

RoHS Compliant

SATA Flash Drive

SU120-297 Product Specifications

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Version 1.1



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:

- **Serial ATA Revision 3.1 Compliance**
 - SATA 6.0 Gbps interface
 - Backward compatible with SATA 3.0/1.5 Gbps interface
 - ATA Command set
- **Capacity**
 - 16, 32, 64, 128 GB
- **Performance***
 - Interface burst read/write: 600 MB/sec
 - Sustained read: up to 520 MB/sec
 - Sustained write: up to 185 MB/sec
 - Random read (4K): up to 39,000 IOPS
 - Random write (4K): up to 28,000 IOPS
- **Flash Management**
 - Built-in hardware ECC
 - Global Wear Leveling
 - Flash bad block management
 - S.M.A.R.T.
 - Power Failure Management
 - TRIM
- **NAND Flash Type:** MLC
- **MTBF:** >1,000,000 hours
- **Temperature Range**
 - Operating:
 - Standard: 0°C to 70°C
 - Extended: -40°C to 85°C
 - Storage: -40°C to 100°C
- **Supply Voltage**
 - 5 V ± 5%
- **Power Consumption***
 - Active mode: 305 mA
 - Idle mode: 65 mA
- **Form Factor**
 - JEDEC MO-297
 - Dimensions (54.0 x 39.8 x 4.0, unit: mm)
- **Connector**
 - 7-pin SATA male connector
 - 15-pin SATA power connector
- **Device Sleep Mode (optional)**
- **Firmware Version:** SFPS928L
- **RoHS Compliant**

*Varies from capacities. The values presented for Performances and Power Consumption are typical and may vary depending on different configurations and platforms.

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1. Product Description

1.1 Introduction

Apacer SU120-297 half-slim MO-297 SSD (Solid State Drive) delivers multiple technological advantages of flash memory storage. With SATA 6.0 Gbps interface, SU120-297 offers exceptional data transfer performance. Form factor wise, this model is fully compliant with JEDEC MO-297 standard, which is designed with standard interface consisting of SATA 7-pin signal segment and 15-pin power segment, while in compact size. This module provides low power consumption compared to traditional hard drive and hot-swapping when removing/ replacing/ upgrading flash disks. Its capacity could provide a wide range up to 128 GB. Moreover, it can reach up to 520 MB/s read as well as 185 MB/s write high performance.

1.2 Capacity Specifications

Table 1-1 Capacity Specifications

Capacity	Total Bytes*	Cylinders	Heads	Sectors	Max LBA**
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

*Display of total bytes varies from file systems.

**Cylinders, heads or sectors are not applicable for these capacities. Only LBA addressing applies.

***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.

1.3 Performance

Table 1-2 Performance Specifications

Capacity \ Performance	16 GB	32 GB	64 GB	128 GB
Sustained Read (MB/s)	520	500	515	505
Sustained Write (MB/s)	185	170	185	180
Random Read IOPS (4K)	39,000	38,000	34,000	30,000
Random Write IOPS (4K)	28,000	27,000	24,000	24,000

Note:

1. Results may vary depending on host system configurations.
2. Sustained Read/Write: The read/write performances are measured by CrystalDiskMark under Windows 7 operating system.

1.4 Pin Assignments

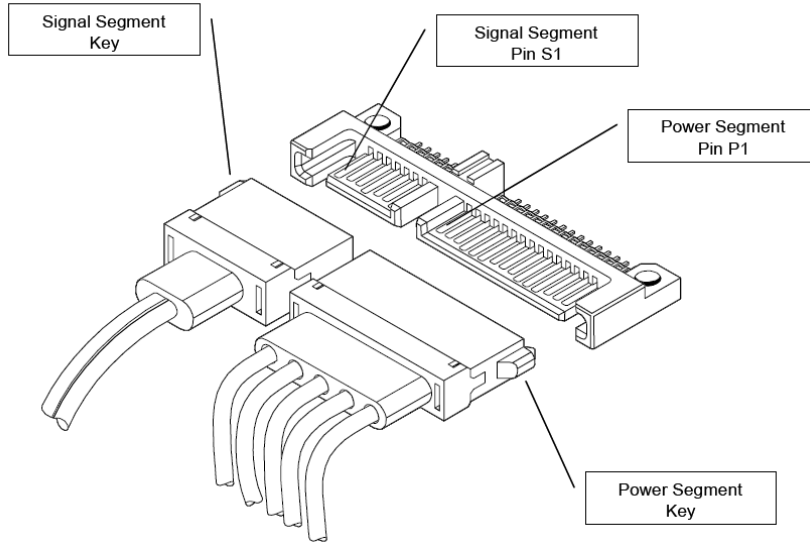


Table 1-3 Signal segment

Pin	Type	Description
S1	GND	
S2	RxP	Serial Data Receiver Signal Pair
S3	RxN	
S4	GND	
S5	TxN	Serial Data Transmitter Signal Pair
S6	TxP	
S7	GND	

Table 1-4 Power segment

Pin	Signal/Description
P1	Not used (3.3V)
P2	Not used (3.3V)
P3	Not used or Device Sleep
P4	Ground
P5	Ground
P6	Ground
P7	5V
P8	5V
P9	5V
P10	Ground
P11	Reserved
P12	Ground
P13	Not used (12V)
P14	Not used (12V)
P15	Not used (12V)

Note: P3 can be configured as trigger pin for Device Sleep.

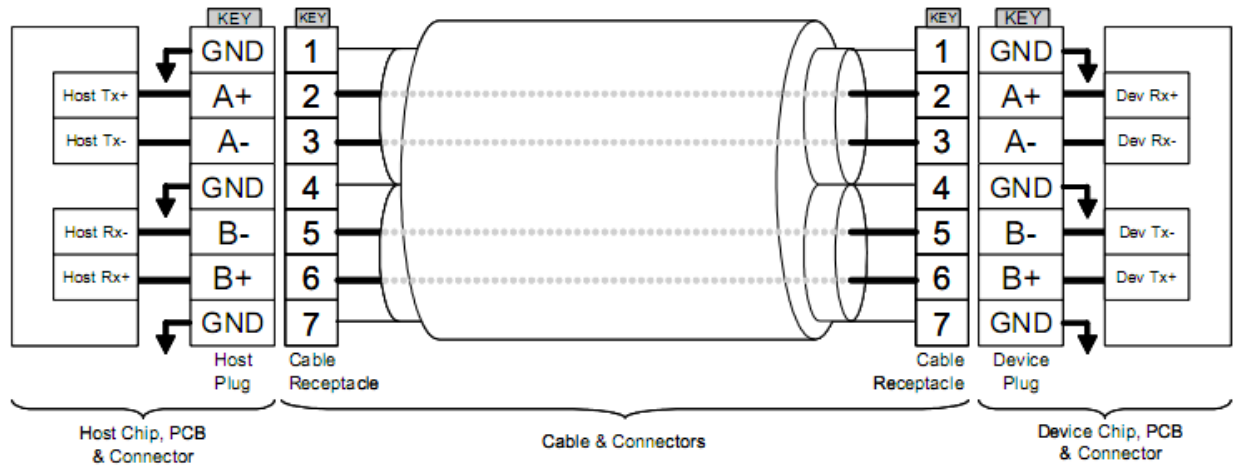


Figure 1-1 SATA Cable / Connector Connection Diagram

The connector on the left represents the Host with TX/RX differential pairs connected to a cable while 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.

2. Software Interface

2.1 Command Set

Table 2-1 Command Set

Command	Code	Command	Code
NOP	00h	Idle	97h
Data Set Management	06h	Check Power Mode	98h
Recalibrate	10f-1Fh	Sleep	99h
Read Sectors	20h	SMART	B0h
Read Sectors without Retry	21h	Device Configuration	B1h
Read Sectors EXT	24h	Read Multiple	C4h
Read DMA EXT	25h	Write Multiple	C5h
Read Native Max Address EXT	27h	Set Multiple Mode	C6h
Read Multiple EXT	29h	Read DMA	C8h
Read Log EXT	2Fh	Read DMA without Retry	C9h
Write Sectors	30h	Write DMA	CAh
Write Sectors Without Retry	31h	Write DMA without Retry	CBh
Write Sectors EXT	34h	Write Multiple FUA EXT	CEh
Write DMA EXT	35h	Standby Immediate	E0h
Set Native Max Address EXT	37h	Idle Immediate	E1h
CFA Write Sectors without erase	38h	Standby	E2h
Write Multiple EXT	39h	Idle	E3h
Write DMA FUA EXT	3Dh	Read Buffer	E4h
Write Long EXT	3Fh	Check Power Mode	E5h
Read Verify Sectors	40h	Sleep	E6h
Read Verify Sectors without Retry	41h	Flush Cache	E7h
Read Verify Sectors EXT	42h	Write Buffer	E8h
Write Uncorrectable EXT	45h	Flush Cache EXT	EAh
Read FPDMA Queued	60h	Identify Device	ECh
Write FPDMA Queued	61h	Set Features	EFh
Seek	70h-7Fh	Security Set Password	F1h
Execute Device Diagnostic	90h	Security Unlock	F2h
Initialize Device Parameters	91h	Security Erase Prepare	F3h
Download Microcode	92h	Security Erase Unit	F4h
Download Microcode DMA	93h	Security Freeze Lock	F5h
Standby Immediate	94h	Security Disable Password	F6h
Idle Immediate	95h	Read Native Max Address	F8h
Standby	96h	Set Max Address	F9h

2.2 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.

3. Flash Management

3.1 Error Correction/Detection

Flash memory cells will deteriorate with use, which might generate random bit errors in the stored data. Thus, this SSD applies the BCH ECC Algorithm, which can detect and correct errors occur during Read process, ensure data been read correctly, as well as protect data from corruption. This ECC supports up to 72bit/1K data.

3.2 Bad Block Management

Bad blocks are blocks that include one or more invalid bits, and their reliability is not guaranteed. Blocks that are identified and marked as bad by the manufacturer are referred to as “Initial Bad Blocks”. Bad blocks that are developed during the lifespan of the flash are named “Later Bad Blocks”. Apacer implements an efficient bad block management algorithm to detect the factory-produced bad blocks and manages any bad blocks that appear with use. This practice further prevents data being stored into bad blocks and improves the data reliability.

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 level 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 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 flush 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.

3.5 TRIM

TRIM is a feature which helps improve the read/write performance and speed of solid-state drives (SSD). Unlike hard disk drives (HDD), SSDs are not able to overwrite existing data, so the available space gradually becomes smaller with each use. With the TRIM command, the operating system can inform the SSD which blocks of data are no longer in use and can be removed permanently. Thus, the SSD will perform the erase action, which prevents unused data from occupying blocks all the time.

3.6 Secure Erase

Secure Erase is a standard ATA command and will write all “0xFF” to fully wipe all the data on hard drives and SSDs. When this command is issued, the SSD controller will empty its storage blocks and return to its factory default settings.

Note: Secure erase command belongs to ATA security command.

4. Reliability Specifications

4.1 Environments

Table 4-1 Environmental Specifications

Environment		Specifications
Temperature	Operating	0°C to 70°C (Standard); -40°C to 85°C (Extended)
	Storage	-40°C to 100°C
Shock		1,500G, 0.5ms
Vibration		20Hz~80Hz/1.52mm (frequency/displacement) 80Hz~2000Hz/20G (frequency/displacement) X, Y, Z axis/60mins each
Drop		80cm free fall, 6 face of each
Bending		≥ 20N, hold 1min/5times
Torque		0.5N-m or 2.5deg , hold 1min/5times
ESD		Pass

Note: Shock and Vibration specifications are subject to change without notice.

4.2 Mean Time Between Failures (MTBF)

Mean Time Between Failures (MTBF) is predicted based on reliability data for the individual components in SFD drive. The prediction result for SU120-297 is more than 1,000,000 hours.

Note: The MTBF is predicated and calculated based on "Telcordia Technologies Special Report, SR-332, Issue 2" method.

4.3 Certification and Compliance

- RoHS
- SATA Revision 3.1
- ATA/ATAPI
- FCC
- CE
- BSMI
- MIL-STD-810G

5. Electrical Characteristics

5.1 Operating Voltage

Table 5-1 lists the supply voltage for SU120-297.

Table 5-1 Operating Voltage

Parameter	Conditions
Supply Voltage	5V ± 5%

5.2 Power Consumption

Table 5-2 lists SU120-297 power consumption.

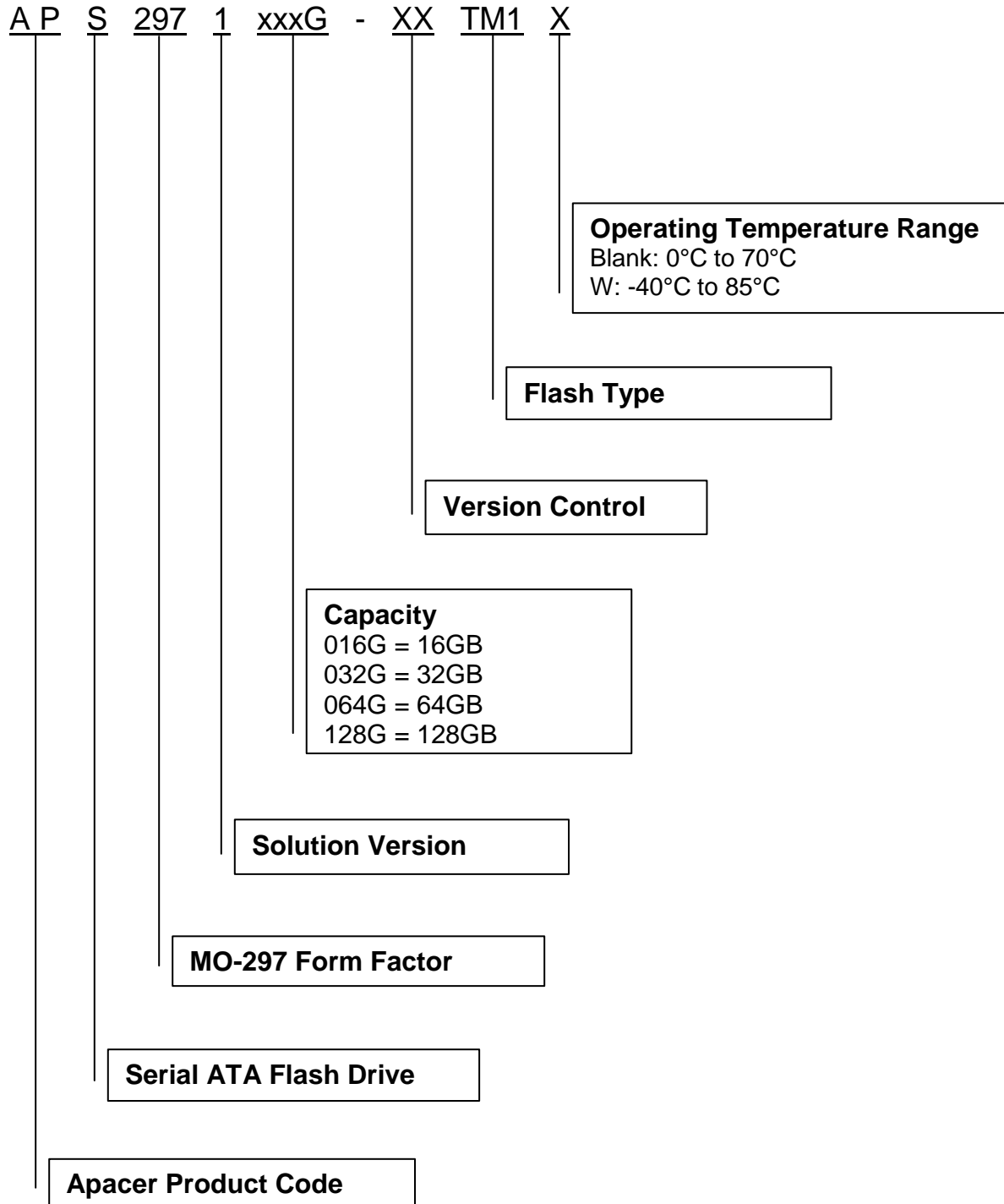
Table 5-2 Power Consumption (typical)

Capacity	16 GB	32 GB	64 GB	128 GB
Performance				
Active (mA)	280	295	295	305
Idle (mA)	65	65	65	65

Note: Power consumption may vary depending on flash configurations or platforms.

7. Product Ordering Information

7.1 Product Code Designation



7.2 Valid Combinations

7.2.1 Operating Temperature (0°C ~ 70°C)

Capacity	No DEVSLP	DEVSLP
16GB	APS2971016G-W5TM1	APS2971016G-W6TM1
32GB	APS2971032G-W5TM1	APS2971032G-W6TM1
64GB	APS2971064G-W5TM1	APS2971064G-W6TM1
128GB	APS2971128G-W5TM1	APS2971128G-W6TM1

7.2.2 Extended Temperature (-40°C ~ 85°C)

Capacity	No DEVSLP	DEVSLP
16GB	APS2971016G-W5TM1W	APS2971016G-W6TM1W
32GB	APS2971032G-W5TM1W	APS2971032G-W6TM1W
64GB	APS2971064G-W5TM1W	APS2971064G-W6TM1W
128GB	APS2971128G-W5TM1W	APS2971128G-W6TM1W

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	Description	Date
1.0	Official release	12/6/2016
1.1	Updated product ordering information	2/15/2017

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. 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: 31-40-290-0686 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, 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