Apacer

RoHS Compliant

Serial ATA Flash Drive

Industrial ST180-25 BiCS5 Product Specifications

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Version 1.5

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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 command set-4 (ACS-4)
- **Capacity**
  - 1, 2, 4, 8, 16 TB
- **Performance**[1]
  - Burst read/write: 600 MB/sec
  - Sequential read: Up to 555 MB/sec
  - Sequential write: Up to 525 MB/sec
  - Random read (4K): Up to 95,000 IOPS
  - Random write (4K): Up to 83,000 IOPS
- **Flash Management**
  - Low-Density Parity-Check (LDPC) Code
  - Global Wear Leveling
  - Flash bad-block management
  - Flash Translation Layer: Page Mapping
  - S.M.A.R.T.
  - Power Failure Management
  - ATA Secure Erase
  - TRIM
  - DataRAID™
  - SMART Read Refresh™
- **DRAM Cache for Enhanced Random Performance**
- **NAND Flash Type:** 3D TLC (BiCS5)
- **MTBF:** >3,000,000 hours
- **Endurance (in drive writes per day: DWPD)**
  - 1 TB: 2.11 DWPD
  - 2 TB: 2.16 DWPD
  - 4 TB: 2.28 DWPD
  - 8 TB: 2.07 DWPD
  - 16 TB: 2.11 DWPD
- **Temperature Range**
  - Operating:
    - Standard: 0°C to 70°C
    - Wide[2]: -40°C to 85°C
  - Storage: -55°C to 100°C
- **Supply Voltage**
  - 5V ± 10%
- **Power Consumption**[1]
  - Active mode (Max.): 830 mA
  - Idle mode: 325 mA
- **SATA Power Management Modes**
- **Connector Type**
  - 7-pin SATA signal connector
  - 15-pin SATA power connector
- **Form Factor**
  - 2.5”
  - Dimensions: 100.00 x 69.85 x 7.00, unit: mm
  - Net weight: 66.5g ± 5%
- **Security**
  - AES 256-bit hardware encryption
  - Trusted Computing Group (TCG) Opal 2.0 (optional)
- **Reliability**
  - Thermal Sensor
  - Thermal Throttling
  - End-to-End Data Protection
- **RoHS Compliant**

Notes:
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.
2. Not supported on 16TB

Table of Contents

1. General Description

Apacer's ST180-25 is a well-balanced solid-state disk (SSD) drive with standard form factor and great performance. Designed in SATA 6 Gb/s interface, ST180-25 provides full compliance with the SATA Revision 3.1 interface specifications and delivers exceptional read/write speed. For data efficiency, the internal controlling unit of the SSD is engineered with DRAM for enhanced random performance, making it the ideal companion for heavy-loading industrial or server operations.

Utilizing 3D NAND for higher capacity up to 16TB and providing more power efficiency than 2D NAND, ST180-25 is built with a powerful SATA controller that supports on-the-module ECC as well as efficient wear leveling scheme and implemented with LDPC (Low Density Parity Check) ECC engine to extend SSD endurance and increase data reliability. Furthermore, ST180-25 is equipped with a built-in thermal sensor to monitor the temperature of the SSD via S.M.A.R.T commands and configured with thermal throttling to dynamically adjust frequency scaling to enhance data reliability and provide sustained performance while overheating. Operating under 6 Gb/s interface, ST180-25 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. For highly-intensive applications, End-to-End Data Protection ensures that data integrity can be assured at multiple points in the path to enable reliable delivery of data transfers.

Security-wise, Advanced Encryption Standard (AES) and Trusted Computing Group (TCG) Opal (optional) ensure data security and provide users with peace of mind knowing their data is safeguarded against unauthorized use at all times. ST180-25 also adopts the latest page mapping file translation layer and comes with various implementations including flash block management, power failure management, TRIM, power saving modes, DataRAID and SMART Read Refresh.

With exceptional performance, trustable reliability and enhanced data protection, ST180-25 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 ST180-25 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 ST180-25 varies from capacities. The illustration is for reference only.

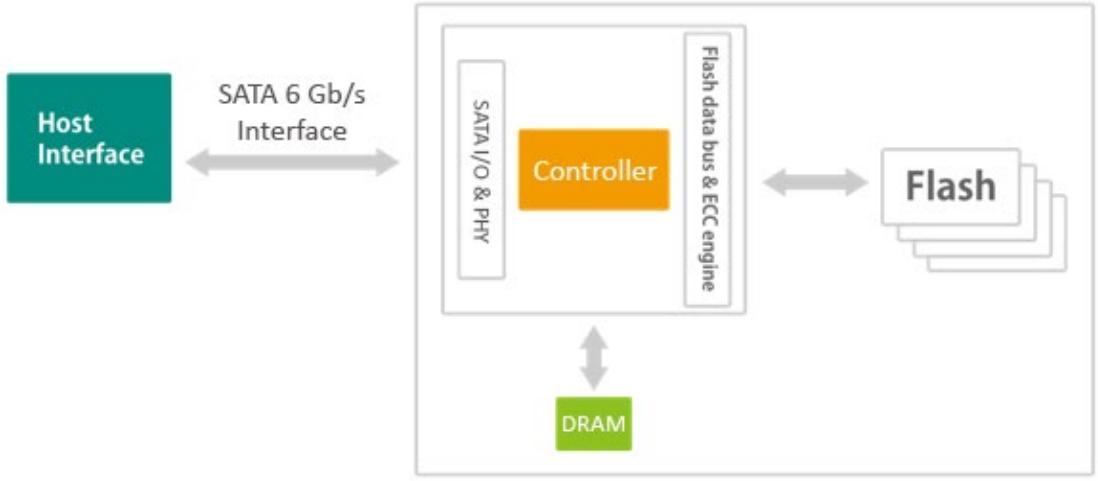


Figure 2-1 Functional Block Diagram

3. Pin Assignments

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

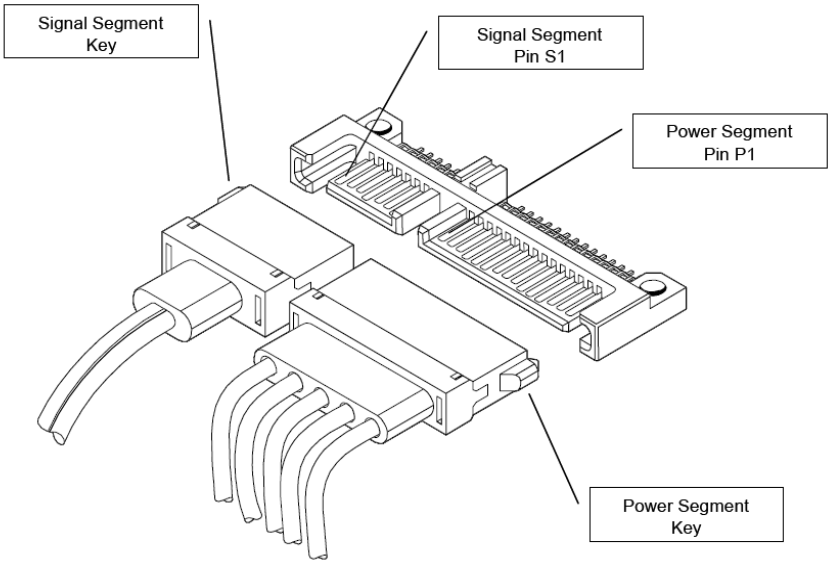


Figure 3-1 SATA Connectors

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	No Connect
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)

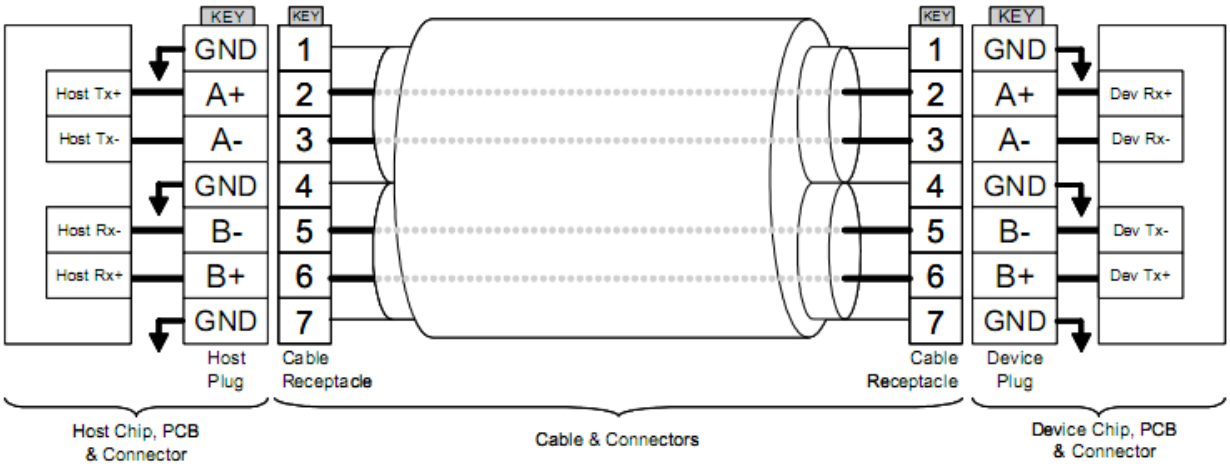


Figure 3-2 SATA Cable/Connector Connection Diagram

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.

4. Product Specifications

4.1 Capacity

Capacity specifications of ST180-25 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
1 TB	1,024,209,543,168	16,383	16	63	2,000,409,264
2 TB	2,048,408,248,320	16,383	16	63	4,000,797,360
4 TB	3,840,755,982,336	16,383	16	63	7,501,476,528
8 TB	7,681,501,126,656	16,383	16	63	15,002,931,888
16 TB	15,362,991,415,296	16,383	16	63	30,005,842,608

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 ST180-25 is listed below in Table 4-2.

Table 4-2 Performance Specifications

Capacity / Performance	1 TB	2 TB	4 TB	8 TB	16 TB
Sequential Read (MB/s)	555	555	555	555	555
Sequential Write (MB/s)	525	525	520	520	515
4K Random Read (IOPS)	95,000	94,000	95,000	95,000	95,000
4K Random Write (IOPS)	83,000	83,000	82,000	82,000	81,000

Notes:
- Results may differ from various flash configurations or host system setting.
- Sequential read/write is based on CrystalDiskMark 8.0.4 with file size 1,000MB.
- Random read/write is measured using IOMeter with Queue Depth 32.

4.3 Environmental Specifications

Environmental specifications of ST180-25 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 ST180-25. The prediction result for ST180-25 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

ST180-25 complies with the following standards:

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

4.6 Endurance

The endurance of a storage device is predicted by Drive Writes Per Day 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	Drive Writes Per Day
1 TB	2.11
2 TB	2.16
4 TB	2.28
8 TB	2.07
16 TB	2.11

Notes:

- This estimation complies with JEDEC random client workload.
- Flash vendor guaranteed 3D NAND TLC P/E cycle: 3K
- WAF may vary from capacity, flash configurations and writing behavior on each platform.
- 1 Terabyte = 1,024 GB
- DWPD (Drive Write Per Day) is calculated based on the number of times that user overwrites the entire capacity of an SSD per day of its lifetime during the warranty period. (3D NAND TLC warranty: 3 years)

5. Flash Management

5.1 Error Correction/Detection

ST180-25 implements a hardware ECC scheme, based on the Low Density Parity Check (LDPC). LDPC is a class of linear block error correcting code which has apparent coding gain over BCH code because LDPC code includes both hard decoding and soft decoding algorithms. With the error rate decreasing, LDPC can extend SSD endurance and increase data reliability while reading raw data inside a flash chip.

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 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.

5.5 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.

5.6 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 Flash Translation Layer – Page Mapping

Page mapping is an advanced flash management technology whose essence lies in the ability to gather data, distribute the data into flash pages automatically, and then schedule the data to be evenly written. Page-level mapping uses one page as the unit of mapping. The most important characteristic is that each logical page can be mapped to any physical page on the flash memory device. This mapping algorithm allows different sizes of data to be written to a block as if the data is written to a data pool and it does not need to take extra operations to process a write command. Thus, page mapping is adopted to increase random access speed and improve SSD lifespan, reduce block erase frequency, and achieve optimized performance and lifespan.

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.

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

5.9 DataRAID™

Apacer's DataRAID algorithm applies an additional level of protection and error-checking. Using this algorithm, a certain amount of space is given over to aggregating and resaving the existing parity data used for error checking. So, in the event that data becomes corrupted, the parity data can be compared to the existing uncorrupted data and the content of the corrupted data can be rebuilt.

5.10 SMART Read Refresh™

Apacer's SMART Read Refresh plays a proactive role in avoiding read disturb errors from occurring to ensure health status of all blocks of NAND flash. Developed for read-intensive applications in particular, SMART Read Refresh is employed to make sure that during read operations, when the read operation threshold is reached, the data is refreshed by re-writing it to a different block for subsequent use.

6. Security and Reliability Features

6.1 Advanced Encryption Standard

Advanced Encryption Standard (AES) is a specification for the encryption of electronic data. AES has been adopted by the U.S. government since 2001 to protect classified information and is now widely implemented in embedded computing applications. The AES algorithm used in software and hardware is symmetric so that encrypting/decrypting requires the same encryption key. Without the key, the encrypted data is inaccessible to ensure information security.

Notably in flash memory applications, AES 256-bit hardware encryption is the mainstream to protect sensitive or confidential data. The hardware encryption provides better performance, reliability, and security than software encryption. It uses a dedicated processor, which is built inside the controller, to process the encryption and decryption. This enormously shortens the processing time and makes it efficient.

6.2 TCG Opal (optional)

Developed by the Trusted Computing Group (TCG), an organization whose members work together to formulate industry standards, Opal is a set of security specifications used for applying hardware-based encryption to storage devices.

Hardware encryption has many advantages. First of all, it transfers the computational load of the encryption process to dedicated processors, reducing the stress on the host system's CPU. In addition, storage devices complying with Opal specifications are self-encryption devices. Opal specifications also feature boot authentication. When the drive is being accessed, the shadow MBR will request the drive password at boot. The drive will only unlock and decrypt if the correct password is supplied. The other feature is LBA-specific permissions. Users are assigned different permissions for LBA ranges created by the device administrator. Each LBA range is password-protected and can only be accessed by users with the correct key to perform permitted actions (read/write/erase).

6.3 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.

6.4 Thermal Throttling

Thermal throttling can monitor the temperature of the SSD equipped with a built-in thermal sensor via S.M.A.R.T. commands. This method can ensure the temperature of the device stays within temperature limits by drive throttling, i.e. reducing the speed of the drive when the device temperature reaches the threshold level, so as to guarantee data reliability, provide sustained performance while overheating, and prolong product lifespan. When the temperature exceeds the maximum threshold level, thermal throttling will be triggered to reduce performance step by step to prevent hardware components from being damaged. Performance is only permitted to drop to the extent necessary for recovering a stable temperature to cool down the device’s temperature. Once the temperature decreases to the minimum threshold value, transfer speeds will rise back to its optimum performance level.

6.5 End-to-End Data Protection

End-to-End Data Protection is a feature implemented in Apacer SSD products that extends error control to cover the entire path from the host computer to the drive and back, and ensure data integrity at multiple points in the path to enable reliable delivery of data transfers. Unlike ECC which does not exhibit the ability to determine the occurrence of errors throughout the process of data transmission, End-to-End Data Protection allows SSD controller to identify an error created anywhere in the path and report the error to the host computer before it is written to the drive. This error-checking and error-reporting mechanism therefore guarantees the trustworthiness and reliability of the SSD.

7. Software Interface

7.1 Command Set

This section defines the software requirements and the format of the commands the host sends to ST180-25. Commands are issued to ST180-25 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

Op Code	Command	Op Code	Command
00h	NOP	B0h	SMART
06h	DATA SET MANAGEMENT	B1h	DEVICE CONFIGURATION
10h	RECALIBRATE	C4h	READ MULTIPLE
20h	READ SECTOR(S)	C5h	WRITE MULTIPLE
21h	READ SECTOR(S) WITHOUT RETRY	C6h	SET MULTIPLE MODE
24h	READ SECTOR(S) EXT	C8h	READ DMA
25h	READ DMA EXT	C9h	READ DMA WITHOUT RETRY
27h	READ NATIVE MAX ADDRESS EXT	CAh	WRITE DMA
29h	READ MULTIPLE EXT	CBh	WRITE DMA WITHOUT RETRY
2Fh	READ LOG EXT	CEh	WRITE MULTIPLE FUA EXT
30h	WRITE SECTOR(S)	E0h	STANDBY IMMEDIATE
31h	WRITE SECTOR(S) WITHOUT RETRY	E1h	IDLE IMMEDIATE
34h	WRITE SECTOR(S) EXT	E2h	STANDBY
35h	WRITE DMA EXT	E3h	IDLE
37h	SET MAX: ADDRESS EXT	E4h	READ BUFFER
39h	WRITE MULTIPLE EXT	E5h	CHECK POWER MODE
3Dh	WRITE DMA FUA EXT	E6h	SLEEP
3Fh	WRITE LONG EXT	E7h	FLUSH CACHE
40h	READ VERIFY SECTOR(S)	E8h	WRITE BUFFER
41h	READ VERIFY SECTOR(S) WITHOUT RETRY	E9h	READ BUFFER DMA
42h	READ VERIFY SECTOR(S) EXT	EAh	FLUSH CACHE EXT
45h	WRITE UNCORRECTABLE EXT	EBh	WRITE BUFFER DMA
47h	READ LOG DMA EXT	ECh	IDENTIFY DEVICE
57h	WRITE LOG DMA EXT	EFh	SET FEATURES
60h	READ FPDMA QUEUED	F1h	SECURITY SET PASSWORD
61h	WRITE FPDMA QUEUED	F2h	SECURITY UNLOCK
70h	SEEK	F3h	SECURITY ERASE PREPARE
77h	SET DATE & TIME EXT	F4h	SECURITY ERASE UNIT
90h	EXECUTE DEVICE DIAGNOSTIC	F5h	SECURITY FREEZE LOCK

Op Code	Command	Op Code	Command
91h	INITIALIZE DEVICE PARAMETERS	F6h	SECURITY DISABLE PASSWORD
92h	DOWNLOAD MICROCODE PIO	F8h	READ NATIVE MAX ADDRESS
93h	DOWNLOAD MICROCODE DMA	F9h	SET MAX

Table 7-2 Trusted Computing Feature Set

Code	Command	Code	Command
5Ch	TRUSTED RECEIVE	5Eh	TRUSTED SEND
5Dh	TRUSTED RECEIVE DMA	5Fh	TRUSTED SEND DMA

Note: This feature set is only applicable to products implemented with AES and Opal functions.

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 7-3 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 7-4 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 7-5 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

8. Electrical Specifications

8.1 Operating Voltage

Table 8-1 lists the supply voltage for ST180-25.

Table 8-1 Operating Range

Item	Range
Supply Voltage	5V ± 10%

8.2 Power Consumption

Table 8-2 lists the power consumption for ST180-25.

Table 8-2 Power Consumption

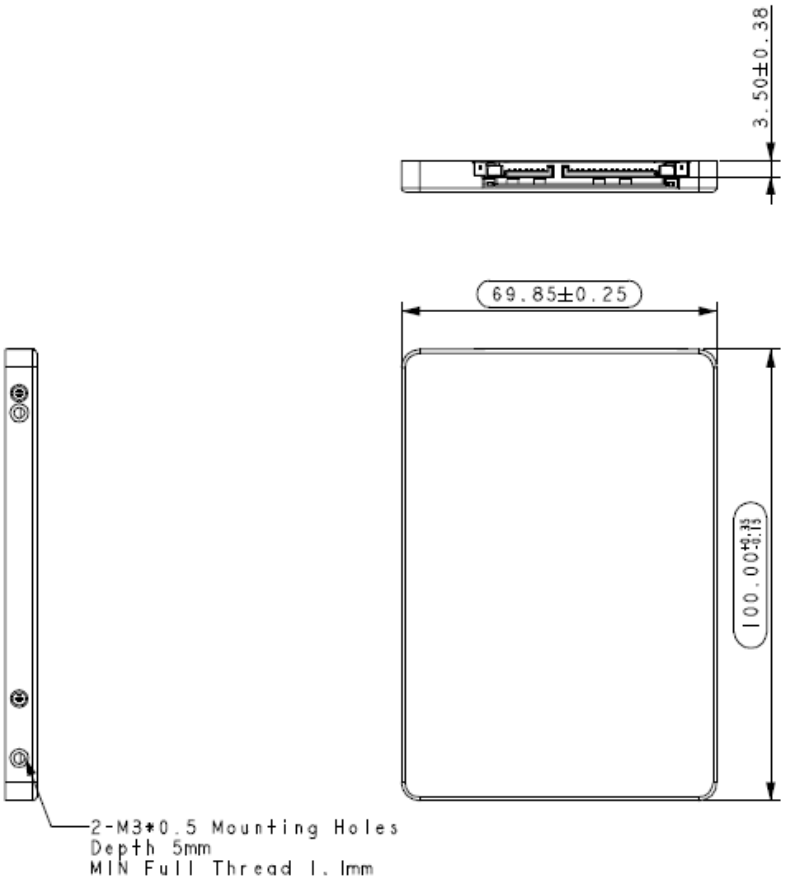
Capacity / Mode	Unit	1 TB	2 TB	4 TB	8 TB	16 TB
Active (Max.)	mA	595	640	680	720	830
Idle		250	260	290	305	325

Notes:
- All values are typical and may vary depending on flash configurations or host system settings.
- Power consumption is measured using CrystalDiskMark 8.0.4 with file size 1,000MB.

9. Mechanical Specifications

Table 9-1 Physical Information

Parameter	Unit	1 TB	2 TB	4 TB	8 TB	16 TB
Length	mm	100.00 +0.35/-0.15				
Width		69.85 ± 0.25				
Height		7.00 +0.10/-0.50				
Weight	g ± 5%	61	61.5	62.5	66.5	66.5



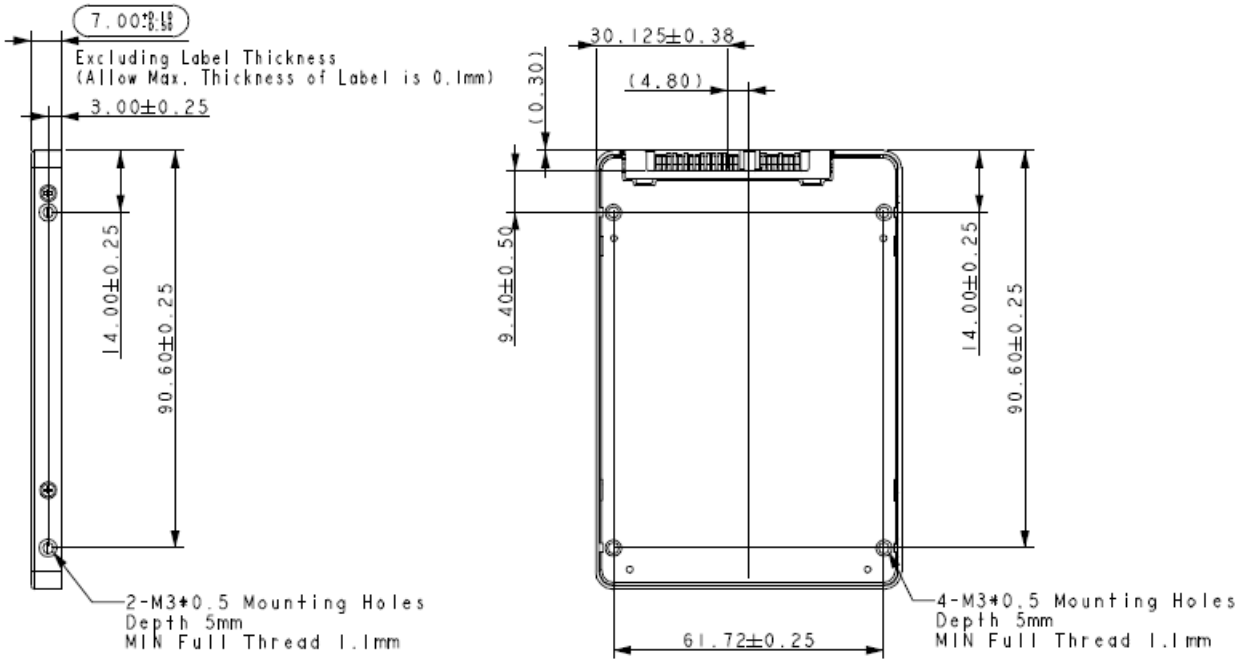


Figure 9-1 Physical Dimensions

10. Product Ordering Information

10.1 Product Code Designations

Apacer's ST180-25 SSD is available in different configurations and densities. See the chart below for a comprehensive list of options for the ST180-25 series devices.

Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	A	1	6	.	X	X	C	X	X	D	.	X	X	X	X	X

Code 1-3 (Product Line & Form Factor)	SATA 2.5 SSD
Code 5-6 (Model/Solution)	18: ST180-25 A3: ST180-25 with TCG Opal
Code 7-8 (Product Capacity)	CL: 1TB CM: 2TB CN: 4TB CP: 8TB CQ: 16TB
Code 9 (Flash Type & Product Temp)	G: 3D TLC standard temperature H: 3D TLC wide temperature
Code 10 (Product Spec)	2.5" 7mm metal housing
Code 12-14 (Version Number)	Random numbers generated by system
Code 15-16 (Firmware Version)	01: Thermal Sensor 02: Thermal Sensor with TCG Opal

10.2 Valid Combinations

The following tables list the available models of the ST180-25 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 Without TCG Opal

Capacity	Standard Temperature	Wide Temperature
1TB	A16.18CLGD.00101	A16.18CLHD.00101
2TB	A16.18CMGD.00101	A16.18CMHD.00101
4TB	A16.18CNGD.00101	A16.18CNHD.00101
8TB	A16.18CPGD.00101	A16.18CPHD.00201
16TB	A16.18CQGD.00101	NA

10.2.2 With TCG Opal (optional)

Capacity	Standard Temperature	Wide Temperature
1TB	A16.A3CLGD.00102	A16.A3CLHD.00102
2TB	A16.A3CMGD.00102	A16.A3CMHD.00102
4TB	A16.A3CNGD.00102	A16.A3CNHD.00102
8TB	A16.A3CPGD.00102	A16.A3CPHD.00102
16TB	A16.A3CQGD.00102	NA

Revision History

Revision	Description	Date
1.0	Initial release	12/28/2022
1.1	Updated Table 7-1 Command Set by removing codes for TCG Opal	4/28/2023
1.2	- Added 1TB and 2TB support - Updated wide-temp valid combination of 8TB	6/29/2023
1.3	- Added TCG Opal support - Added 6.2 TCG Opal and Table 7-2 - Updated 10. Product Ordering Information by adding valid combinations with TCG Opal support	7/14/2023
1.4	- Added rear view of the product to the cover page - Added standard-temp 16GB support	8/31/2023

Global Presence

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