Apacer

RoHS Compliant

USB Flash Drive

AH321 Product Specifications

August 28, 2020

Version 1.0

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Specifications Overview:

- **USB2.0 High-Speed and USB1.1 Full-Speed Compatible Interface**
- **Capacity**
  - 256, 512 MB
  - 1, 2, 4, 8, 16, 32 GB
- **Performance***
  - Sequential read: up to 34 MB/s
  - Sequential write: up to 22 MB/s
- **Flash Management**
  - Built-in hardware ECC
  - Global Wear Leveling
  - S.M.A.R.T.
- **Support Non-Removable Setting**
- **NAND Flash Type:** SLC
- **MTBF:** > 3,000,000 hours
- **Endurance (in Terabytes Written: TBW)**
  - 256 MB: 13 TBW
  - 512 MB: 28 TBW
  - 1 GB: 58 TBW
  - 2 GB: 111 TBW
  - 4 GB: 225 TBW
  - 8 GB: 464 TBW
  - 16 GB: 884 TBW
  - 32 GB: 1,768 TBW
- **Temperature Range**
  - Operating:
    Standard: 0°C to 70°C
    Wide: -40°C to 85°C
  - Storage: -40°C to 100°C
- **Supply Voltage**
  - 5.0 V
- **Power Consumption***
  - Active mode: 185 mA
  - Idle mode: 65 mA
- **OS Support**
  - Windows: WinXP/7 or later
  - Mac: 10.2.8 or later
  - Linux: 2.4.10 or later
- **Dimensions:** 60.59 x 19.00 x 8.00, unit: mm
- **LED Indicators for Drive Behavior**
- **RoHS Compliant**

*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.

Table of Contents

1. General Descriptions

Apacer's USB FLASH Drive (UFD) is a high performance flash disk drive designed offering portable storage solutions. UFDs can be plugged into a standard USB 2.0 connector commonly found in desktops, portable computers and even enterprise PC systems. Apacer's UFDs have an efficient built-in microcontroller and file management firmware that ensures ideal performance, functionality and reliability. This product is well suited for portable flash storage applications while operating at minimal power consumption.

2. Functional Block

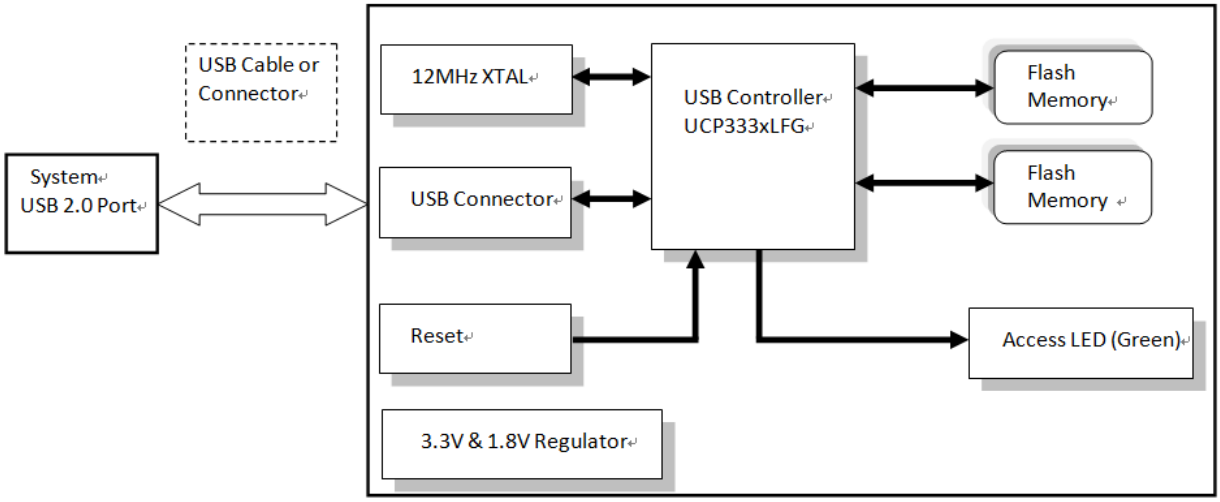

Figure 1-1 Functional Block Diagram

3. Product & Reliability Specifications

3.1 Capacity Specifications

AH321 is available as shown in Table 3-1.

Table 3-1 Capacity Specifications

Capacity	Total Bytes	Total LBA
256 MB	254,803,968	497,664
512 MB	501,219,328	978,944
1 GB	1,029,701,632	2,011,136
2 GB	2,061,500,416	4,026,368
4 GB	4,009,754,624	7,831,552
8 GB	8,254,390,272	16,121,856
16 GB	16,039,018,496	31,326,208
32 GB	32,078,036,992	62,652,416

Note: The number of total bytes may vary depending on the file system in use.

3.2 Performance Specifications

Performance of AH321 is listed below in Table 3-2.

Table 3-2 Performance Specifications

Capacity / Performance	256 MB	512 MB	1 GB	2 GB	4 GB	8 GB	16 GB	32 GB
Sequential Read (MB/s)	31	31	32	34	28	32	34	31
Sequential Write (MB/s)	10	15	19	19	21	15	22	21

Note:
Results may differ from various flash configurations or host system setting, and the above test results are based on the default file structure with FAT 32 file system.
*Sequential performance is based on CrystalDiskMark 5.2.1 with file size 1,000MB.
**Random performance measured using IOMeter with Queue Depth 32.

3.3 Environmental Specifications

Environmental specification of AH321 is available as shown in Table 3-3.

Table 3-3 Environmental Specifications

Item	Specifications
Operating temp.	0°C to 70°C (Standard); -40°C to 85°C (Wide)
Non-operating temp.	-40°C to 100°C
Operating vibration	7.69 GRMS, 20~2000 Hz/random (compliant with MIL-STD-810G)
Non-operating vibration	15G, 10~2000 Hz/sine (compliant with MIL-STD-810G)
Operating shock	50G, 11ms/half-sine (compliant with MIL-STD-202G)
Non-operating shock	1,500G, 0.5ms/half-sine (compliant with MIL-STD-883K)

3.4 Mean Time Between Failures (MTBF)

Mean Time Between Failures (MTBF) is predicted based on reliability data for the individual components in Apacer's USB flash drive. Serving as statistical reference, the prediction result for Apacer's AH321 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.

3.5 Certification and Compliance

AH321 complies with the following standards:

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

3.6 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 3-4 Endurance Specifications

Capacity	TeraBytes Written
256 MB	13
512 MB	28
1 GB	58
2 GB	111
4 GB	225
8 GB	464
16 GB	884
32 GB	1,768

Note:

- This estimation values are based on sequential write behavior.
  (Apacer EDTestTool, test mode sequential data pattern 100.00% of disk space with 128K)
- 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

3.7 LED Indicator Behavior

The behavior of the AH321 LED indicator is described in Table 3-5.

Table 3-5 LED Behavior

Location	LED Color	Description
As indicated by the red marker below	Yellow green	LED blinks when the drive is being accessed such as power on, read or write. The blink frequency is 65.536ms switch H to L and loop.

4. Flash Management

4.1 Performance-optimized Controller

The heart of AH321 is the USB controller, which translates standard USB signals into the data and controls of the flash media. This proprietary USB controller is specifically designed to attain high data throughput from host to flash.

4.2 Error Correction/Detection

Flash memory cells can deteriorate with use, which might lead to random bit errors in the stored data. Thus, this USB applies the BCH ECC Algorithm, which can detect and correct errors occurring during Read process, ensure data to be read correctly, as well as protect data from corruption. This device can correct up to 24bit/1K data.

4.3 Global Wear Leveling

Flash memory can be erased a limited number of times, This number is called the erase cycle limit, or write endurance limit, The erase cycle limit applies to each individual erase block in the flash device.

In a typical application, and especially if a file system is used, specific pages are constantly updated (e.g., the page that contains the FAT, registry, etc.). Without any special handling, these pages would wear out more rapidly than other pages, reducing the lifetime of the entire flash.

To overcome this inherent deficiency, Apacer's AH321 uses Global Wear Leveling algorithm. This algorithm ensures that consecutive writes of a specific sector are not written physically to the same page in the flash. This spreads flash media usage evenly across all pages, thereby maximizing flash lifetime.

The Global Wear Leveling mechanism provides write/erase cycles for reliable data storage over an extended period.

4.4 S.M.A.R.T.

S.M.A.R.T. is an abbreviation for Self-Monitoring, Analysis and Reporting Technology, a self-monitoring system that provides indicators of drive health as well as potential disk problems. It serves as a warning for users from unscheduled downtime by monitoring and displaying critical drive information. Ideally, this should allow taking proactive actions to prevent drive failure and make use of S.M.A.R.T. information for future product development reference.

5. Electrical Specifications

5.1 Operating Range

Table 5-1 lists the absolute stress rating for AH321.

Caution: **Absolute Maximum Stress Ratings –** Applied conditions greater than those listed under "Absolute Maximum Stress Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these conditions or conditions greater than those defined in the operational sections of this data sheet is not implied. Exposure to absolute maximum stress rating conditions may affect device reliability.

Table 5-1 Operating Range

Range	Ambient Temperature	Voltage
Standard Temperature	0°C to 70°C	4.5-5.5V
Wide Temperature	-40°C to 85°C	

5.2 Absolute Maximum Rating

Table 5-2 lists the absolute maximum power ratings for AH321.

Table 5-2 Absolute maximum power pin stress ratings

Parameter	Symbol	Min	Max	Unit
Power Supply Input	VDD- VSS	-0.3	5.5	V
Voltage on any pin except VDD with respect to GND	VIN	–ss – 0.3	VDD +0.3	V

6. Physical Characteristics

Table 6-1 Dimensions

Length	Width	Height (Max)
60.59 mm	19.00 mm	8.00 mm

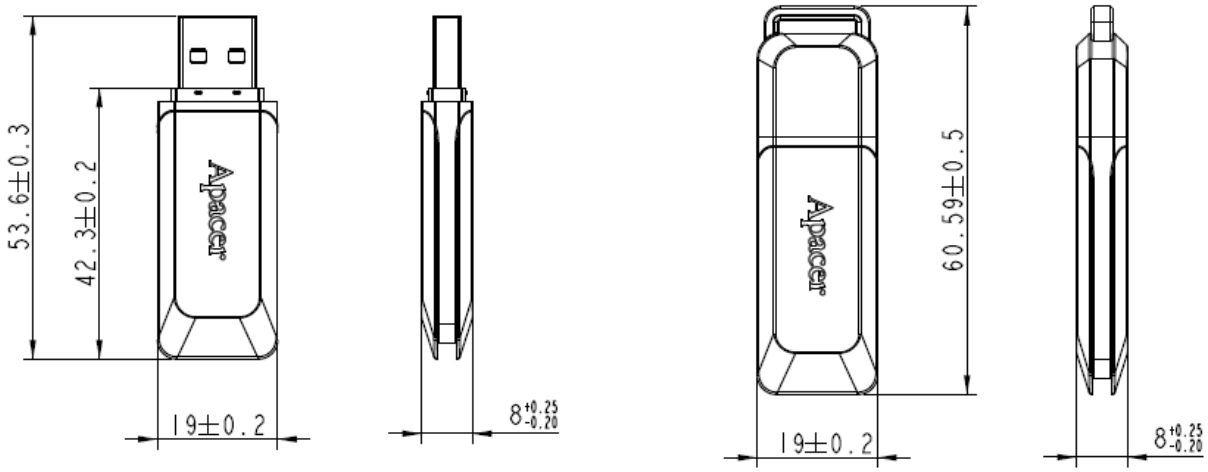

Figure 6-1 Dimensions

7. Product Ordering Information

7.1 Product Code Designations

AP HA xxxX X 1 3 X G – 6 T

- **Apacer Product Code**
- **Handy**
- **Capacity**
  256M = 256MB
  512M = 512MB
  001G = 1GB
  002G = 2GB
  004G = 4GB
  008G = 8GB
  016G = 16GB
  032G = 32GB
- **Solution Version**
- **Model Name**
  1 = AH321
- **PCB Version**
- **Temperature**
  C: Commercial Temperature
  E: Wide Temperature
- **G: RoHS Compliant**
- **Firmware Version**
- **Flash Type**
  T: Toshiba SLC

7.2 Valid Combinations

Capacity	Standard Temperature	Wide Temperature
256 MB	APHA256MR13CG-6T	APHA256MT13EG-6T
512 MB	APHA512MR13CG-6T	APHA512MT13EG-6T
1 GB	APHA001GR13CG-6T	APHA001GT13EG-6T
2 GB	APHA002GR13CG-6T	APHA002GT13EG-6T
4 GB	APHA004GR13CG-6T	APHA004GT13EG-6T
8 GB	APHA008GR13CG-6T	APHA008GT13EG-6T
16 GB	APHA016GR13CG-6T	APHA016GT13EG-6T
32 GB	APHA032GR13CG-6T	APHA032GT13EG-6T

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 (with content structure update)	8/28/2020

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