

**Industrial M.2 2280 PCIe Gen3x4  
A-Series 3D TLC  
with Power shield  
512GB,1TB,2TB  
データシート**

株式会社アドテック

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Features	
<ul style="list-style-type: none"> <li>● Compliance with               <ul style="list-style-type: none"> <li>- PCIe Gen 3 (8Gb/s) X4 Lane with L1.2 support</li> <li>- Compliant with PCIe Express 3.1</li> <li>- NVMe 1.3 register interface and command set<sup>1</sup></li> </ul> </li> <li>● Capacities               <ul style="list-style-type: none"> <li><b>Bics4:</b></li> <li>- 3D TLC NT/WT: 512GB,1TB,2TB</li> <li><b>Bics3:</b></li> <li>- 3D TLC NT/WT: 1TB</li> </ul> </li> <li>● Data Protection and Reliability               <ul style="list-style-type: none"> <li>- Support DDR3/DDR3L External DRAM Buffer.</li> <li>- Performance-optimized LDPC engine provides maximum error correction capability for 2D TLC as well as 3D TLC.</li> <li>- SECDED2 SRAM ECC error handling and prevention on major memory buffers.</li> <li>- RAID engine provides multi-page protection for NAND flash data.</li> <li>- Supports 4 flash channels with 4 chip enable (CE) pins per channel.</li> <li>- Supports ONFI 4.0/3.0 and Toggle 3.0/2.0 interface, frequency up to 667 MT/s.</li> <li>- Programmable driving strength fits different types of NAND configurations.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● MTBF               <ul style="list-style-type: none"> <li>- &gt; 2,000,000 hours</li> </ul> </li> <li>● Temperature ranges               <ul style="list-style-type: none"> <li>Operating:</li> <li>- Standard: 0°C to 70°C</li> <li>- Industrial: -40°C to 85°C</li> <li>Storage:</li> <li>- -55°C to 95°C</li> </ul> </li> <li>● Supply voltage               <ul style="list-style-type: none"> <li>- 3.3 V ±5%</li> </ul> </li> <li>● Form factor               <ul style="list-style-type: none"> <li>- PCIe</li> </ul> </li> <li>● Shock &amp; Vibration               <ul style="list-style-type: none"> <li>- Shock: 1500G@0.5ms</li> <li>- Vibration: 20 G</li> </ul> </li> <li>● Certification and Compliance               <ul style="list-style-type: none"> <li>- FCC</li> <li>- CE</li> <li>- RoHs</li> </ul> </li> <li>● NAND Flash Type               <ul style="list-style-type: none"> <li>- 3D TLC</li> </ul> </li> </ul>

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## Revision History

Rev	Date	Description
1.0	2022/09/12	First Release

# 1. Product Description

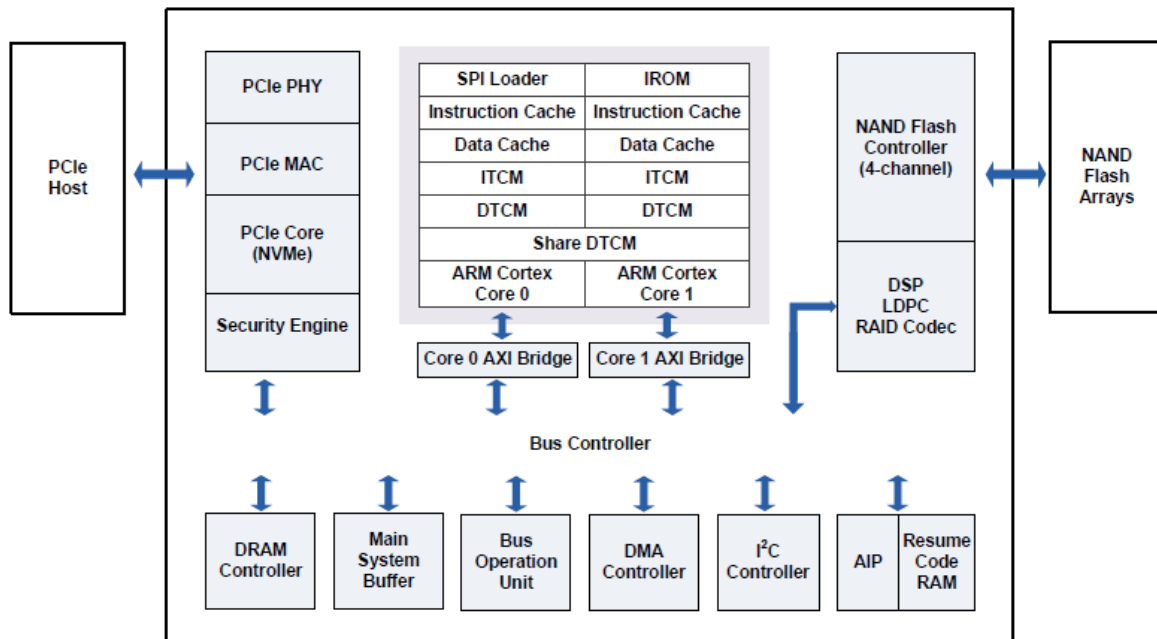
## 1.1. Product Overview

This SSD is a NVMe Express DRAM SSD designed as the standard M.2 form factor with PCIe interface and TLC NAND Flash. This SSD supports PCIe Gen III, and it is compliant with NVMe 1.3 providing excellent performance. Moreover, it adopts TLC NAND Flash providing high endurance and reliability. With sophisticated error detection and correction (ECC) functions.

Another innovative design feature is worth mention is "Power Shield" , excellent electronic circuit design provides high efficiency power protection capacitor charging efficiency, when a suddenly power failure can protect the integrity of the data write. This SSD is the perfect storage device for industrial PCs, Vehicle System, Professional-Grade Photography System.

This SSD is integrated with Silicom Motion controller which provides both low power consumption and efficient heat dissipation, working together, maximizes the reliability and endurance to respond the growing need for more data storage space.

## 1.2. Block Diagram



## 2. Product Specification

### 2.1. Capacity

Raw Capacity	Capacity	LBA
512GB	447.11 GB	937,703,088
1 TB	894.24 GB	1,875,385,008
2 TB	1788.5 GB	3,750,748,848

### 2.2. Performance

- 3D TLC (Bics4)

Capacity	512GB	1TB	2TB
<b>Sequential Read(Max)</b>	3258MB/sec	3460 MB/sec	3462 MB/sec
<b>Sequential Write(Max)</b>	939 MB/sec	1883 MB/sec	2899 MB/sec

- 3D TLC (Bics3)

Capacity	1TB
<b>Sequential Read(Max)</b>	3440 MB/sec
<b>Sequential Write(Max)</b>	1852 MB/sec

Notes:

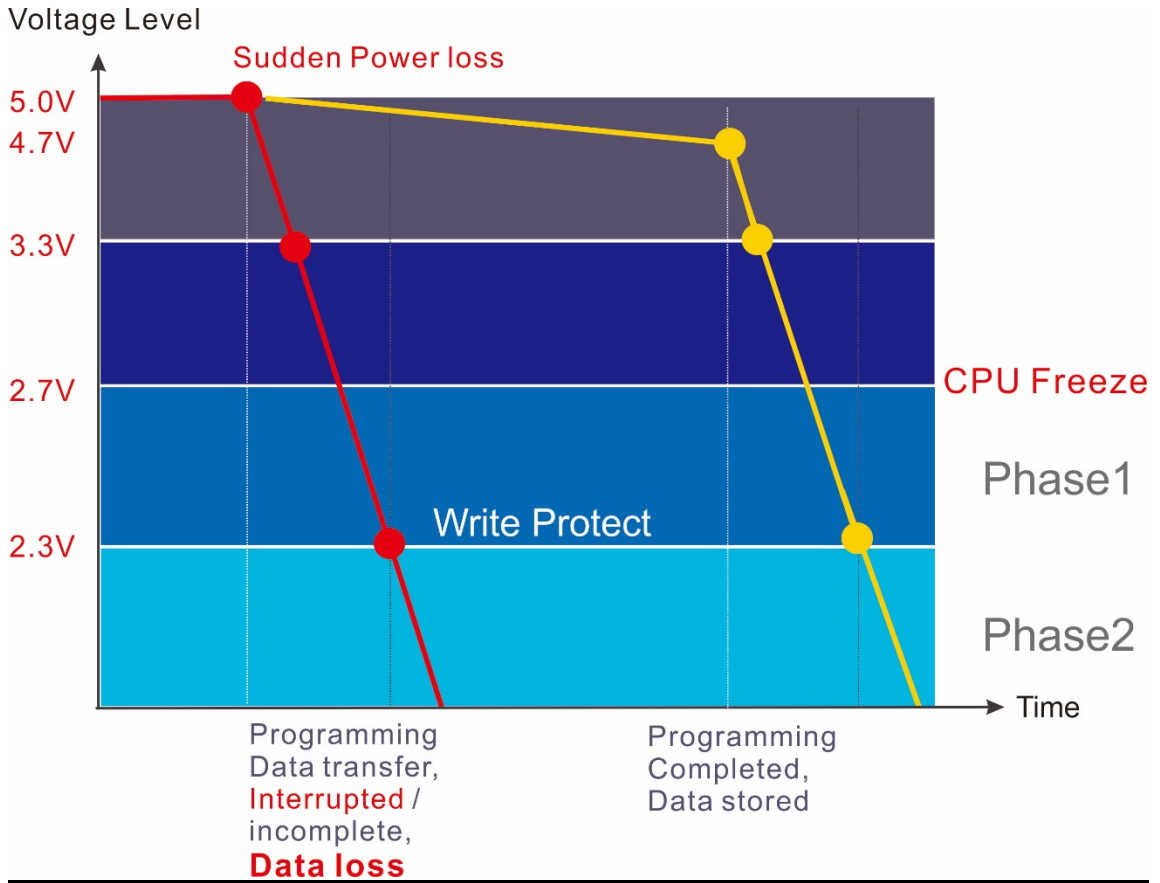
- Performance may base on SSD capacity, hardware test platform, test software, operating system and other system variables.
  - The performance provided is the highest of the same capacity combinations.
- The actual speed will be different because the ICs and channels are different from the quantity.

### 2.3. Software Function

- ECC Scheme
- UART function
- GPIO
- S.M.A.R.T
- TRIM

## 2.4. Power shield function

Excellent Power Shield function, when a suddenly power failure can protect the integrity of the data write.





### 3. Reliability Specifications

#### 3.1. Environmental Conditions

Environmental specifications are following MIL-STD-810F, as following table.

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

Note1: Vibration reference standard "IEC 60068-2-6"

Note2: Shock reference standard "IEC 60068-2-27"

Note3: MTBF condition," Telcordia SR-332"

#### 3.2. TBW

Capacity	TBW
512GB	769 TB
1TB	1538 TB
2TB	3077 TB

## 4. Specification

### 4.1. Overview

The overlook views of M.2 2280 Module are illustrated in Figure 1.

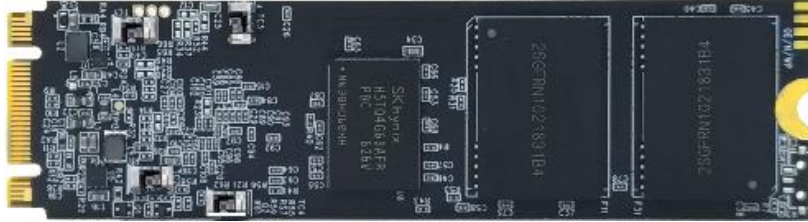


Figure 1: M.2 2280 Module Overlook Diagram

### 4.2. Dimension

The Dimensions of M.2 2280 Module are illustrated in Figure 1.

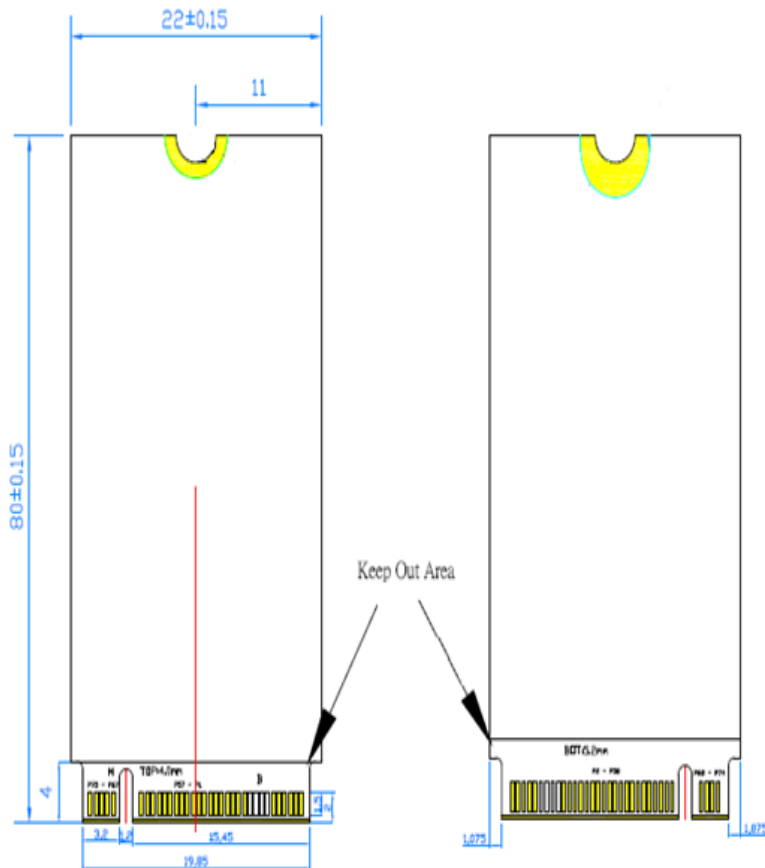


Figure 1: M.2 2280 Module Dimensions

### 4.3. Electronic Specifications

#### 4.4.1 PCIe interface Signals

Signal	Ball NO.	Type	Description	PU/PD
PORXP	F1	Input	PCIe Received data differential pair	-
PORXN	G1	Input		-
P1RXP	J1	Input		-
P1RXN	K1	Input		-
P2RXP	M1	Input		-
P2RXN	N1	Input		-
P3RXP	R1	Input		-
P3RXN	T1	Input		-
P0TXP	G2	Output	PCIe Transmit data differential pair	-
P0TXN	H2	Output		-
P1TXP	K2	Output		-
P1TXN	L2	Output		-
P2TXP	N2	Output		-
P2TXN	P2	Output		-
P3TXP	T2	Output		-
P3TXN	U2	Output		-
REFCLKP	D2	Input	100MHz positive input of differential input clock	-
REFCLKN	D1	Input	100MHz negative input of differential input clock	-
RREF	J3	Input	Reference resistor connection for PCIe PHY	-

#### 4.4. Error Detection and Correction

The LDPC ECC engine executes parity generation and error detection/correction features, and enhances decoding throughput and data reliability. With LDPC of correction capability 1e-2 RBER, the hard and soft decoding mechanism provides powerful error correction. Hence the SSD can enhance the endurance and retention of TLC NAND and extends the SSD lifespan.

#### 4.5. Wear-Leveling

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

#### 4.6. Bad Blocks Management

Bad Blocks are blocks that contain one or more invalid bits whose reliability are not guaranteed. The Bad Blocks may be presented while the SSD is shipped, or may generate during the life time of the SSD. When the Bad Blocks is detected, it will be flagged, and not be used anymore. The SSD implement Bad Blocks management and replacement, Error Correct Code to avoid data error occurred. The functions will be enabled automatically to transfer data from Bad Blocks to spare blocks, and correct error bit. After the reserved block less than 10 of each channel, the SSD will be locked, and cannot be read and written anymore. Host can send a vendor ATA command to unlock the SSD for backup data or system from SSD.

#### 4.7. Mean Time Between Failures (MTBF)

**Failure Rate:** The total number of failures within an item population, divided by the total number of life units expended by that population, during a particular measurement interval under stated condition.

**Mean Time Between Failures (MTBF):** A basic measure of reliability for repairable items: The mean number of life units during which all parts of the item perform within their specified limits, during a particular measurement interval under stated conditions.

Product	Condition	MTBF (Hours)
M.2 2280 PCIe	Telcordia SR-332 GB, 25°C	>2,000,000

Table6: M.2 2280 PCIe MTBF

## 4.8. Endurance

- Data Retention: 10 years.
- Flash Endurance:
  - TLC: 3,000 P/E Cycle
- Wear-Leveling Algorithm: Support.
- Bad Blocks Management: Support.
- Error Correct Code: Support..

## 4.9. Power Characteristics

### 4.9.1. Supply Voltage

Parameter Specifications	Parameter Specifications
Input Voltage	3.3V +/- 5%

### 4.9.2. Power Consumption

Parameter Specifications	Specifications (W)
Idle (max.)	0.69W
Active (max.)	6.6W

Notes:

1. The measured power voltage is 3.3V.
2. Its average value of power consumption is achieved based on 100% conversion efficiency.  
Power Consumption may differ according to flash configuration and platform.