

RoHS Compliant

Solid State Drive

Professional PPSS25 Product Specifications

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Version 1.8

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Specifications Overview:

- **Compliance with SATA Revision 3.2**
 - SATA 6 Gb/s interface
 - Backward compatible with SATA 1.5/3 Gb/s interfaces
- **Capacity**
 - 256, 512, 1024 GB
- **Performance¹**
 - Burst read/write: 600 MB/sec
 - Sequential read: Up to 560 MB/sec
 - Sequential write: Up to 510 MB/sec
 - Random read (4K): Up to 87,000 IOPS
 - Random write (4K): Up to 67,000 IOPS
- **Flash Management**
 - Low-Density Parity-Check (LDPC) Code
 - Global Wear Leveling
 - Flash bad-block management
 - Flash Translation Layer: Page Mapping
 - Power Failure Management
 - S.M.A.R.T.
 - ATA Secure Erase
 - TRIM
 - Hyper Cache Technology
- **NAND Flash Type: 3D TLC**
- **MTBF: >2,000,000 hours**
- **Endurance (in Terabytes Written: TBW)**
 - 256 GB: 385 TBW
 - 512 GB: 820 TBW
 - 1024 GB: 2,065 TBW
- **Temperature Range**
 - Operating (Tc): 0°C to 70°C
 - Storage (Ta): -40°C to 70°C
- **Supply Voltage**
 - 5V ± 5%
- **Power Consumption¹**
 - Active mode (Max.): 2,100 mW
 - Idle mode: 335 mW
- **Connector Type**
 - 7-pin SATA signal connector
 - 15-pin SATA power connector
- **Physical Characteristics**
 - Form factor: 2.5"
 - Dimensions: 100.00 x 69.85 x 7.00, unit: mm
- **RoHS Compliant**
- **Warranty: 5 years or TBW (whichever occurs first)**

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. Product Specifications

1.1 Performance

Performance of Apacer Professional PPSS25 is listed below in Table 1-1.

Table 1-1 Performance Specifications

Capacity	256 GB	512 GB	1024 GB
Performance			
Sequential Read (MB/s)	560	560	560
Sequential Write (MB/s)	450	480	510
4K Random Read (IOPS)	87,000	87,000	87,000
4K Random Write (IOPS)	28,000	67,000	67,000

Notes:

- Results may differ from various flash configurations or host system setting.
- Sequential read/write is measured using different versions of CrystalDiskMark with file size 1,000MB, depending on capacity:
 - 256GB/512GB: CrystalDiskMark 6.0.2
 - 1024GB: CrystalDiskMark 8.0.4
- Random read/write is measured using IOMeter with Queue Depth 32.

1.2 Environmental Specifications

Environmental specifications of Apacer Professional PPSS25 are shown in Table 1-2.

Table 1-2 Environmental Specifications

Parameter	Type	Specifications
Temperature	Operating (Tc)	0°C to 70°C
	Non-operating (Ta)	-40°C to 70°C
Vibration	Non-operating	20G, 20~2000 Hz/random
Shock	Non-operating	1,500G, half-sine wave

Notes:

- This Environmental Specification table indicates the conditions for testing the device. Real world usages may affect the results.
- Tc: case temperature; Ta: ambient temperature. The operating temperature is determined by the case temperature. Adequate airflow is advisable as it enables the device to maintain optimal temperatures, especially in environments with heavy workloads.

1.3 Mean Time Between Failures (MTBF)

Mean Time Between Failures (MTBF) is predicted based on reliability data for the individual components in Apacer Professional PPSS25. The prediction result for Apacer Professional PPSS25 is more than 2,000,000 hours.

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

1.4 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 1-3 Endurance Specifications

Capacity	TeraBytes Written
256 GB	385
512 GB	820
1024 GB	2,065

Notes:

- The endurance of SSD could be estimated based on users' behaviors, NAND endurance cycles, and write amplification factor. It is not guaranteed by the flash vendor.
- TBW may vary from flash configuration and platform.

1.5 Certification and Compliance

Apacer Professional PPSS25 complies with the following standards:

- CE
- UKCA
- FCC
- RoHS

2. Pin Assignments

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

Figure 2-1 SATA Connectors

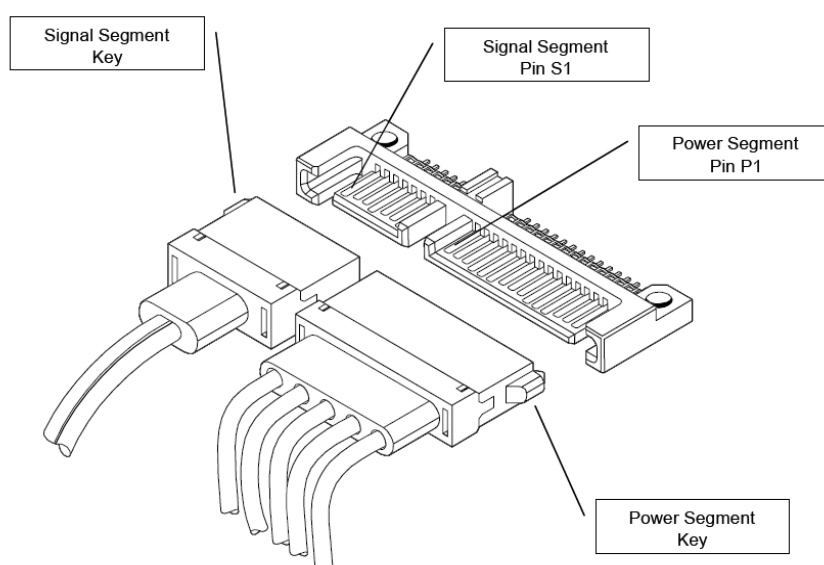


Table 2-1 Signal Segment

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 2-2 Power Segment

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

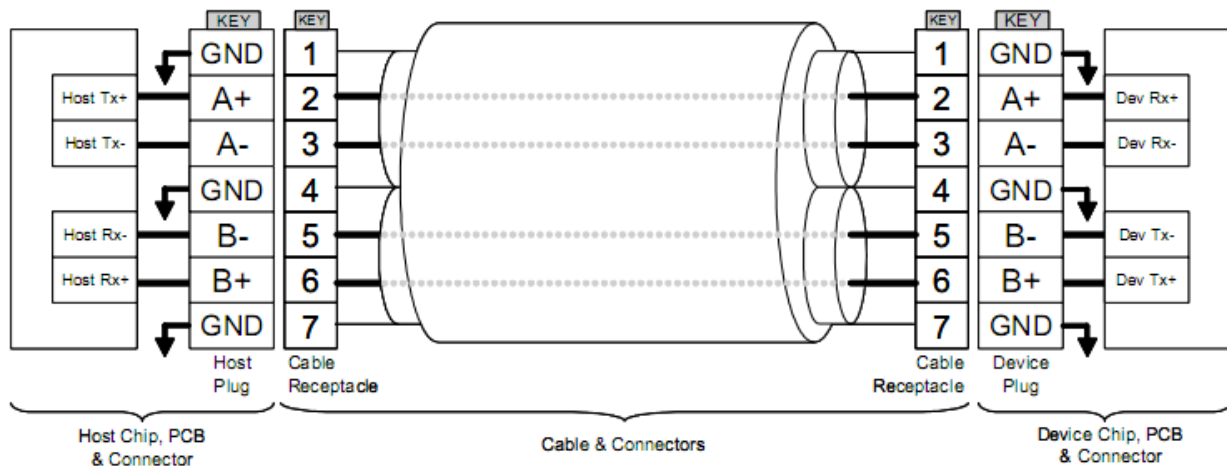


Figure 2-2 SATA Cable/Connector Connection Diagram

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.

3. Flash Management

3.1 Error Correction/Detection

Apacer Professional PPSS25 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.

3.2 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.

3.3 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.

3.4 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.

3.5 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.

3.6 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.

3.7 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.

3.8 Hyper Cache Technology

Apacer proprietary Hyper Cache technology uses a portion of the available capacity as SLC (1bit-per-cell) NAND flash memory, called Hyper cache mode. When data is written to SSD, the firmware will direct the data to Hyper Cache mode, providing excellent performance to handle various scenarios in industrial use.

4. Electrical Specifications

4.1 Operating Voltage

Table 4-1 lists the supply voltage for Apacer Professional PPSS25.

Table 4-1 Operating Range

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

4.2 Power Consumption

Table 4-2 lists the power consumption for Apacer Professional PPSS25.

Table 4-2 Power Consumption

Mode \ Capacity	Unit	256 GB	512 GB	1024 GB
Active (Max.)	mW	1,750	2,000	2,100
Idle		325	335	330

Notes:

- All values are typical and may vary depending on flash configurations or host system settings.
- Power consumption is measured using different versions of CrystalDiskMark with file size 1,000MB, depending on capacity:
 - 256GB/512GB: CrystalDiskMark 6.0.2
 - 1024GB: CrystalDiskMark 8.0.4

5. Mechanical Specifications

Table 5-1 Physical Dimensions

Parameter	Unit	256 GB	512 GB	1024 GB
Length	mm	100.00 ± 0.25		
Width		69.85 ± 0.25		
Height		7.00 ± 0.20		

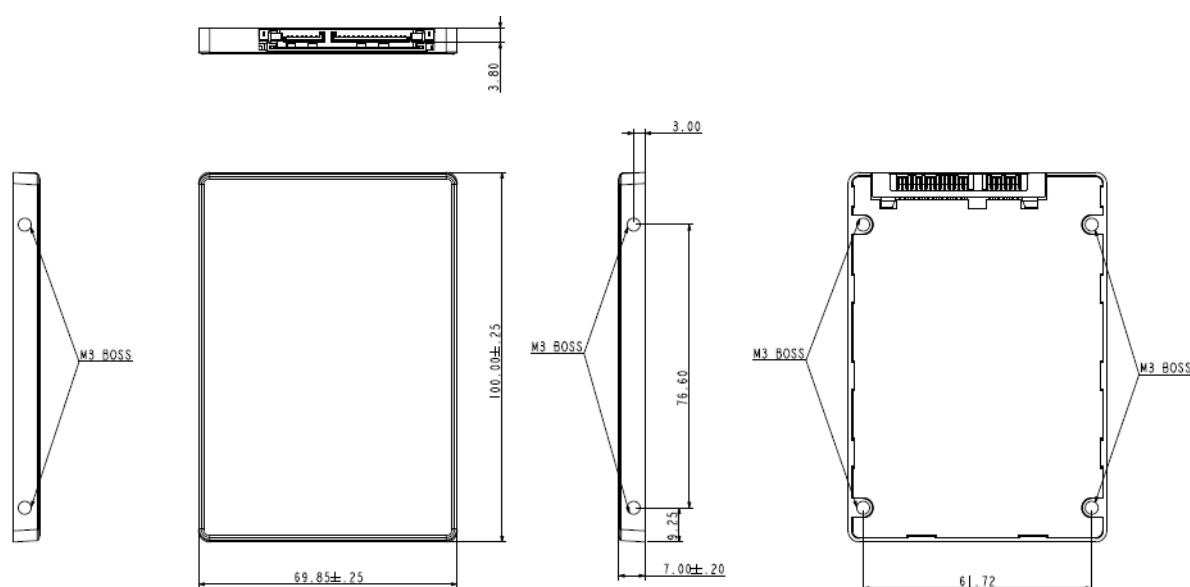


Figure 5-1 Physical Dimensions

6. Product Ordering Information

The following table lists the available models of the Apacer Professional PPSS25 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.

Capacity	Retail P/N
256GB	AP256GPPSS25-R
512GB	AP512GPPSS25-R
1024GB	AP1TPPSS25-R

Revision History

Revision	Description	Date
1.0	Initial release	6/17/2020
1.1	Updated Endurance on Specifications Overview page and 1.4 Endurance	6/23/2020
1.2	Updated warranty period from 3 years to 5 years on Specifications Overview page	8/4/2020
1.3	- Changed 1TB to 1024GB - Added 2048GB support	10/27/2020
1.4	Updated vibration and shock specs at 1.2 Environmental Specifications	11/12/2020
1.5	- Removed 128GB support - Added Low-Density Parity-Check (LDPC) Code, Flash Translation Layer: Page Mapping, ATA Secure Erase and Hyper Cache Technology to Flash Management on Specifications Overview page - Updated performance for 256GB-2048GB at Table 1-1 - Added 2. Pin Assignments - Added 3.1 Error Correction/Detection, 3.4 Flash Translation Layer - Page Mapping, 3.6 ATA Secure Erase and 3.8 Hyper Cache Technology to 3. Flash Management	12/30/2021
1.6	- Updated Performance on Specifications Overview page - Updated Table 1-1 - Added UKCA to 1.5 Certification and Compliance	3/7/2023
1.7	- Updated Performance on Specifications Overview page - Updated Table 1-1 and the note for sequential performance - Updated the note regarding CDM version at Table 4-2 - Updated 5. Mechanical Specifications - Updated valid combination of 2048GB at 6. Product Ordering Information	7/4/2023
1.8	- Changed model name from 2.5" NAS SSD to PPSS25 - Removed 2048GB support - Added a note regarding temperature at Table 1-2	4/10/2024

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