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AGI M.2 PCIe Gen3 SSD AP381E Series

Product Specification

Version 1.0

Part Number Information

AG2568GAP381E	Capacity: 256GB	PCIe M.2
AG5128GAP381E	Capacity: 512GB	PCIe M.2
AG1T08GAP381E	Capacity: 1TB	PCIe M.2

Revision History

Rev.	Date	Description
Preliminary	2025.09.10	First version draft published
V1.0	2026.05.29	Update capacity, performance, and reliability information

1. Introduction

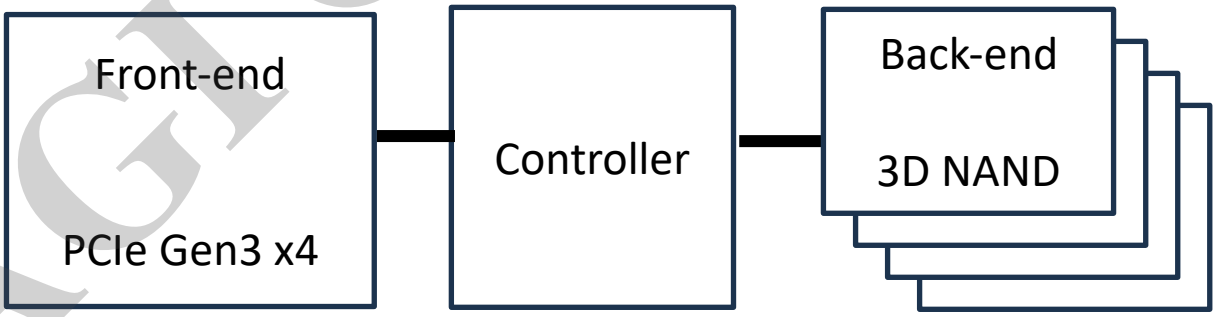
1.1 General Description

The AGI® Industrial M.2 PCIe Gen3 SSD is designed and built for industrial computers and embedded systems, providing stability, reliability and low power consumption. Here are three common applications for AGI® SSDs:

Hard drive replacement - Solid-state drives are the next generation of storage technology and run faster, quieter and cooler than traditional hard drives. With no moving parts, SSDs are also more durable and more reliable than hard drives.

For industrial PCs and embedded systems - AGI solid-state drives improve overall system responsiveness so it boots quicker, loads applications faster and operates more efficiently. They are suitable for a wide range of industrial and embedded platforms.

Revive older systems - Solid-state drives not only improve system performance but can also be used to extend the service life of older systems. Choosing an SSD is a practical and cost-effective way to upgrade an existing platform without a full system replacement.



1.2 General Description

1.2.1 Background Garbage Collection

SSDs use dedicated controllers to manage NAND Flash storage and perform Garbage Collection (GC). GC is a background management process that helps organize valid and invalid data within the Flash memory.

When a file is deleted in an operating system such as Windows, the OS usually updates its file system table to mark that file as deleted. On a hard disk drive (HDD), the invalid data can remain in place until the system writes new data over it.

NAND Flash works differently. Data that already exists in a used block cannot be overwritten directly. Before new data can be written, the SSD must complete a Program/Erase cycle. In practice, the controller first moves any valid data from the used block to available pages in another block, then erases the original block, and finally writes the new data to the erased block. This operation is known as Garbage Collection. Modern operating systems also support the TRIM command, which allows the OS to inform the SSD which data is no longer needed, helping the SSD reclaim space earlier and reduce unnecessary data movement.

1.2.2 Wear-Leveling

AGI Flash storage devices use controller technologies designed to balance the number of Program/Erase (P/E) cycles across the Flash memory. By spreading write and erase activity more evenly among memory blocks, wear-leveling helps extend drive life and maintain more consistent performance throughout the product's service life.

1.2.3 Feature Description

- PCIe Gen3 x4 / NVMe 1.3 (or 1.4)
- Compliant with PCIe Express 3.1
- Advanced hardware LDPC ECC Technology
- Wear-Leveling
- Bad Block Management
- Background Garbage Collection
- TRIM Command
- SLC Cache Technology
- Supports Host Memory Buffer (HMB)
- AES 256-bit encryption support
- S.M.A.R.T. Monitor
- Thermal Throttling

2. General Product Specifications

2.1 Capacity

Addressable sectors follow the IDEMA organization standard, reference to Document LBA1-03 LBA Count for Disk Drives Standard.

Unformatted Capacity	Total User Addressable Sectors in LBA
256GB	500,118,192
512GB	1,000,215,216
1TB	2,000,409,264

2.2 Fundamental Specification

- Density: 256GB/512GB/1TB
- Form-Factor: NGFF 2280 M.2
- Interface: PCIe Gen3 x4, NVMe 1.4
- Performance:

Capacity	256GB	512GB	1TB
Sequential Read	1600	3300	3300
Sequential Write	1500	2000	2000
4K Random Read (QD32)	500	1000	1000
4K Random Write (QD32)	1000	1100	1100

- Power Consumption:

Power	Minimum Power (mW)	Maximum Power (mW)	Average Power (mW)
Power Mode Active	2643.41	3311.7	3230.7
Random Read	2192.81	2394.3	2346.9
Random Write	2643.41	3110.3	2890.8
Sequential Read	2462.22	3311.7	3230.7
Sequential Write	2629.11	3115.8	2906.4

*This data is based on testing with the 1TB capacity model.

2.3 Power Specification

Parameter	Specification
Input Voltage	3.3V +/- 5%

2.4 Reliability Specification

Parameter	Value
Mean Time between Failure (MTBF)	2,000,000 hours

2.5 Endurance and Warranty Policy

AGI warrants that its products will be free from defects in material and workmanship for the original end-user customer. Warranty coverage for this product remains valid until the earlier of the following:

(i) Three years from the original end-user customer's date of purchase.

(ii) The date on which the SSD reaches its TBW threshold, as determined by AGI software.

Parameter	Specification	
Warranty Period	3 Years/TBW either or	
TBW	256GB	200TB
	512GB	400TB
	1TB	800TB

3. Physical Specification

The NGFF M.2 2280 form factor complies with the JEDEC specification for NGFF M.2 2280. Detailed mechanical dimensions are listed below, including tolerance information.

Length	Width	Thickness	Weight
80mm	22mm	3.5mm	6g

4. Environment Specifications

4.1 Storage Specification

Mode	Min	Max	unit
Operating	-25	85	℃
Storage	-40	85	℃

4.2 Durability Specification

All materials are required to pass the ICQ unit's visual inspection (VI) and quality tests. Routine durability testing covers both new PCBAs and running materials to ensure consistent product durability.

Item	Condition
Shock	1500G@0.5ms

5. PCIe M.2 2280 Pin Assignment

Signal (Even Pin — Bottom Side)	Pin	Pin	Signal (Odd Pin — Top Side)
+3.3V	74	75	GND
+3.3V	72	73	GND
+3.3V	70	71	GND
SUSCLK (32.768 kHz)	68	69	PEDET (No Connect for PCIe)
Module Key (M)	66	67	N/C
Module Key (M)	64	65	Module Key (M)
Module Key (M)	62	63	Module Key (M)
Module Key (M)	60	61	Module Key (M)
MFG_CLK (No Connect)	58	59	Module Key (M)
MFG_DATA (No Connect)	56	57	GND
PEWAKE# (I/O, 0/3.3V)	54	55	REFCLKp (100 MHz +)
CLKREQ# (I/O, 0/3.3V)	52	53	REFCLKn (100 MHz –)
PERST# (I, 0/3.3V)	50	51	GND
N/C	48	49	PERp0 (Lane 0 RX +)
N/C	46	47	PERn0 (Lane 0 RX –)
ALERT# (O, 0/1.8V) N/C	44	45	GND
SMB_DATA (I/O, 0/1.8V) N/C	42	43	PETp0 (Lane 0 TX +)
SMB_CLK (I/O, 0/1.8V) N/C	40	41	PETn0 (Lane 0 TX –)
N/C	38	39	GND
N/C	36	37	PERp1 (Lane 1 RX +)
N/C	34	35	PERn1 (Lane 1 RX –)
N/C	32	33	GND
N/C	30	31	PETp1 (Lane 1 TX +)
N/C	28	29	PETn1 (Lane 1 TX –)
N/C	26	27	GND
N/C	24	25	PERp2 (Lane 2 RX +)
N/C	22	23	PERn2 (Lane 2 RX –)
N/C	20	21	GND
+3.3V	18	19	PETp2 (Lane 2 TX +)
+3.3V	16	17	PETn2 (Lane 2 TX –)
+3.3V	14	15	GND
+3.3V	12	13	PERp3 (Lane 3 RX +)
LED1# (Activity LED, N/C)	10	11	PERn3 (Lane 3 RX –)
N/C	8	9	GND
N/C	6	7	PETp3 (Lane 3 TX +)
+3.3V	4	5	PETn3 (Lane 3 TX –)
+3.3V	2	3	GND
		1	GND