks can be almost evenly distributed. This will increase the lifespan of SSDs.

5.4 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.

5.5 Power Failure Management

Power Failure Management plays a crucial role when power supply becomes unstable. Power disruption may occur when users are storing data into the SSD, leading to instability in the drive. However, with Power Failure Management, a firmware protection mechanism will be activated to scan pages and blocks once power is resumed. Valid data will be transferred to new blocks for merging and the mapping table will be rebuilt. Therefore, data reliability can be reinforced, preventing damage to data stored in the NAND Flash.

Note: The controller unit of this product model is designed with a DRAM as a write cache for improved performance and data efficiency. Though unlikely to happen in most cases, the data cached in the volatile DRAM might be potentially affected if a sudden power loss takes place before the cached data is flushed into non-volatile NAND flash memory.

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5.6 TRIM

TRIM is a SATA command that helps improve the read/write performance and efficiency of solid-state drives (SSD). The command enables the host operating system to inform SSD controller which blocks contain invalid data, mostly because of the erase commands from host. The invalid will be discarded permanently and the SSD will retain more space for itself.

5.7 Device Sleep (DevSleep or DEVSLP) Mode

Device Sleep is a feature that allows SATA devices to enter a low power mode by designating a particular pin as DEVSLP signal with an aim to reducing power consumption.

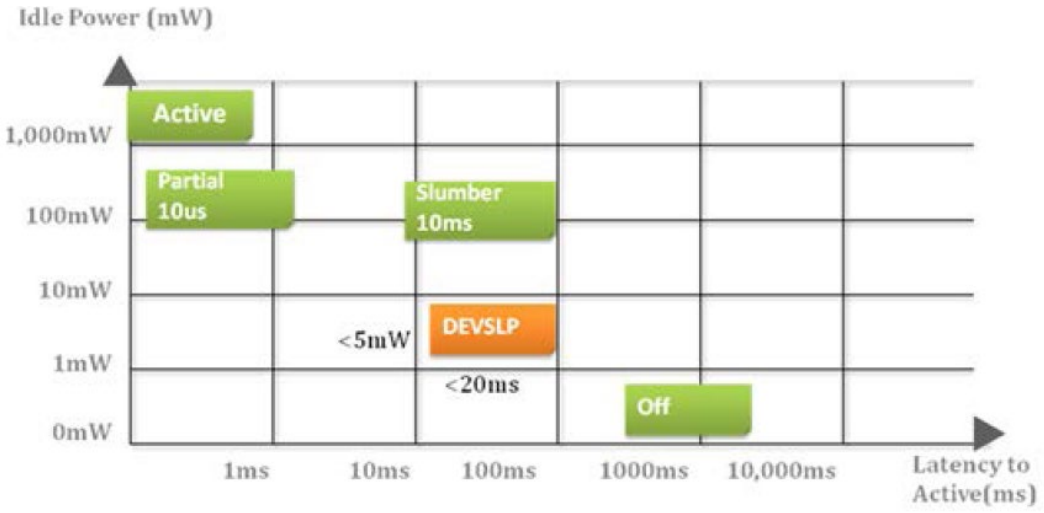


Figure 5-1 Device Sleep

5.8 SATA Power Management

By complying with SATA 6 Gb/s specifications, the SSD supports the following SATA power saving modes:

- ACTIVE: PHY ready, full power, TX & RX operational
- PARTIAL: Reduces power, resumes in under 10 µs (microseconds)
- SLUMBER: Reduces power, resumes in under 10 ms (milliseconds)
- HIPM: Host-Initiated Power Management
- DIPM: Device-Initiated Power Management
- AUTO-SLUMBER: Automatic transition from partial to slumber.
- Device Sleep (DevSleep or DEVSLP): PHY powered down; power consumption ≦ 5 mW; host assertion time ≦ 10 ms; exit timeout from this state ≦ 20 ms (unless specified otherwise in SATA Identify Device Log).

Note: The behaviors of power management features would depend on host/device settings.

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6. Reliability Features

6.1 Thermal Sensor

Apacer Thermal Sensor is a digital temperature sensor with serial interface. By using a designated pin for transmission, storage device owners are able to read temperature data.

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7. Software Interface

7.1 Command Set

This section defines the software requirements and the format of the commands the host sends to SS210-25. Commands are issued to SS210-25 by loading the required registers in the command block with the supplied parameters, and then writing the command code to the Command register.

Table 7-1 Command Set

Code	Command	Code	Command
E5h	CHECK POWER MODE	F4h	SECURITY ERASE UNIT
06h	DATA SET MANAGEMENT	F5h	SECURITY FREEZE LOCK
92h	DOWNLOAD MICROCODE	F1h	SECURITY SET PASSWORD
90h	EXECUTE DEVICE DIAGNOSTIC	F2h	SECURITY UNLOCK
E7h	FLUSH CACHE	70h	SEEK
EAh	FLUSH CACHE EXT	EFh	SET FEATURES
ECh	IDENTIFY DEVICE	C6h	SET MULTIPLE MODE
E3h	IDLE	E6h	SLEEP
E1h	IDLE IMMEDIATE	B0h	SMART
91h	INITIALIZE DEVICE PARAMETERS	E2h	STANDBY
E4h	READ BUFFER	E0h	STANDBY IMMEDIATE
C8h	READ DMA	E8h	WRITE BUFFER
25h	READ DMA EXT	CAh	WRITE DMA
60h	READ FPDMA QUEUED	35h	WRITE DMA EXT
C4h	READ MULTIPLE	3Dh	WRITE DMA FUA EXT
29h	READ MULTIPLE EXT	61h	WRITE FPDMA QUEUED
2Fh	READ LOG EXT	3Fh	WRITE LOG EXT
47h	READ LOG DMA EXT	57h	WRITE LOG DMA EXT
20h	READ SECTOR	C5h	WRITE MULTIPLE
24h	READ SECTOR EXT	39h	WRITE MULTIPLE EXT
40h	READ VERIFY SECTORS	CEh	WRITE MULTIPLE FUA EXT
42h	READ VERIFY SECTORS EXT	30h	WRITE SECTOR
10h	RECALIBRATE	34h	WRITE SECTOR EXT
F6h	SECURITY DISABLE PASSWORD	45h	WRITE UNCORRECTABLE EXT
F3h	SECURITY ERASE PREPARE		

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7.2 S.M.A.R.T.

SMART, an acronym for Self-Monitoring, Analysis and Reporting Technology, is an open standard that allows a hard disk drive to automatically detect its health and report potential failures. When a failure is recorded by SMART, users can choose to replace the drive to prevent unexpected outage or data loss. Moreover, SMART can inform users of impending failures while there is still time to perform proactive actions, such as copy data to another device.

Table 7-2 SMART Subcommand Set

Code	SMART Subcommand
D0h	READ DATA
D1h	READ ATTRIBUTE THRESHOLDS
D2h	ENABLE/DISABLE ATTRIBUTE AUTOSAVE
D4h	EXECUTE OFF-LINE IMMEDIATE
D5h	SMART READ LOG
D6h	SMART WRITE LOG
D8h	ENABLE OPERATIONS
D9h	DISABLE OPERATIONS
DAh	RETURN STATUS

Table 7-3 General SMART Attribute Structure

Byte	Description
0	ID (Hex)
1 – 2	Status Flag
3	Value
4	Worst
5*-11	Raw Data

*Byte 5: LSB

Table 7-4 SMART Attribute ID List

ID (Hex)	Attribute Name
9 (0x09)	Power-on Hours
12 (0x0C)	Power Cycle Count
163 (0xA3)	Maximum Erase Count
164 (0xA4)	Average Erase Count
166 (0xA6)	Total Later Bad Block Count
167 (0xA7)	SSD Protect Mode (Vendor Specific)
168 (0xA8)	SATA PHY Error Count
171 (0xAB)	Program Fail Count
172 (0xAC)	Erase Fail Count
175 (0xAF)	Bad Cluster Table Count
192 (0xC0)	Unexpected Power Loss Count
194 (0xC2)	Temperature
231 (0xE7)	Lifetime Left
241 (0xF1)	Total Sectors of Write

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8. Electrical Specifications

8.1 Operating Voltage

Table 8-1 lists the supply voltage for SS210-25.

Table 8-1 Operating Range

Item	Range
Supply Voltage	5V ± 5% (4.75-5.25V)

8.2 Power Consumption

Table 8-2 lists the power consumption for SS210-25.

Table 8-2 Power Consumption

Capacity / Mode	Unit	8 GB	16 GB	32 GB	64 GB	128 GB	240 GB
Active (Max.)	mA	275	190	305	440	470	475
Idle		70	75	75	70	70	75

Notes:
- All values are typical and may vary depending on flash configurations or host system settings.
- Power consumption is measured using CrystalDiskMark 5.2.1 with file size 1,000MB.

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9. Mechanical Specifications

9.1 7mm Type Dimensions

Table 9-1 Physical Dimensions

Parameter	Unit	8 GB	16 GB	32 GB	64 GB	128 GB	240 GB
Length	mm	100.00 ± 0.20					
Width		69.85 ± 0.20					
Height		6.90 + 0.10/-0.40					

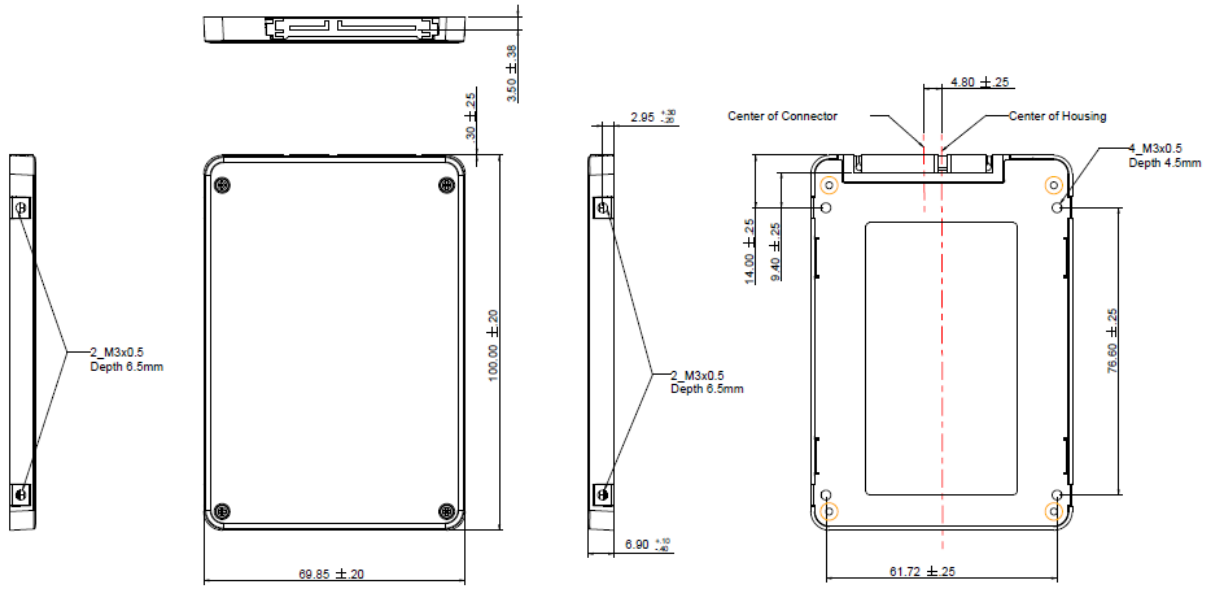


Figure 9-1 7mm Housing Physical Dimensions

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9.2 9.5mm Type Dimensions

Table 9-2 Physical Dimensions

Parameter	Unit	8 GB	16 GB	32 GB	64 GB	128 GB	240 GB
Length	mm	100.00 ± 0.20					
Width		69.84 ± 0.20					
Height		9.30 ± 0.20					

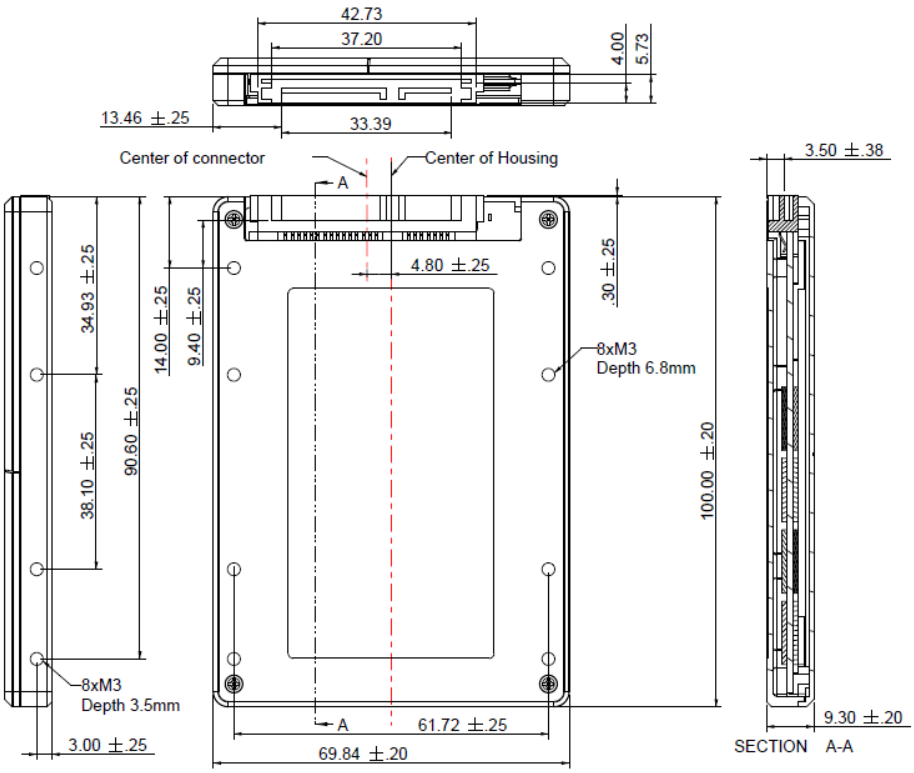


Figure 9-2 9.5mm Housing Physical Dimensions

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10. Product Ordering Information

10.1 Product Code Designations

AP S 25A F X xxxG – 7X T X T

Features
T: Thermal Sensor

Temperature Range
Blank: Standard Temperature
W: Wide Temperature

Flash Type

Version Control

Capacity
008G: 8GB
016G: 16GB
032G: 32GB
064G: 64GB
128G: 128GB
240G: 240GB

Housing Type
B: 9.5mm
7: 7mm

Solution Version

2.5 inch Form Factor

Serial ATA Flash Drive

Apacer Product Code

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10.2 Valid Combinations

The following tables list the available model of the SS210-25 series which are 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.

10.2.1 9.5mm Metal Housing

Capacity	Standard Temperature	Wide Temperature
8GB	APS25AFB008G-7BTT	APS25AFB008G-7BTWT
16GB	APS25AFB016G-7BTT	APS25AFB016G-7BTWT
32GB	APS25AFB032G-7BTT	APS25AFB032G-7BTWT
64GB	APS25AFB064G-7BTT	APS25AFB064G-7BTWT
128GB	APS25AFB128G-7BTT	APS25AFB128G-7BTWT
240GB	APS25AFB240G-7FTT	APS25AFB240G-7FTWT

10.2.2 7mm Housing

Capacity	Standard Temperature	Wide Temperature
8GB	APS25AF7008G-7BTT	APS25AF7008G-7BTWT
16GB	APS25AF7016G-7BTT	APS25AF7016G-7BTWT
32GB	APS25AF7032G-7BTT	APS25AF7032G-7BTWT
64GB	APS25AF7064G-7BTT	APS25AF7064G-7BTWT
128GB	APS25AF7128G-7BTT	APS25AF7128G-7BTWT
240GB	APS25AF7240G-7FTT	APS25AF7240G-7FTWT

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Revision History

Revision	Description	Date
1.0	Official release	11/4/2016
1.1	Updated the capacity of 256GB to 240GB	1/25/2017
1.2	Updated product ordering information	2/22/2017
1.3	Updated 7.2.2 7mm Housing by removing “Metal”	3/31/2017
1.4	Updated product ordering information for 240GB	4/6/2017
1.5	Added 8-16GB support	6/1/2017
1.6	Removed altitude spec from 4.1 Environmental	11/7/2017
1.7	- Updated 5.2 Power Consumption - Updated 7. Product Ordering Information due to FW change	6/20/2018
1.8	Corrected the typo at 7.2.1 from 9mm Metal Housing to 9.5 Metal Housing	6/28/2018
1.9	Added Thermal Sensor support	7/9/2018
2.0	- Renamed Power Failure Management to DataDefender at Flash Management on Specifications Overview page and 3.5 section and updated the technology description - Added Endurance to Specifications Overview page and 5.4 Endurance	11/23/2018
2.1	Completed endurance rating for 8GB at Endurance on Specifications Overview page and 5.4 Endurance	2/21/2019
2.2	Updated shock and vibration specs for Table 5-1 Environmental Specifications	7/12/2019
2.3	Changed DataDefender back to Power Failure Management	11/13/2019
2.4	- Added product photo to the cover page - Updated Performance and Power Consumption on Specifications Overview page - Updated performance for 240GB at 1.3 Performance - Updated idle power consumption for all capacities and active power consumption for 240GB at 6.2 Power Consumption - Updated 8. Product Ordering Information due to FW change	11/15/2019
2.5	Updated part number for 64GB with wide temperature at 8.2.1 section	1/3/2020
2.6	- Changed SATA 6.0 Gbps to SATA 6 Gb/s in accordance with SATA naming guidelines - Updated Table 1-1 by changing max LBA to total LBA, total bytes and total LBA for 240GB - Capitalized every letter for commands at 2.1 Command Set and SMART subcommand at 2.2 S.M.A.R.T.	1/26/2021

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Revision	Description	Date
	- Updated the description of 3.2 Bad Block Management - Modified 256GB to 240GB at Table 5-2	
2.7	- Updated MTBF to >3,000,000 hours on Specifications Overview and 4.4 Mean Time Between Failures (MTBF) - Updated storage temp to -55°C to 100°C on Specifications Overview and Table 4-3 Environmental Specifications - Added UKCA to 4.5 Certification and Compliance - Updated Table 7-1 Command Set - Updated 10. Product Ordering Information due to firmware change	3/4/2024

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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: 1-510-249-9551
sa@apacerus.com

Japan
Apacer Technology Corp.
6F, Daiyontamachi Bldg., 2-17-12, Shibaura, Minato-Ku,
Tokyo, 108-0023, 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: 31-40-290-0686
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,
1874, South End C Cross, 9th Block Jayanagar,
Bangalore-560069, India
Tel: 91-80-4152-9061/62
Fax: 91-80-4170-0215
sales_india@apacer.com

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