

**RoHS Compliant**

## **USB Flash Drive**

**EH322 Product Specifications**



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**Version 2.0**



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## Specifications Overview:

- **USB3.0 Super Speed compatible, and backward compatible with USB2.0 & interface**
  - USB3.0 max. transfer rate: 5.0 Gbps
  - Backward compatible with 480Mbps & 12 Mbps
- **Capacity**
  - SLC: 256, 512 MB  
1, 2, 4, 8, 16, 32 GB
  - MLC: 8, 16, 32, 64, 128 GB
- **Performance\***
  - SLC**
    - Sequential read: Up to 80 MB/sec
    - Sequential write: Up to 70 MB/sec
  - MLC**
    - Sequential read: Up to 205 MB/sec
    - Sequential write: Up to 95 MB/sec
- **Endurance (in Terabytes Written: TBW)**
  - SLC**
    - 256 MB: 2 TBW
    - 512 MB: 5 TBW
    - 1 GB: 11 TBW
    - 2 GB: 22 TBW
    - 4 GB: 44 TBW
    - 8 GB: 88 TBW
    - 16 GB: 176 TBW
    - 32 GB: 352 TBW
  - MLC**
    - 8 GB: 6 TBW
    - 16 GB: 13 TBW
    - 32 GB: 29 TBW
    - 64 GB: 26 TBW
    - 128 GB: 66 TBW
- **Temperature Range**
  - Operating:
    - Standard: 0°C to 70°C
    - Wide: -40°C to 85°C
  - Storage: -40°C to 100°C
- **Flash Management**
  - Flash bad-block management
  - Built-in hardware ECC
  - Power saving implemented
  - Wear-leveling algorithms
  - S.M.A.R.T.
  - Power Failure Management
- **Power Consumption\***
  - Operating voltage: 5V
  - SLC**
    - Active mode: 225 mA
    - Idle mode: 65 mA
  - MLC**
    - Active mode: 275 mA
    - Idle mode: 80 mA
- **OS Support**
  - Windows: WinXP/7 or later
  - Mac: 10.2.8 or later
  - Linux: 2.4.10 or later
- **USB Bus-Powered Capability**
- **NAND Flash Type: SLC/MLC**
- **LED Indicators for Drive Behavior**
- **Dimensions: 55.29 x 18.00 x 8.50, unit: mm**
- **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.

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# 1. General Descriptions

Apacer USB3.0 Handy Flash Drive EH322 is ultra high-performance flash disk drive designed offering portable storage solutions or external memory expansion. This new generation USB flash drive is compatible with the latest USB specification – USB3.0 Super Speed, with a maximum transfer rate of 5.0 Gbps. The connector is backward employable with USB2.0 and USB1.1 interfaces as well. With compliance with USB3.0 specification, this USB drive can deliver up to 195 MB/s outstanding performance. Reliability wise, the USB comes with built-in hardware ECC to ensure data integrity. This product is well suited for portable flash storage applications while operating at minimal power consumption.

## 1.1 Performance-Optimized USB Controller

### 1.1.1 Power Saving Implemented

The internal controller of the USB model is designed with power saving implementations, allowing the device to operate at low power consumption.

### 1.1.2 Program RAM Architect

The internal Program RAM implementation allows the host to upgrade firmware codes anytime when needed.

### 1.1.3 Error Correction Code (ECC)

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.

### 1.1.4 Flash 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. When host performs program/erase command on a block, bad block may appear in Status Register. Since bad blocks are inevitable, the solution is to keep them in control. Apacer flash devices are programmed with ECC and block mapping technique 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.

### 1.1.5 Wear-Leveling Algorithms

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. Wear leveling is an important mechanism that level out the wearing of blocks so that the wearing-down of blocks can be almost evenly distributed. This will increase the lifespan of flash drives. Commonly used wear leveling types are Static and Dynamic.

## **1.1.6 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.

## **1.1.7 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.

## 2. General Specifications

### 2.1 SLC

**Table 2-1** General Specifications (SLC)

Item		Specifications								
Interface		Super-speed USB3.0 compliant; backward compatible with USB2.0 and USB1.1								
Performance* (MB/s)			<b>256MB</b>	<b>512MB</b>	<b>1GB</b>	<b>2GB</b>	<b>4GB</b>	<b>8GB</b>	<b>16GB</b>	<b>32GB</b>
		<b>Read</b>	60	60	65	65	65	80	80	80
		<b>Write</b>	10	21	40	40	50	65	70	70
Power Consumption**		Active: 225 mA Idle: 65 mA								
MTBF		2,000,000 hours								
Temperature	Operating	0°C to 70°C (Standard); -40°C to 85°C (Wide)								
	Storage	-40°C to 100°C								

Note:

Results may vary from flash configurations or host system settings.

\*Sequential performance is based on CrystalDiskMark 5.2.1 with file size 1,000MB.

\*\*Active power is an average power measurement performed using CrystalDiskMark with 128KB sequential read/write transfers.

### 2.2 MLC

**Table 2-2** General Specifications (MLC)

Item		Specifications							
Interface		Super-speed USB3.0 compliant; backward compatible with USB2.0 and USB1.1							
Performance*			<b>8GB***</b>		<b>16GB</b>	<b>32GB</b>	<b>64GB</b>	<b>128GB****</b>	
		<b>Read</b>	205	95	190	190	185	190	195
		<b>Write</b>	20	29	55	45	95	95	80
Power consumption**			<b>8GB***</b>		<b>16GB</b>	<b>32GB</b>	<b>64GB</b>	<b>128GB****</b>	
		<b>Active</b>	165	150	270	265	275	265	175
		<b>Idle</b>	75	50	85	80	80	55	35
MTBF		1,000,000 hours							
Temperature	Operating	0°C to 70°C (Standard); -40°C to 85°C (Wide)							
	Storage	-40°C to 100°C							

Note:

Results may vary from flash configurations or host system settings.

\*Sequential performance is based on CrystalDiskMark 5.2.1 with file size 1,000MB.

\*\*Active power is an average power measurement performed using CrystalDiskMark with 128KB sequential read/write transfers.

\*\*\*Values on the left are measured on 32Gb x2 while those on the right are measured on 64Gb x1.

\*\*\*\*Values on the left are measured on 512Gb x2 while those on the right are measured on 1Tb x1.

## 2.3 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 2-3** Endurance Specifications (SLC)

Capacity	TeraBytes Written
256 MB	2
512 MB	5
1 GB	11
2 GB	22
4 GB	44
8 GB	88
16 GB	176
32 GB	352

**Table 2-4** Endurance Specifications (MLC)

Capacity	TeraBytes Written
8 GB	6
16 GB	13
32 GB	29
64 GB	26
128 GB	66

Note:

- The estimated values are based on sequential write behavior. (Apacer EDTest Tool, test mode – sequential data pattern – 100.00% of disk space)
- Flash vendor guaranteed MLC P/E cycle: Toshiba - 3K.
- The WLE/WAF values may vary with the real application on user platform.
- 1 Terabyte = 1,000 GB.

## 2.4 LED Indicator Behavior

The behavior of the EH322 LED indicator is described in Table 2-5.

**Table 2-5** LED Behavior

Location	LED Color	Description
As indicated by the red marker below	Blue	LED blinks when the drive is being accessed such as power on, read or write. The blink frequency is 50ms switch H to L and loop.



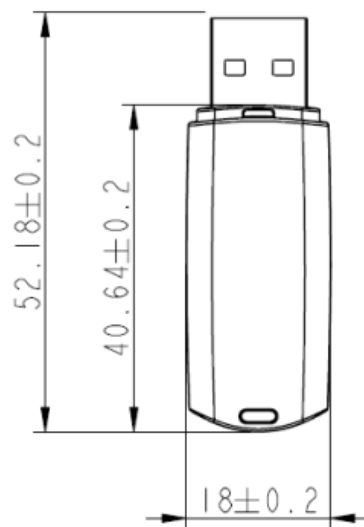
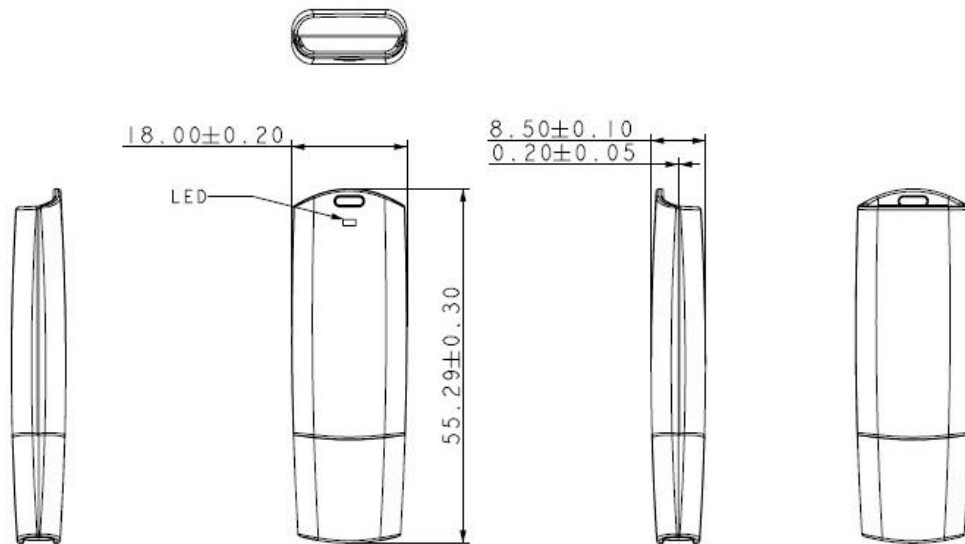
### 3. Absolute Maximum Rating

**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 3-1** Absolute Stress Rating

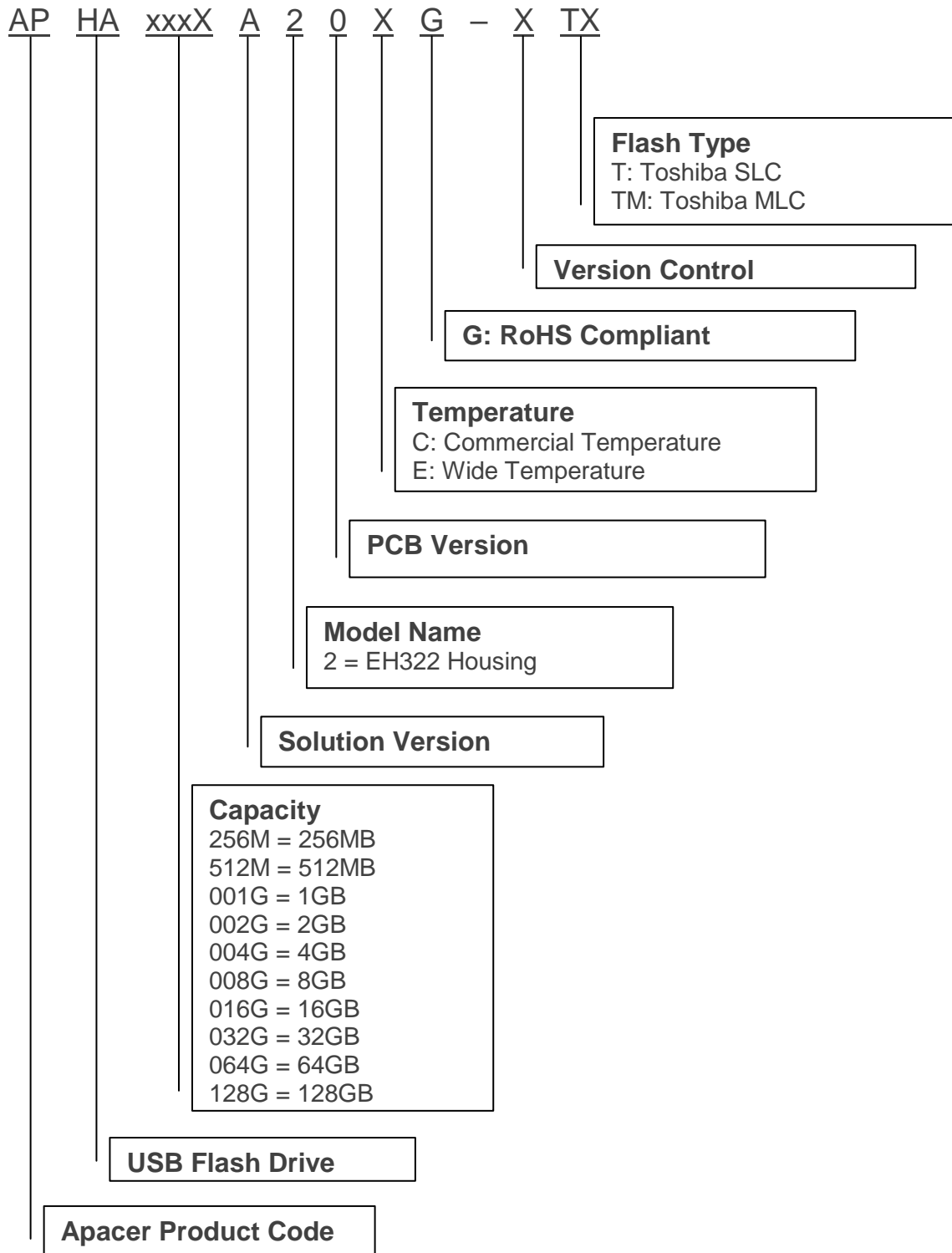
Item	Range
Supply Voltage	5V $\pm$ 5% (4.75-5.25V)
Required Power Supply	4.5-5.5V
Operating Temperature	0°C to 70°C (Standard) -40°C to 85°C (Wide)

## 4. Physical Characteristics



## 5. Product Ordering Information

### 5.1 Product Code Designations



## 5.2 Valid Combinations

### 5.2.1 EH322 (SLC)

Capacity	Standard Temperature	Wide Temperature
256MB	APHA256MA20CG-2T	APHA256MA20EG-2T
512MB	APHA512MA20CG-2T	APHA512MA20EG-2T
1GB	APHA001GA20CG-2T	APHA001GA20EG-2T
2GB	APHA002GA20CG-2T	APHA002GA20EG-2T
4GB	APHA004GA20CG-2T	APHA004GA20EG-2T
8GB	APHA008GA20CG-2T	APHA008GA20EG-2T
16GB	APHA016GA20CG-2T	APHA016GA20EG-2T
32GB	APHA032GA20CG-2T	APHA032GA20EG-2T

### 5.2.2 EH322 (MLC)

Capacity	Standard Temperature	Wide Temperature
8GB	APHA008GA20CG-3TM	APHA008GA20EG-3TM
16GB	APHA016GA20CG-3TM	APHA016GA20EG-3TM
32GB	APHA032GA20CG-3TM	APHA032GA20EG-3TM
64GB	APHA064GA20CG-3TM	APHA064GA20EG-3TM
128GB	APHA128GA20CG-3TM	APHA128GA20EG-3TM*
		APHA128G4LCEG-3TM*

**Note:** APHA128GA20EG-3TM represents the SSD manufactured based on 512Gb x2 while APHA128G4LCEG-3TM based on 1Tb x1.

## Revision History

Revision	Description	Date
1.0	Official release	04/20/2015
1.1	- Modified performance and power consumption data for MLC models. - Updated valid combinations for SLC and MLC models.	09/17/2015
1.2	- Revised model name from AH322 to EH322. - Revised product ordering information.	10/14/2015
1.3	Added S.M.A.R.T. and Power Failure Management to Features	10/3/2016
1.4	- Added 512Gb x2 & 1Tbx1 on MLC 128GB performance and power consumption - Updated product ordering information for MLC 128GB	7/13/2017
1.5	Updated dimensions on Features page	7/20/2017
1.6	- Updated Flash Management on Features page - Added OS Support on Features page - Updated performance table - Added LED Indicators for Drive Behavior on Features page - Updated 4. Physical Characteristics	11/10/2017
1.7	Added 2.3 Endurance	12/19/2017
1.8	- Updated the description of 1.1.3 Error Correction Code (ECC) - Renamed extended temperature to wide temperature - Renamed Power Failure Management to DataDefender at Flash Management on Specifications Overview page and 1.1.7 section and updated the technology description	12/13/2018
1.9	Replaced DataDefender with Power Failure Management	5/8/2019
2.0	- Updated technology description for 1.1.7 Power Failure Management - Added 2.4 LED Indicator Behavior section	9/18/2019

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