

RoHS Compliant USB Flash Drive

Industrial AH321 Product Specifications



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Version 1.1



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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
- **Performance¹**
 - 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.
- **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: 112 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**
 - 5V ± 5%
- **Power Consumption¹**
 - Active mode: 185 mA
 - Idle mode: 65 mA
- **Supports Non-Removable Setting**
- **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 Indicator for Drive Behavior**
- **RoHS Compliant**

Note:

1. Varies from capacities. The values for performance and power consumption 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 AH321 is a high-performance flash drive designed to provide a reliable and portable storage solution. Featuring a standard USB 2.0 interface, it is compatible with desktops, laptops, and enterprise PC systems. Equipped with an efficient microcontroller and advanced file management firmware, AH321 ensures optimal performance, functionality, and reliability. With its compact design and low power consumption, this flash drive is an ideal choice for users seeking dependable and energy-efficient portable storage.

2. Functional Block

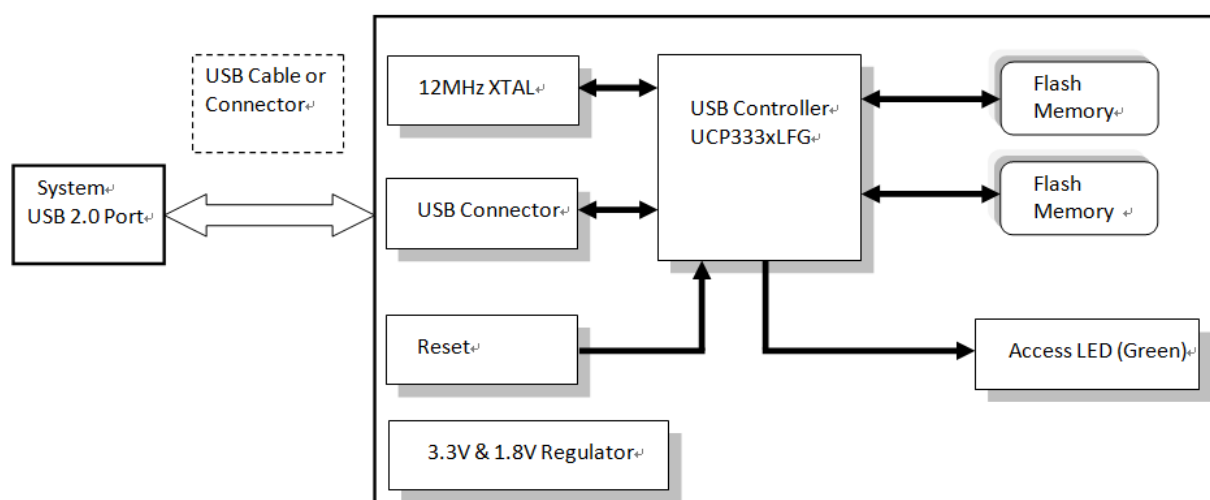


Figure 2-1 Functional Block Diagram

3. Product Specifications

3.1 Capacity

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	2,000,683,008	3,907,584
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

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.

3.2 Performance

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

Notes:

- 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.

3.3 Environmental Specifications

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

Table 3-3 Environmental Specifications

Parameter	Type	Specifications
Temperature	Operating	0°C to 70°C (Standard); -40°C to 85°C (Wide)
	Non-operating	-40°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.

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
- UKCA
- 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	112
4 GB	225
8 GB	464
16 GB	884
32 GB	1,768

Notes:

- 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 cycles: 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 has a limited number of erase cycles, known as the erase cycle limit or write endurance limit. This limit applies to each individual erase block within the flash device.

In typical applications, especially those utilizing a file system, certain pages are frequently updated (e.g., pages containing the File Allocation Table (FAT), registry, etc.). Without specialized handling, these pages would wear out more quickly than others, reducing the overall lifespan of the flash memory.

To address this issue, Apacer's AH321 implements a Global Wear Leveling algorithm. This algorithm ensures that consecutive writes to a specific sector are not physically written to the same page in the flash memory. Instead, it distributes write operations evenly across all available pages, effectively balancing wear and maximizing the flash's lifespan.

The Global Wear Leveling mechanism enhances reliability by extending the number of write/erase cycles, ensuring long-term data integrity and storage durability.

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.

Table 4-1 SMART Attribute ID List

ID (Hex)	Attribute Name
162 (0xA2)	Spare Block Count
163 (0xA3)	Maximum Erase Count
164 (0xA4)	Average Erase Count
166 (0xA6)	Total Later Bad Block Count
167 (0xA7)	Protect Mode

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. Mechanical Specifications

Table 6-1 Physical Dimensions

Parameter	Unit	256 MB	512 MB	1 GB	2GB	4 GB	8 GB	16 GB	32 GB
Length	mm	60.59 ± 0.50							
Width		19.00 ± 0.20							
Height		$8.00 + 0.25 / - 0.20$							

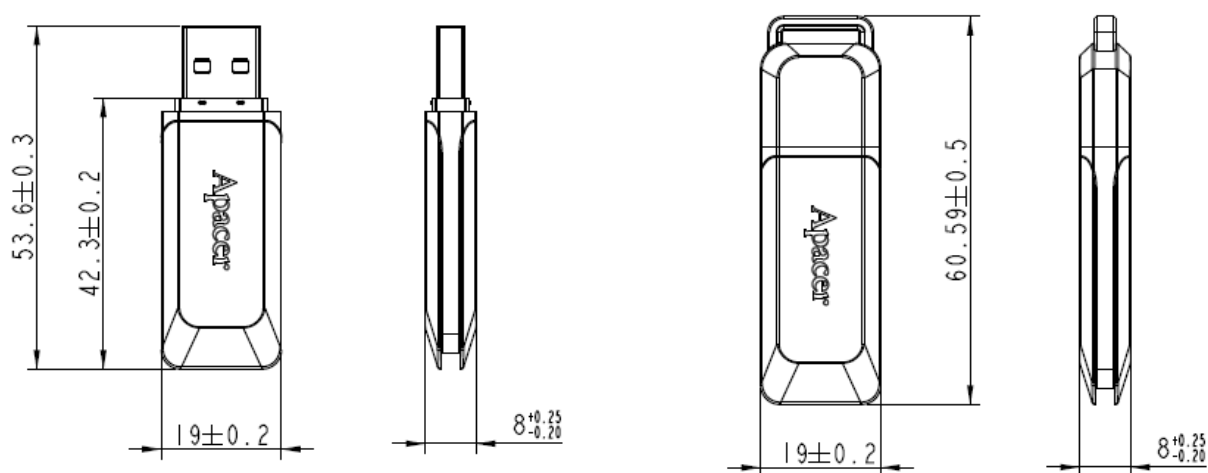
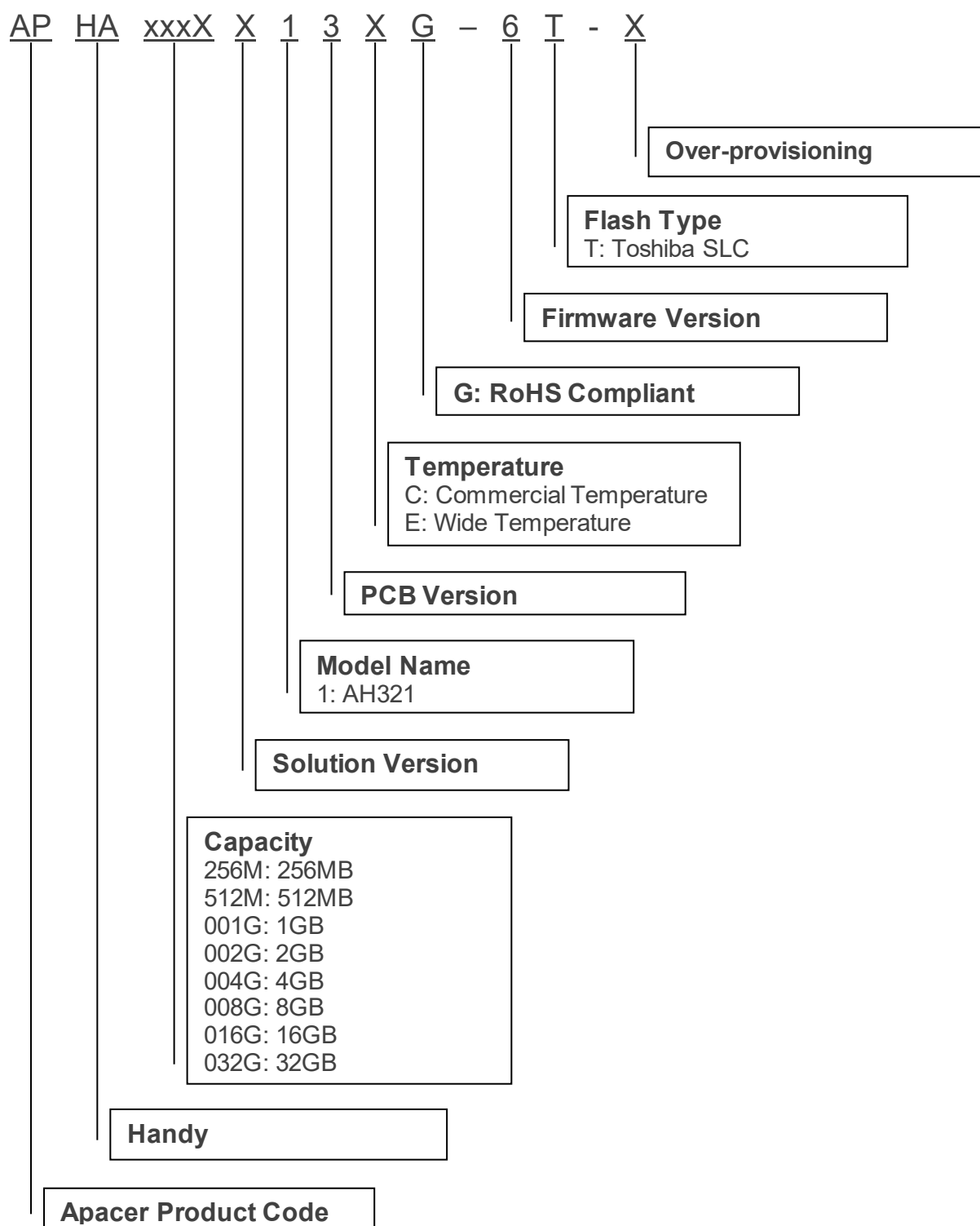


Figure 6-1 Physical Dimensions

7. Product Ordering Information

7.1 Product Code Designations



7.2 Valid Combinations

The following table lists the available models of the AH321 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	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-O	APHA002GT13EG-6T-O
4 GB	APHA004GR13CG-6T	APHA004GT13EG-6T
8 GB	APHA008GR13CG-6T	APHA008GT13EG-6T
16 GB	APHA016GR13CG-6T	APHA016GT13EG-6T
32 GB	APHA032GR13CG-6T	APHA032GT13EG-6T

Revision History

Revision	Description	Date
1.0	Official release (with content structure update)	8/28/2020
1.1	<ul style="list-style-type: none">- Updated total bytes and LBA for 2GB at Table 3-1- Updated endurance rating for 2GB on the Specifications Overview page and Table 3-4- Updated 7. Product ordering Information for 2GB	2/24/2025

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