

Product Specification

Morex M.2 PCIe A4E



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Form Factor

- M.2 2280-D2-M

Storage:

- -55°C to 95°C

NAND Flash Type

- 3D-MLC

Shock & Vibration

- Shock: 1500G@0.5ms
- Vibration: 20G (7~2KHz)

Capacities

- 128GB, 256GB

MTBF

- > 3,000,000 hours

Performance

- Sequential Read Q128T1 (max): 1260 MB/sec
- Sequential write Q128T1 (max): 907 MB/sec
- Random Read Q128T1 (max): 92200 IOPS
- Random write Q128T1 (max): 97500 IOPS

Compliance With

- PCIe Gen 3 x 4
- PCIe Base Specification Revision 3.1
- Support NVMe 1.2 Protocol
- M.2 PCIe interface
- Self-Monitoring, Analysis, and Reporting Technology(S.M.A.R.T)

Supply Voltage

- 3.3V±5%

Power Consumption

- Idle mode: 1.19W (3.3Vx360mA)
- Active mode(max): 5.28W (3.3Vx1600mA)

Data Protection and Reliability

- The new generation *NANDXtend™ includes 2KB LDPC engine with advanced firmware algorithm
- Global wear leveling algorithm

Temperature Ranges**Operating:**

- Standard: 0°C~+70°C
- Extended: -25°C~+85°C
- Industrial: -40°C~+85°C

Certificates and Declarations

- RoHS
- REACH

*NANDXtend™ is a trademark owned by Silicon Motion Technology Corp. and used by Morex.

REVISION HISTORY

Version	Description	Date
Beta-1	Preliminary release	2017/01/09
1.0	Initial release	2017/02/08

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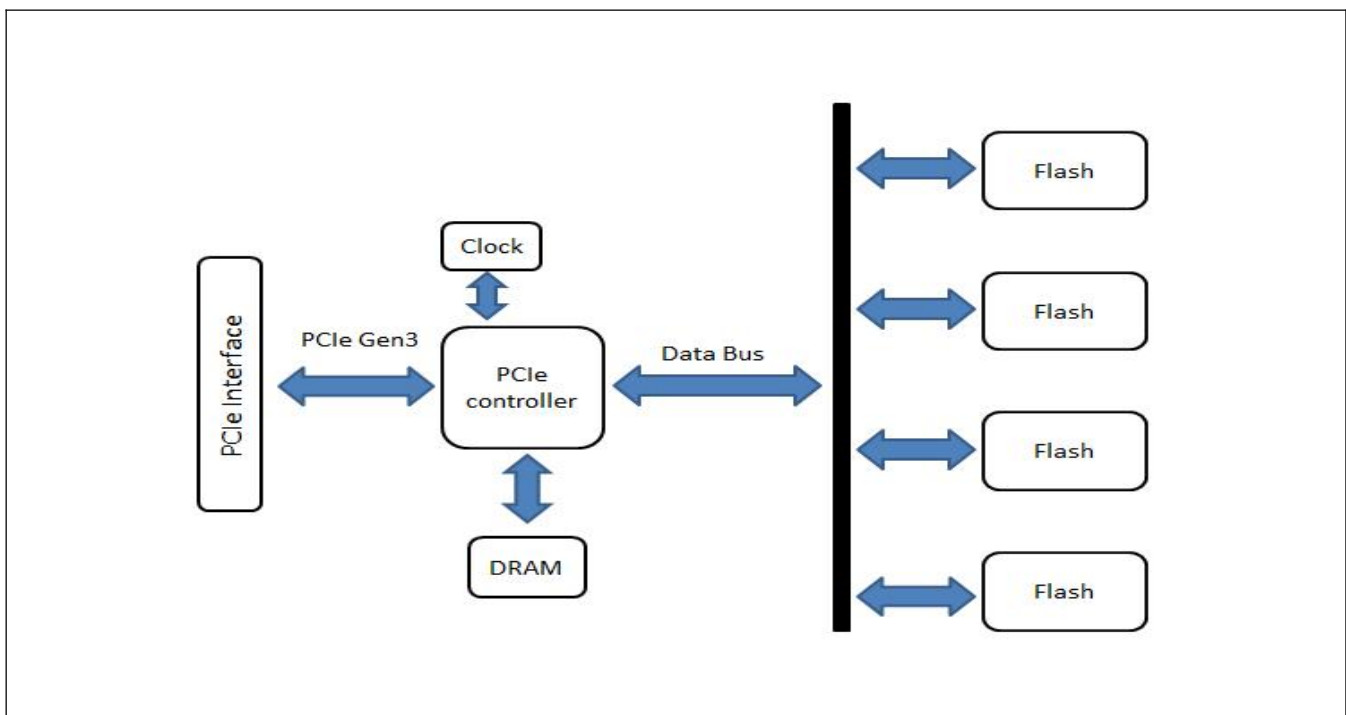
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1. Overview

1.1 Introduction

M.2 PCIe A4E is a PCIe Gen3 x4 32Gb/s 3D MLC NAND flash module. The compact-sized M.2 PCIe A4E offers superior read/write speeds and reliability for data center server and heavy users of computer games.

1.2 Block Diagram



2. Product Specifications

2.1 Capacity

Raw Capacity	Cylinder	Head	Sector	Capacity	LBA*
128GB	16383	16	63	111.79GB	234441648
256GB	16383	16	63	223.57GB	468862128

Note: *One LBA = 512 Bytes.

2.2 Performance

Brand	Capacity	Sequential Read Q128T1 MB/sec (Max.)	Sequential Write Q128T1 MB/sec (Max.)	Random Read IOPS (4KB QD128T1)	Random Write IOPS (4KB QD128T1)
Micron	128GB	974	497	43.6K	120K
Intel	256GB	1260	907	92.2K	97.5K

Note: Test tool: CrystalDiskMark 5.1.2

* Sequential performance is measured by file size 4GB.

**Random performance is measured by 4KB Queue Depth 128.

2.3 Power Characteristics

Supply Voltage	Parameter Specification
Input Voltage	3.3V±5%
Power Consumption	Specification (W)
Idle (max.)	1.19W (3.3Vx360mA)
Active (max.)	5.28W (3.3Vx1600mA)

2.4 Environmental Conditions

Environment	Specification
Storage Temperature	-55°C~+95°C
Operating Temperature	0°C+70°C (Standard) ; -25°C~+85°C (Extended); -40°C~+85°C (Industrial)
Vibration*	20G (7~2K Hz)
Shock**	1500G@0.5ms
Humidity	Relative Humidity: 10-95%, non-condensing
MTBF***	>3,000,000 hours

Note: *Vibration reference to IEC 60068-2-6 testing standard.

**Shock reference to IEC 60068-2-27 testing standard.

***MTBF prediction is based on Telcordia SR-332.

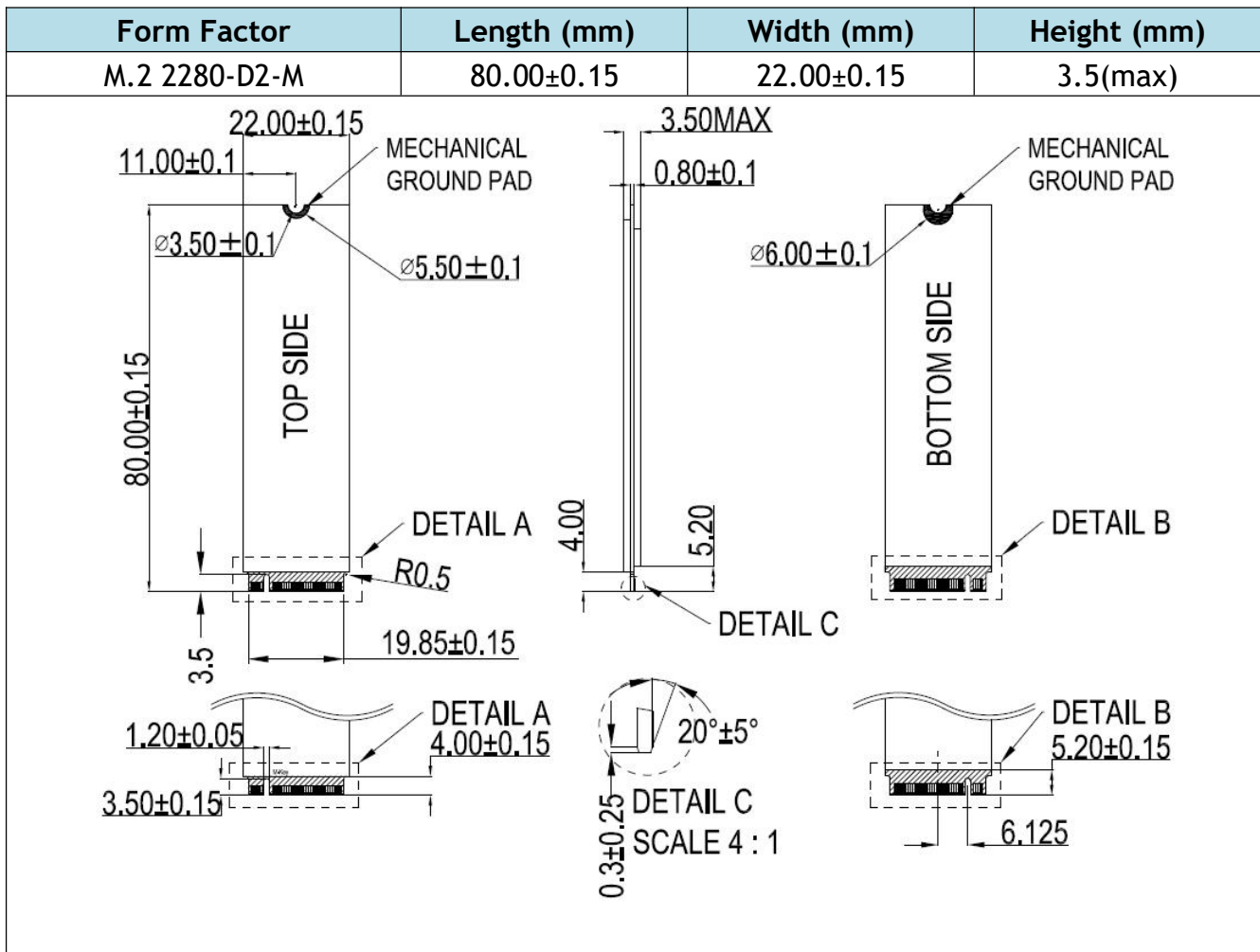
2.5 Total Bytes Written

Capacity	Endurance - TBW*
128GB	147TB
256GB	294TB

Note: * TBW calculation is tested upon JEDEC JESD218A & 219A standards.

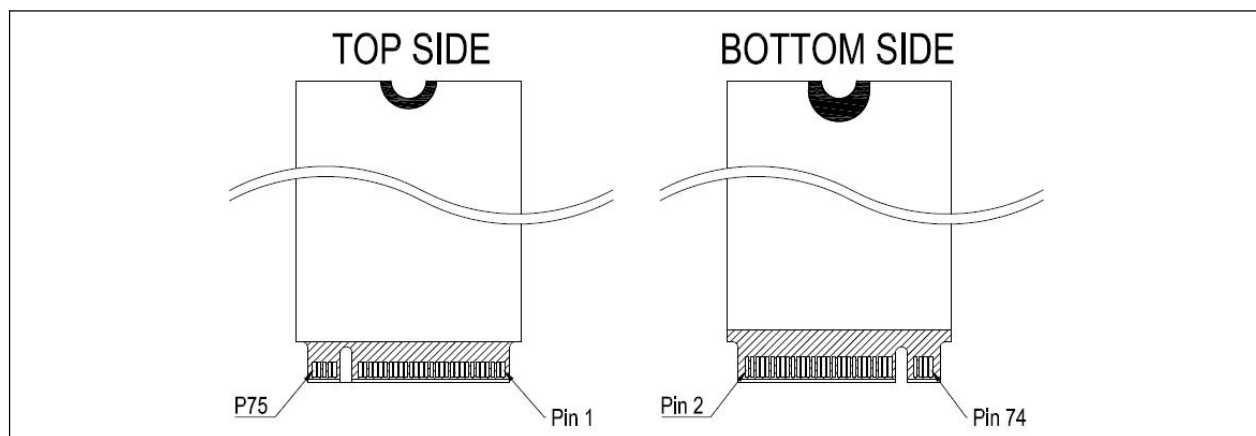
3. Mechanical Information

3.1 Dimensions



Notes: All dimensions are in millimeters.

3.2 Connector Pin Signal Location



3.3 Connector Pin Signal Definitions

PIN #	Function	PIN #	Function
74	3.3V	75	CONFIG_2=GND
72	3.3V	73	GND
70	3.3V	71	GND
68	NC	69	CONFIG_1= NC
	Module Key	67	NC
	Module Key		Module Key
	Module Key		Module Key
	Module Key		Module Key
58	NC	57	GND
56	NC	55	REFCLKP
54	NC	53	REFCLKN
52	CLKREQ#	51	GND
50	PERST#	49	PERp0
48	NC	47	PERn0
46	NC	45	GND
44	NC	43	PETp0
42	NC	41	PETn0
40	NC	39	GND
38	NC	37	PERp1
36	NC	35	PERn1
34	NC	33	GND
32	NC	31	PETp1
30	NC	29	PETn1
28	NC	27	GND
26	NC	25	PERp2
24	NC	23	PERn2
22	NC	21	CONFIG_0=GND
20	NC	19	PETp2
18	3.3V	17	PETn2
16	3.3V	15	GND
14	3.3V	13	PERp3
12	3.3V	11	PERn3
10	LED1#	9	GND
8	NC	7	PETp3
6	NC	5	PETn3
4	3.3V	3	GND

2	3.3V	1	CONFIG_3=GND
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4. Software Information

4.1 Software Function

- S.M.A.R.T
- TRIM

4.2 SMART Attributes

SMART Log Page (LID=0x02)	
Bytes	Description
0	Critical Warning: This field indicates critical warnings for the state of the controller. Each bit corresponds to a critical warning type; multiple bits may be set. If a bit is cleared to '0', then that critical warning does not apply. Critical warnings may result in an asynchronous event notification to the host. Bits in this field represent the current associated state and are not persistent.
2:1	Composite Temperature: Contains a value corresponding to a temperature in degrees Kelvin that represents the current composite temperature of the controller and namespace(s) associated with that controller. The manner in which this value is computed is implementation specific and may not represent the actual temperature of any physical point in the NVM subsystem. The value of this field may be used to trigger an asynchronous event Warning and critical overheating composite temperature threshold values are reported by the WCTEMP and CCTEMP fields in the Identify Controller data structure.
3	Available Spare: Contains a normalized percentage (0 to 100%) of the remaining spare capacity available.
4	Available Spare Threshold: When the Available Spare falls below the threshold indicated in this field, an asynchronous event completion may occur. The value is indicated as a normalized percentage (0 to 100%).
5	Percentage Used: Contains a vendor specific estimate of the percentage of NVM subsystem life used based on the actual usage and the manufacturer's prediction of NVM life. A value of 100 indicates that the estimated endurance of the NVM in the NVM subsystem has been consumed, but may not indicate an NVM subsystem failure. The value is allowed to exceed 100. Percentages greater than 254 shall be represented as 255. This value shall be updated once per power-on hour (when the controller is not in a sleep state). Refer to the JEDEC JESD218A standard for SSD device life and endurance measurement techniques.
31:6	Reserved
47:32	Data Units Read: Contains the number of 512 byte data units the host has read from the controller; this value does not include metadata. This value is reported in thousands

	(i.e., a value of 1 corresponds to 1000 units of 512 bytes read) and is rounded up. When the LBA size is a value other than 512 bytes, the controller shall convert the amount of data read to 512 byte units. For the NVM command set, logical blocks read as part of Compare and Read operations shall be included in this value.
63:48	Data Units Written: Contains the number of 512 byte data units the host has written to the controller; this value does not include metadata. This value is reported in thousands (i.e., a value of 1 corresponds to 1000 units of 512 bytes written) and is rounded up. When the LBA size is a value other than 512 bytes, the controller shall convert the amount of data written to 512 byte units. For the NVM command set, logical blocks written as part of Write operations shall be included in this value. Write Uncorrectable commands shall not impact this value.
79:64	Host Read Commands: Contains the number of read commands completed by the controller. For the NVM command set, this is the number of Compare and Read commands.
95:80	Host Write Commands: Contains the number of write commands completed by the controller. For the NVM command set, this is the number of Write commands.
111:96	Controller Busy Time: Contains the amount of time the controller is busy with I/O commands. The controller is busy when there is a command outstanding to an I/O Queue (specifically, a command was issued via an I/O Submission Queue Tail doorbell write and the corresponding completion queue entry has not been posted yet to the associated I/O Completion Queue). This value is reported in minutes.
127:112	Power Cycles: Contains the number of power cycles.
143:128	Power On Hours: Contains the number of power-on hours. This does not include time that the controller was powered and in a low power state condition.
159:144	Unsafe Shutdowns: Contains the number of unsafe shutdowns. This count is incremented when a shutdown notification (CC.SHN) is not received prior to loss of power.
175:160	Media and Data Integrity Errors: Contains the number of occurrences where the controller detected an unrecovered data integrity error. Errors such as uncorrectable ECC, CRC checksum failure, or LBA tag mismatch are included in this field.
191:176	Number of Error Information Log Entries: Contains the number of Error Information log entries over the life of the controller.
195:192	Warning Composite Temperature Time: Contains the amount of time in minutes that the controller is operational and the Composite Temperature is greater than or equal to the Warning Composite Temperature Threshold (WCTEMP) field and less than the Critical Composite Temperature Threshold (CCTEMP) field in the Identify Controller data structure. If the value of the WCTEMP or CCTEMP field is 0h, then this field is always cleared to 0h regardless of the Composite Temperature value.
199:196	Critical Composite Temperature Time: Contains the amount of time in minutes that the controller is operational and the Composite Temperature is greater the Critical Composite Temperature Threshold (CCTEMP) field in the Identify Controller data

	structure in Figure 90. If the value of the CCTEMP field is 0h, then this field is always cleared to 0h regardless of the Composite Temperature value.
201:200	Temperature Sensor 1: Contains the current temperature in degree Kelvin reported by temperature sensor 1.
203:202	Temperature Sensor 2: Contains the current temperature in degree Kelvin reported by temperature sensor 2.
205:204	Temperature Sensor 3: Contains the current temperature in degree Kelvin reported by temperature sensor 3.
207:206	Temperature Sensor 4: Contains the current temperature in degree Kelvin reported by temperature sensor 4.
209:208	Temperature Sensor 5: Contains the current temperature in degree Kelvin reported by temperature sensor 5.
211:210	Temperature Sensor 6: Contains the current temperature in degree Kelvin reported by temperature sensor 6.
213:212	Temperature Sensor 7: Contains the current temperature in degree Kelvin reported by temperature sensor 7.
215:214	Temperature Sensor 8: Contains the current temperature in degree Kelvin reported by temperature sensor 8.
511:216	Reserved
63:48	Data Units Written: Contains the number of 512 byte data units the host has written to the controller; this value does not include metadata. This value is reported in thousands (i.e., a value of 1 corresponds to 1000 units of 512 bytes written) and is rounded up. When the LBA size is a value other than 512 bytes, the controller shall convert the amount of data written to 512 byte units. For the NVM command set, logical blocks written as part of Write operations shall be included in this value. Write Uncorrectable commands shall not impact this value.
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