

# **FORESEE PCIe Gen4 M.2 2280 SSD XP2100 Datasheet**

**Version: A2**

**2022.04**

Shenzhen Longsys Electronics Co., Ltd, together with any and all of its affiliates (herein after referred as "Longsys" or "Longsys Electronics") LONGSYS RESERVES THE RIGHT TO CHANGE PRODUCTS, INFORMATION AND SPECIFICATIONS WITHOUT NOTICE.

Products and specifications discussed herein are for reference purposes only. All information discussed herein is provided on an "AS IS" basis, without warranties of any kind.

This document and all information discussed herein remain the sole and exclusive property of Longsys. No license of any patent, copyright, mask work, trademark or any other intellectual property right is granted by one party to the other party under this document, by implication, estoppel or otherwise.

Longsys products are not intended for use in life support, critical care, medical, safety equipment, or similar applications where product failure could result in loss of life or personal or physical harm, or any military or defense application, or any governmental procurement to which special terms or provisions may apply.

For updates or additional information about Longsys products, contact your nearest Longsys office.

All brand names, trademarks and registered trademarks belong to their respective owners.

© 2020 Shenzhen Longsys Electronics Co., Ltd. All rights reserved.

## Revision History

| <b><i>Revision Number</i></b> | <b><i>Description</i></b>                       | <b><i>Revision Date</i></b> |
|-------------------------------|-------------------------------------------------|-----------------------------|
| A0                            | Initial release.                                | 2021.07                     |
| A1                            | Update performance and power consumption        | 2021.10                     |
| A2                            | Fix performance data and power consumption data | 2022.04                     |

## Table of content

|                                                      |    |
|------------------------------------------------------|----|
| 1. General Description.....                          | 4  |
| 2. Mechanical Specification.....                     | 5  |
| 2.1 M.2 2280 SSD physical dimensions and Weight..... | 5  |
| 3. Product Specifications.....                       | 6  |
| 3.1 Capacity .....                                   | 6  |
| 3.2 Performance .....                                | 6  |
| 3.3 System Power Consumption.....                    | 6  |
| 3.4 Supply Voltage.....                              | 7  |
| 3.5 System Reliability .....                         | 7  |
| 3.6 Endurance.....                                   | 7  |
| 3.7 Environmental Specifications .....               | 7  |
| 4. Electrical Interface Specification.....           | 8  |
| 4.1 Connector Dimension and Pin Location .....       | 8  |
| 4.2 M.2 2280 Pin Assignments and Definition .....    | 8  |
| 5. Supported Command Set and Feature.....            | 10 |
| 5.1 Admin Command Set .....                          | 10 |
| 5.2 NVM Express I/O Command Set.....                 | 10 |
| 5.3 Log Page Identifiers Support .....               | 10 |
| 5.4 Feature Identifiers Support.....                 | 10 |
| 5.5 SMART/Health Information.....                    | 11 |
| 5.6 Identify Command.....                            | 12 |
| 6. Product Line up.....                              | 13 |
| 7. Contact information.....                          | 13 |

# 1. General Description

## ●Capacity

- 256GB/512GB/1TB is available

## ●Form Factor

- M.2 2280

## ●Features

- PCIe Gen4 16Gb/s Interface, up to 4 Lanes
- Compliant with NVMe Express Revision 1.4
- Support Host Memory Buffer

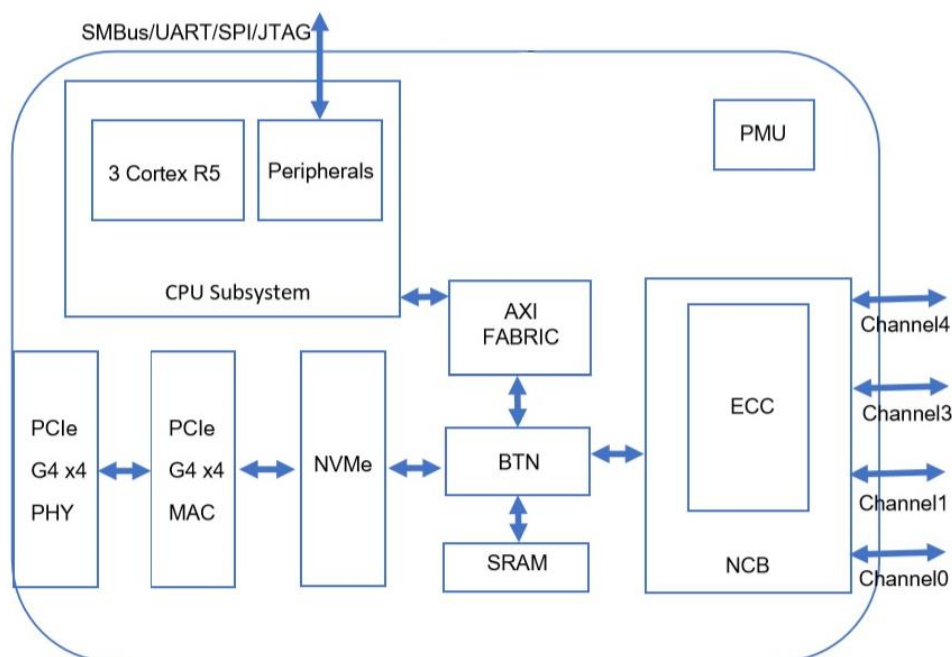
## ●Performance

- 256GB
  - Read: Up to 4900MB/s
  - Write: Up to 1900MB/s
- 512GB
  - Read: Up to 5300MB/s
  - Write: Up to 3900MB/s
- 1TB
  - Read: Up to 5300MB/s
  - Write: Up to 4800MB/s

## ●TBW

- 256GB: 768TB
- 512GB: 1536TB
- 1TB: 3072TB

## ●SSD Functional Block Diagram

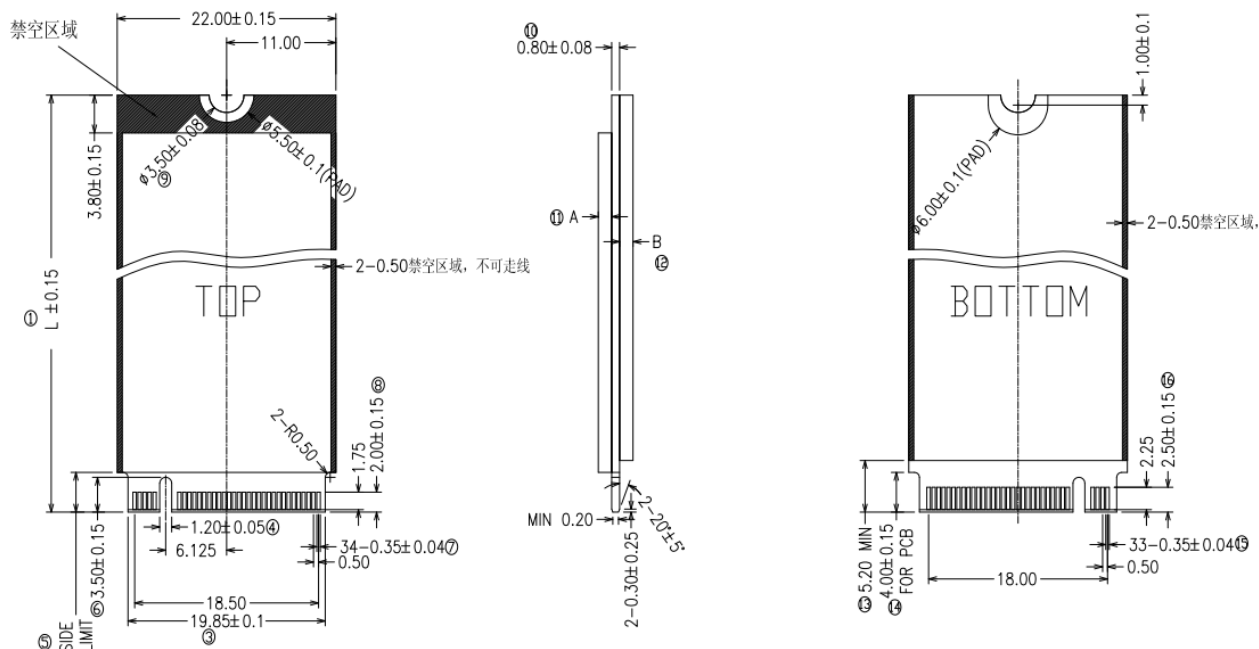


[Figure 1-1] SSD Functional Block Diagram

## 2. Mechanical Specification

### 2.1 M.2 2280 SSD physical dimensions and Weight

| Capacity        | Height (mm) | Width (mm) | Length (mm) | Weight (gram) |
|-----------------|-------------|------------|-------------|---------------|
| 256GB/512GB/1TB | MAX 2.25    | 22.00±0.15 | 80.00±0.15  | MAX 8g        |



[Figure 2-1] M.2 2280 Physical dimension

## 3. Product Specifications

### 3.1 Capacity

| Nominal Capacity         | 256GB     | 512GB      | 1TB        |
|--------------------------|-----------|------------|------------|
| Unformatted Capacity     | 238.47    | 476.94GB   | 953.87GB   |
| User-Addressable Sectors | 500118192 | 1000215216 | 2000409264 |
| Bytes per Sector         | 512 Bytes |            |            |

**[Table 3-1] User Addressable Sectors**

NOTE:

1 Megabyte (MB) = 1 Million bytes; 1 Gigabyte (GB) = 1 Billion bytes

2 User Addressable Sectors in LBA mode is calculated by IDEMA rule.

### 3.2 Performance

| Parameter              | Unit | 256GB  | 512GB  | 1TB    |
|------------------------|------|--------|--------|--------|
| Sequential Read (Max)  | MB/S | 4900   | 5300   | 5300   |
| Sequential Write (Max) | MB/S | 1900   | 3900   | 4800   |
| Random Read 4K (Max)   | IOPS | 262000 | 512000 | 810000 |
| Random Write 4K (Max)  | IOPS | 480000 | 588000 | 810000 |

**[Table 3-2] Drive Performance**

\* Actual performance may vary depending on use conditions and environment

\* Note

1. Performance measured using CrystalDiskMark 7.0.0

2. Write cache enabled

3. 1MB/sec = 1,048,576 bytes/sec was used in sequential performance

-System: Intel Z370 Chipset, Intel Core i7-8700K@3.7GHz, 8GB DDR4

-OS: Windows 10 x64 with HMB turn on.

### 3.3 System Power Consumption

| Input Voltage 3.3V±5%              |       |         |         |         |
|------------------------------------|-------|---------|---------|---------|
| Parameter                          |       | 256GB   | 512GB   | 1TB     |
| Active <sup>1</sup> (Typical, RMS) | Read  | 3140mW  | 3310 mW | 3310 mW |
|                                    | Write | 2350mW  | 3100 mW | 3410 mW |
| Idle <sup>2</sup> (Typical)        |       | 1000 mW |         |         |
| L1.2 (Typical)                     |       | 5 mW    |         |         |

**[Table 3-4] Power Consumption**

CPU : AMD Ryzen 5 3600X 6-Core processor

DRAM : 16GB DDR4

Chipset : AMD X570

OS : Windows 10 x64

Test Tool : CrystalDiskMark 7.0.0

### 3.4 Supply Voltage

| Item                   | Requirements      |
|------------------------|-------------------|
| Allowable voltage      | 3.3V ± 5%         |
| Allowable noise/ripple | 100mV p-p or less |

**[Table 3-3] Voltage Requirements**

### 3.5 System Reliability

| Capacity | MTBF            |
|----------|-----------------|
| 256GB    | 1,500,000 Hours |
| 512GB    |                 |
| 1TB      |                 |

**[Table 3-5] MTBF Specifications**

MTBF is Mean Time Between Failure. As same word, annual failure ratio is 0.4%.

### 3.6 Endurance

| TBW   |        |        |
|-------|--------|--------|
| 256GB | 512GB  | 1TB    |
| 768TB | 1536TB | 3072TB |

**[Table 3-7] Endurance Specifications**

Notes:

1-TBW (Terabytes Written) is a measurement of SSDs' expected lifespan, which represents the amount of data written to the device. To calculate the TBW of a SSD, the following equation is applied:

$$TBW = [(NAND\ Endurance) \times (SSD\ Capacity)] / WAF$$

NAND Endurance: NAND endurance refers to the P/E (Program/Erase) cycle of a NAND flash.

SSD Capacity: The SSD capacity is the specific capacity in total of a SSD.

WAF: Write Amplification Factor (WAF) is a numerical value representing the ratio between the amount of data that a SSD controller needs to write and the amount of data that the host's flash controller writes. A better WAF, which is near 1, guarantees better endurance and lower frequency of data written to flash memory.

2-The above TBW values are calculated based on WAF=1.

3-TBW may differ according to flash configuration and platform.

4-The endurance of SSD could be estimated based on user behavior, NAND endurance cycles, and write amplification factor. It is not guaranteed by flash vendor.

### 3.7 Environmental Specifications

| Features    | Operating                             | Non-Operating |
|-------------|---------------------------------------|---------------|
| Temperature | 0°C to 70°C                           | -40°C to 85°C |
| Humidity    | 5% to 95%, non-condensing             |               |
| Vibration   | 7~800Hz, 3.08Grms, 30min/axis(X,Y,Z)  |               |
| Shock       | 1500G, duration 0.5ms, Half Sine Wave |               |

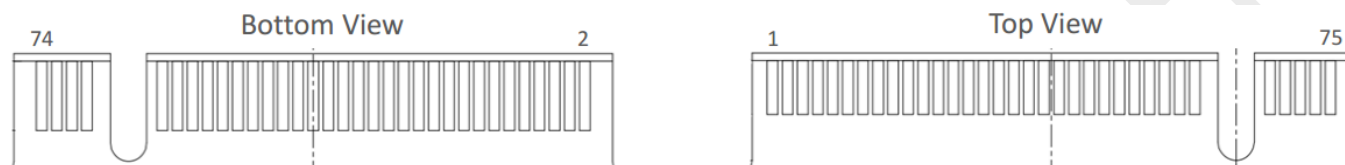
**[Table 3-6] Power Consumption**

Notes:

- 1-Temperature is measured by SMART Temperature .Proper airflow recommended.
- 2-Humidity is measured in non-condensing
- 3-Test condition for shock: 0.5ms duration with half sine wave
- 4-Test condition for vibration: 10Hz to 2,000Hz, 15mins/axis on 3axis

## 4. Electrical Interface Specification

### 4.1 Connector Dimension and Pin Location



[Figure 4-1] M.2 2280 Signal and Power pins

### 4.2 M.2 2280 Pin Assignments and Definition

| Pin # | Assignment | Description | Pin # | Assignment | Description             |
|-------|------------|-------------|-------|------------|-------------------------|
| 1     | GND        | Ground      | 2     | 3.3V       | 3.3V source             |
| 3     | GND        | Ground      | 4     | 3.3V       | 3.3V source             |
| 5     | PETn3      | PCIe TX     | 6     | N/C        | N/C                     |
| 7     | PETp3      | PCIe TX     | 8     | PLN#       | Power Loss Notification |
| 9     | GND        | Ground      | 10    | LED_1#     | Device Active Signal    |
| 11    | PERn3      | PCIe RX     | 12    | 3.3V       | 3.3V source             |
| 13    | PERp3      | PCIe RX     | 14    | 3.3V       | 3.3V source             |
| 15    | GND        | Ground      | 16    | 3.3V       | 3.3V source             |
| 17    | PETn2      | PCIe TX     | 18    | 3.3V       | 3.3V source             |
| 19    | PETp2      | PCIe TX     | 20    | N/C        | N/C                     |
| 21    | GND        | Ground      | 22    | VIO_1.8V   | I/O source              |
| 23    | PERn2      | PCIe RX     | 24    | N/C        | N/C                     |
| 25    | PERp2      | PCIe RX     | 26    | N/C        | N/C                     |
| 27    | GND        | Ground      | 28    | N/C        | N/C                     |
| 29    | PETn1      | PCIe TX     | 30    | PLA_S3#    | Power Loss Acknowledge  |
| 31    | PETp1      | PCIe TX     | 32    | N/C        | N/C                     |
| 33    | GND        | Ground      | 34    | N/C        | N/C                     |
| 35    | PERn1      | PCIe RX     | 36    | N/C        | N/C                     |
| 37    | PERp1      | PCIe RX     | 38    | N/C        | N/C                     |
| 39    | GND        | Ground      | 40    | N/C        | N/C                     |
| 41    | PETn0      | PCIe TX     | 42    | N/C        | N/C                     |
| 43    | PETp0      | PCIe TX     | 44    | N/C        | N/C                     |
| 45    | GND        | Ground      | 46    | N/C        | N/C                     |
| 47    | PERn0      | PCIe RX     | 48    | N/C        | N/C                     |
| 49    | PERp0      | PCIe RX     | 50    | PERST#     | PCIe Reset              |

| Pin # | Assignment | Description              | Pin # | Assignment | Description               |
|-------|------------|--------------------------|-------|------------|---------------------------|
| 51    | GND        | Ground                   | 52    | CLKREQ#    | PCIe Device Clock Request |
| 53    | REFCLKN    | PCIe Reference Clock     | 54    | N/C        | N/C                       |
| 55    | REFCLKP    | PCIe Reference Clock     | 56    | N/C        | N/C                       |
| 57    | GND        | Ground                   | 58    | N/C        | N/C                       |
| 59    | N/C        | Mechanical Notch         | 60    | N/C        | Mechanical Notch          |
| 61    | N/C        | Mechanical Notch         | 62    | N/C        | Mechanical Notch          |
| 63    | N/C        | Mechanical Notch         | 64    | N/C        | Mechanical Notch          |
| 65    | N/C        | Mechanical Notch         | 66    | N/C        | Mechanical Notch          |
| 67    | N/C        | N/C                      | 68    | N/C        | N/C                       |
| 69    | N/C        | N/C                      | 70    | 3.3V       | 3.3V source               |
| 71    | GND        | Ground                   | 72    | 3.3V       | 3.3V source               |
| 73    | VIO_CFG    | IO Voltage configuration | 74    | 3.3V       | 3.3V source               |
| 75    | GND        | Ground                   |       |            |                           |

[Table 4-1] M.2 2280 Connector Pin Assignment

## 5. Supported Command Set and Feature

The Admin command sets and NVM I/O command sets of FORESEE SSD P700 are defined in compliant with NVM Express specification revision 1.3.

### 5.1 Admin Command Set

| Opcode(Hex) | Command Name                |
|-------------|-----------------------------|
| 00h         | Delete I/O Submission Queue |
| 01h         | Create I/O Submission Queue |
| 02h         | Get Log Page                |
| 04h         | Delete I/O Completion Queue |
| 05h         | Create I/O Completion Queue |
| 06h         | Identify                    |
| 08h         | Abort                       |
| 09h         | Set Features                |
| 0Ah         | Get Features                |
| 0Ch         | Asynchronous Event Request  |
| 10h         | Firmware Commit             |
| 11h         | Firmware Image Download     |
| 80h         | Format NVM                  |

[Table 5-1] Admin command

### 5.2 NVM Express I/O Command Set

| Opcode(Hex) | Command Name       |
|-------------|--------------------|
| 00h         | Flush              |
| 01h         | Write              |
| 02h         | Read               |
| 09h         | Dataset Management |

[Table 5-2] NVMe I/O command

### 5.3 Log Page Identifiers Support

| Log Identifier (Hex) | Description                |
|----------------------|----------------------------|
| 01h                  | Error Information          |
| 02h                  | SMART / Health Information |
| 03h                  | Firmware Slot Information  |

[Table 5-3] Log Identifier

### 5.4 Feature Identifiers Support

| Feature Identifier (Hex) | Description                    |
|--------------------------|--------------------------------|
| 04h                      | Temperature Threshold          |
| 07h                      | Number of Queues               |
| 08h                      | Interrupt Coalescing           |
| 09h                      | Interrupt Vector Configuration |
| 0Dh                      | Host Memory Buffer             |

**[Table 5-4] Feature Identifier**

## 5.5 SMART/Health Information

| Bytes   | Description                                       |
|---------|---------------------------------------------------|
| 0       | Critical Warning                                  |
| 2:1     | Composite Temperature                             |
| 3       | Available Spare                                   |
| 4       | Available Spare Threshold                         |
| 5       | Percentage Used                                   |
| 31:6    | Reserved                                          |
| 47:32   | Data Units Read                                   |
| 63:48   | Data Units Written                                |
| 79:64   | Host Read Commands                                |
| 95:80   | Host Write Commands                               |
| 111:96  | Controller Busy Time                              |
| 127:112 | Power Cycles                                      |
| 143:128 | Power On Hours                                    |
| 159:144 | Unsafe Shutdowns                                  |
| 175:160 | Media and Data Integrity Errors                   |
| 191:176 | Number of Error Information Log Entries           |
| 195:192 | Warning Composite Temperature Time                |
| 199:196 | Critical Composite Temperature Time               |
| 201:200 | Temperature Sensor 1                              |
| 203:202 | Temperature Sensor 2                              |
| 205:204 | Temperature Sensor 3                              |
| 207:206 | Temperature Sensor 4                              |
| 209:208 | Temperature Sensor 5                              |
| 211:210 | Temperature Sensor 6                              |
| 213:212 | Temperature Sensor 7                              |
| 215:214 | Temperature Sensor 8                              |
| 219:216 | Thermal Management Temperature 1 Transition Count |
| 223:220 | Thermal Management Temperature 2 Transition Count |
| 227:224 | Total Time For Thermal Management Temperature 1   |
| 231:228 | Total Time For Thermal Management Temperature 2   |
| 511:232 | Reserved                                          |

**[Table 5-5] SMART Information**

## 5.6 Identify Command

The Identify Command returns the data described below.

| Bytes     | Default Value | Description                                                  |
|-----------|---------------|--------------------------------------------------------------|
| 01:00     | XXX           | PCI Vendor ID(VID)                                           |
| 03:02     | XXX           | PCI Subsystem Vendor ID                                      |
| 23:04     | XXX           | Serial Number                                                |
| 63:24     | XXX           | Model Number                                                 |
| 71:64     | XXX           | Firmware Revision                                            |
| 72        | 10h           | Recommended Arbitration Burst                                |
| 75:73     | 845DD7h       | IEEE OUI Identifier                                          |
| 76        | 00h           | Controller Multi-Path I/O and Namespace Sharing Capabilities |
| 77        | 08h           | Maximum Data Transfer Size                                   |
| 255:78    | -             | Reserved                                                     |
| 257:256   | 04h           | Optional Admin Command Support                               |
| 258       | 03h           | Abort Command Limit                                          |
| 259       | 03h           | Asynchronous Event Request Limit                             |
| 260       | 02h           | Firmware Updates                                             |
| 261       | 02h           | Log Page Attributes                                          |
| 262       | 07h           | Error Log Page Entries                                       |
| 263       | 03h           | Number of Power States Support                               |
| 264       | 01h           | Admin Vendor Specific Command Configuration                  |
| 265:511   | -             | Reserved                                                     |
| 512       | 66h           | Submission Queue Entry Size                                  |
| 513       | 44h           | Completion Queue Entry Size                                  |
| 515:514   | -             | Reserved                                                     |
| 519:516   | 01h           | Number of Namespaces                                         |
| 521:520   | 14h           | Optional NVM Command Support                                 |
| 523:522   | 00h           | Fused Operation Support                                      |
| 524       | 00h           | Format NVM Attributes                                        |
| 525       | 01h           | Volatile Write Cache                                         |
| 527:526   | 01h           | Atomic Write Unit Normal                                     |
| 529:528   | 00h           | Atomic Write Unit Power Fail                                 |
| 530       | 00h           | NVM Vendor Specific Command Configuration                    |
| 531-2047  | -             | Reserved                                                     |
| 2079:2048 | 00h           | Power State 0 Descriptor                                     |
| ...       | 00h           | (N/A)                                                        |
| 3071:3040 | 00h           | Power State 31 Descriptor                                    |
| 4095:3072 | -             | Reserved                                                     |

**[Table 5-6] Identify Data Structure**

## 6. Product Line up

| Type              | Capacity | MODEL       | Part Number       |
|-------------------|----------|-------------|-------------------|
| PCIe M.2 2280 SSD | 256GB    | XP2100F256G | FSB0C256G-C6C7200 |
| PCIe M.2 2280 SSD | 512GB    | XP2100F512G | FSB0C512G-C6C7200 |
| PCIe M.2 2280 SSD | 1TB      | XP2100F001T | FSB0C001T-C6C7200 |

## 7. Contact information

Tel: +86-755-8616-8848

Fax: +86-755-8616-9388

Email: [sales@longsys.com](mailto:sales@longsys.com)

Website: [www.longsys.com](http://www.longsys.com)

Add: 8/F, 1 Building, Finance Base, No.8, Kefa Road, High-Tech Park, Shenzhen, China