



# Industrial M.2 2280 / 22110 PCIe NGFF SSD

## **Product Specification**

INDUSTRIAL

M.2 2280 / 22110 PCIe Gen3 x4 SSD

Version 01V0

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#### Revision History

Revision	Description	Date
1.0	Initial release	2017/01/23

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**1. Introduction**

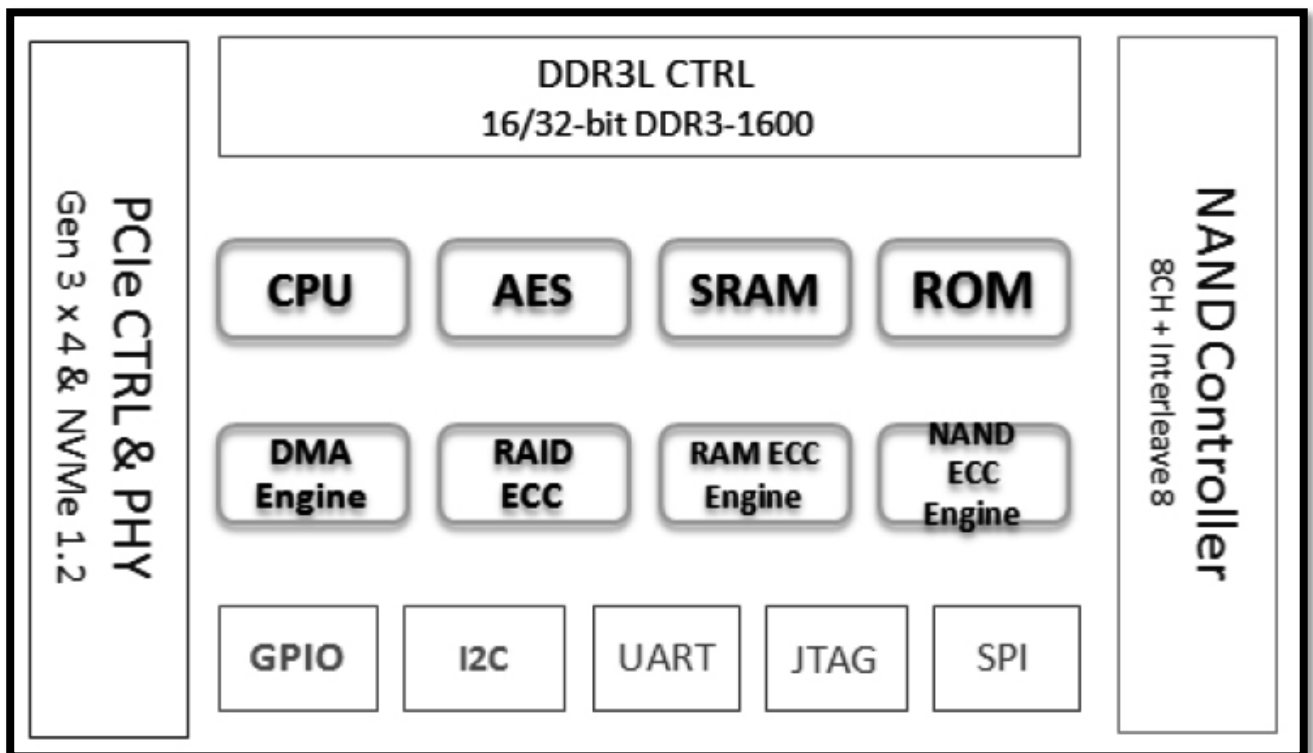
APRO M.2 PCIe Module – PHANES-I Series is fully compliant with the standard Next Generation Form Factor (NGFF) called M.2 Card Format and support 2280/22110 form-factors.

APRO M.2 PCIe Module products provide the advantages of flash disk technology with PCIe Gen3 x4 interface to the host computer with high performance.

The main used flash memories are 15nm MLC-NAND type flash memory chips. The available disk capacities are 128GB, 256GB, and 512GB for 2280 form-factor and 256GB, 512GB and 1TB for 22110 form-factors.

The operating temperature grade is optional for Standard grade 0°C ~ 70°C and wide temp grade supports -40°C ~ +85°C. The data transfer performance by sequential read is up to 2,800 MB/sec, and sequential write is up to 1,500 MB/sec.

It applies the BCH ECC algorithm, which can detect and correct errors occur during read process, Flash memory cells will deteriorate with use, which might correct up to 120 bits error in 2K Byte data, ensure data been read correctly, as well as protect data from corruption.



**Figure 1: APRO M.2 PCIe Module PHANES-I Series controller block diagram**

## 1.1. Scope

This document describes features, specifications and installation guide of APRO's M.2 PCIe Module – PHANES-I Series. In the appendix, there provides order information, warranty policy, RMA/DOA procedure for the most convenient reference.

## 1.2. System Features

- 15nm MLC-NAND type flash technology.
- Bootable for O.S. Installation.
- Support PCIe Gen3 x 4 interfaces.
- Compliant with NVMe 1.2 & PCI Express Base 3.0 Standard.
- Support M.2 2280 and 22110-D5-M form-factor.
- Support Static and Dynamic Wear Leveling advanced flash management
- Support Windows Trim command.
- SMART (Self-Monitoring, Analysis and Reporting Technology) function supported.
- ECC support BCH ECC algorithm 120 bits error in 2K Byte data
- M.2 2280 form-factor capacities are 128GB, 256GB, and 512GB.
- M.2 22110 form-factor capacities are 256GB, 512GB and 1TB.
- Sequential read performance up to 2,800 MB/sec.
- Sequential write performance up to 1,550 MB/sec.
- Support 3.3V  $\pm$  5% operation.
- Standard grade supports operating temperature 0°C to +70°C, and Wide Temperature Grade, -40°C to +85°C.

## 1.3. Flash Management Technology - Static and Dynamic Wear Leveling

In order to gain the best management for flash memory, APRO M.2 PCIe Module PHANES-I Series supports Static and Dynamic Wear-leveling technology to manage the Flash system. The life of flash memory is limited; the management is to increase the life of the flash product.

A static wear-leveling algorithm evenly distributes data over an entire Flash cell array and searches for the least used physical blocks. The identified low cycled sectors are used to write the data to those locations. If blocks are empty, the write occurs normally. If blocks contain static data, it moves that data to a more heavily used location before it moves the newly written data. The static wear leveling maximizes effective endurance Flash array compared to no wear leveling or dynamic wear leveling.

## 2. Product Specifications

For all the following specifications, values are defined at ambient temperature and nominal supply voltage unless otherwise stated.

### 2.1. System Environmental Specifications

**Table 1: Environmental Specification**

APRO M.2 PCIe Module		Standard Grade	Wide Temperature Grade
PHANES-I Series		SBMDPxxxG-PICTMB-80/11	WBMDPxxxG-PICTMB-80C/11C
Temperature	Operating:	0°C ~ +70°C	-40°C ~ +85°C
	Non-operating:	-20°C ~ +80°C	-50°C ~ +95°C
Humidity	Operating & Non-operating:	10% ~ 95% non-condensing	
Vibration	Operating & Non-operating:	80Hz~2000Hz, 20G, 3 axes	
Shock	Operating & Non-operating:	0.5ms, 1500 G, 3 axes	

### 2.2. System Power Requirements

**Table 2: Power Requirement**

APRO M.2 PCIe Module			
PHANES-I Series			
3.3V±5% DC Input Voltage (VCC)		2280 (512GB)	22110 (1TB)
Current (Maximum average value)	Reading Mode :	5,110 mW (max.)	6,000 mW (max.)
	Writing Mode :	6,920 mW (max.)	7,300 mW (max.)
	Idle Mode :	400 mW (max.)	400 mW (max.)

### 2.3. System Performance

**Table 3: System Performances**

Data Transfer Mode supporting		Support PCIe Gen3 x 4 interfaces.							
Average Access Time		0.1 ms (estimated)							
Maximum Performance	Capacity	128GB		256GB		512GB		1TB	
	Form-factor	2280	22110	2280	22110	2280	22110	2280	22110
	Sequential Read (MB/s)	2,300	n/a	2,750	2,750	2,750	2,800	n/a	2,800
	Sequential Write(MB/s)	650	n/a	1,400	1,350	1,450	1,550	n/a	1,550

Note:

(1). All values quoted are typically at 25 °C and nominal supply voltage.

(2). The performance above is based on CrystalDiskMark

**2.4. System Reliability**

**Table 4: System Reliability**

<b>Wear-leveling Algorithms</b>	Static and Dynamic Wear-leveling	
<b>Bad Blocks Management</b>	Supportive	
<b>ECC Technology</b>	120 bits error in 2K Byte	
<b>Endurance</b>	3,000 times erase counts.	
<b>Capacity</b>	<b>TBW(TB)</b>	<b>DWPD &amp; Lifespan</b>
<b>128GB</b>	175	DWPD=1.91 DWPD ( Drive Written Per Day ) Lifespan = 2 Years
<b>256GB</b>	349	
<b>512GB</b>	698	
<b>1TB</b>	1,396	

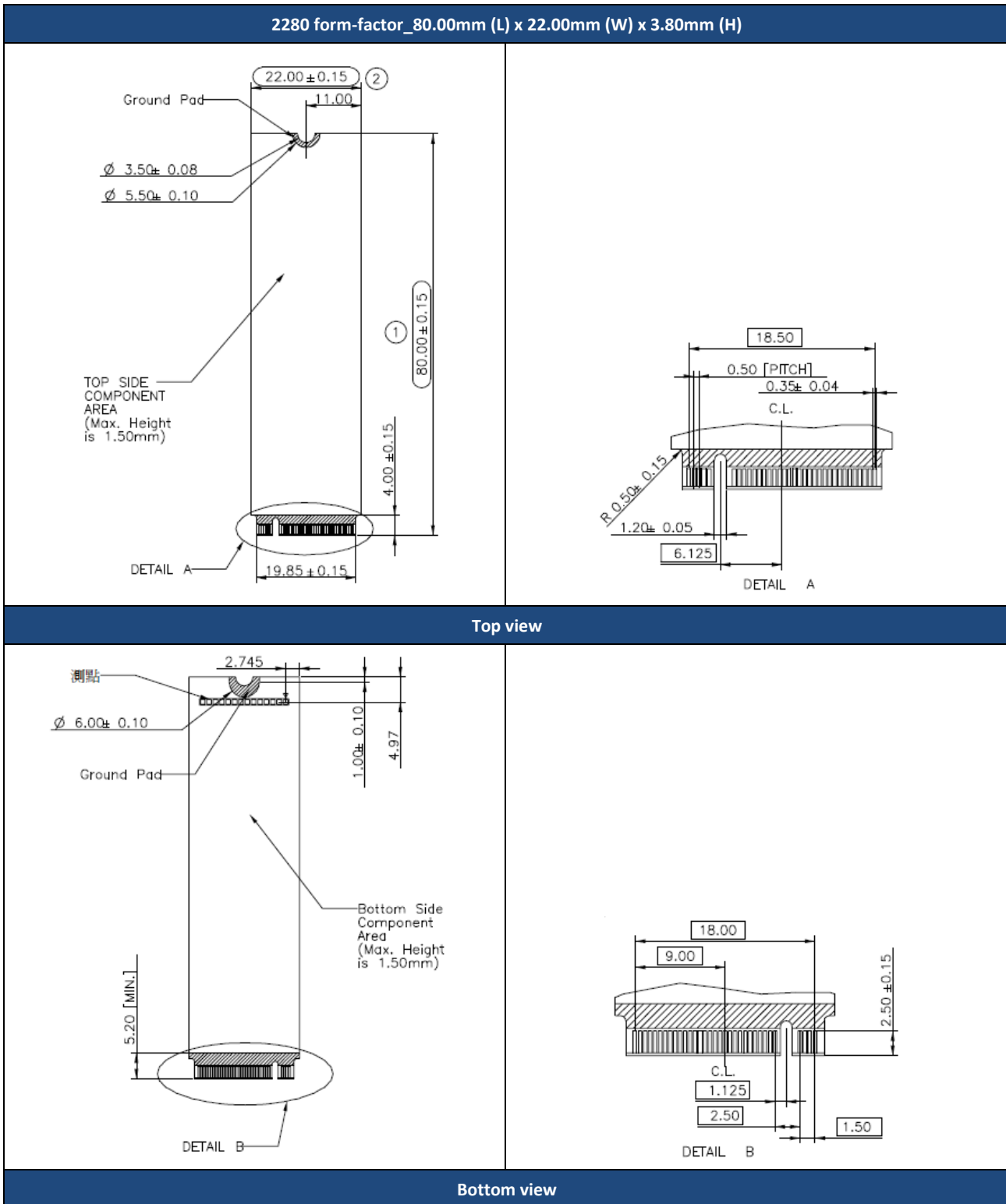
Note:

1). Follow JEDEC 219 pattern to test WAF

2.5. Physical Specifications

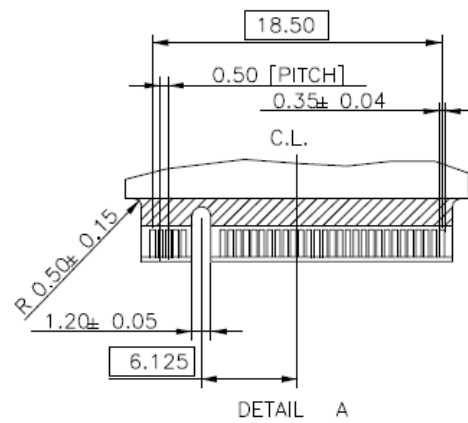
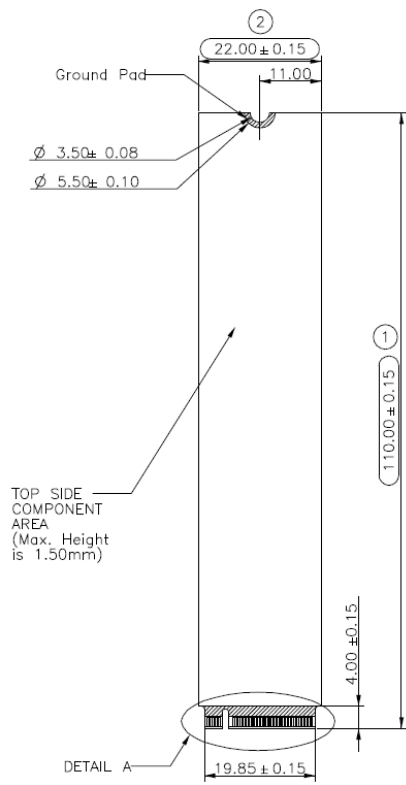
Form-factor	2280	22110
Length:	80.00 mm	110.00 mm
Width:	22.00 mm	22.00 mm
Thickness:	3.80 mm	3.80 mm
Weight:	7.00 g / 0.25 oz	10.00 g / 0.35 oz

Figure 2: APRO M.2 PCIe Module Dimension

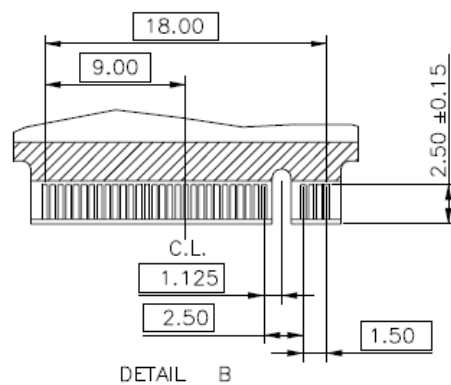
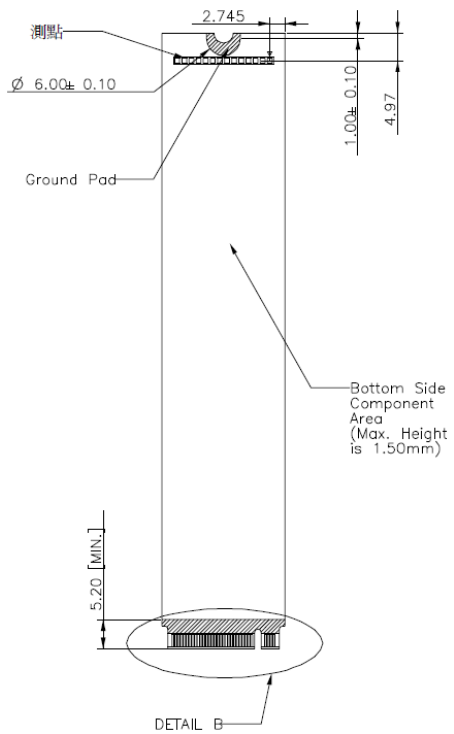




22110 form-factor\_110.00mm (L) x 22.00mm (W) x 3.80mm (H)



Top view



Bottom view

Table 5: Physical Specifications of APRO M.2 PCIe Module-PHANES-I Series

## **2.5.1. Conformal coating**

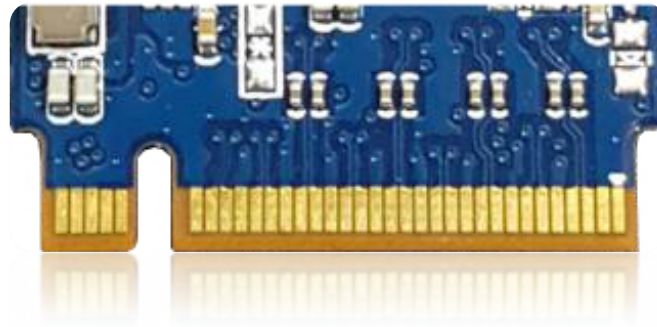
Conformal coating is a protective, dielectric coating designed to conform to the surface of an assembled printed circuit board. Commonly used conformal coatings include silicone, acrylic, urethane and epoxy. APRO applies only silicone on APRO storage products upon requested especially by customers. The type of silicone coating features good thermal shock resistance due to flexibility. It is also easy to apply and repair.

Conformal coating offers protection of circuitry from moisture, fungus, dust and corrosion caused by extreme environments. It also prevents damage from those Flash storages handling during construction, installation and use, and reduces mechanical stress on components and protects from thermal shock. The greatest advantage of conformal coating is to allow greater component density due to increased dielectric strength between conductors.

APRO uses MIL-I-46058C silicon conformal coating

## **3. Interface Description**

### **3.1. APRO M.2 PCIe Module interface**



**Figure 3 : The connectors of M.2 2280/22110 PCIe Module**

### 3.2. Pin Assignments

Pin No.	PCIe Pin	Description
1	GND	Ground
2	3.3V	3.3V source
3	GND	Ground
4	3.3V	3.3V source
5	PETn3	PCIe TX Differential signal defined by the PCI Express M.2 spec
6	N/C	No connect
7	PETp3	PCIe TX Differential signal defined by the PCI Express M.2 spec
8	N/C	No connect
9	GND	Ground
10	LED1#(O)	Status indicators via LED devices
11	PERn3	PCIe RX Differential signal defined by the PCI Express M.2 spec
12	3.3V	3.3V source
13	PERp3	PCIe RX Differential signals defined by the PCI Express M.2 spec.
14	3.3V	3.3V source
15	GND	Ground
16	3.3V	3.3V source
17	PETn2	PCIe TX Differential signal defined by the PCI Express M.2 spec
18	3.3V	3.3V source
19	PETp2	PCIe TX Differential signal defined by the PCI Express M.2 spec
20	N/C	No connect
21	GND	Ground
22	N/C	No connect
23	PERn2	PCIe RX Differential signal defined by the PCI Express M.2 spec
24	N/C	No connect
25	PERp2	PCIe RX Differential signal defined by the PCI Express M.2 spec
26	N/C	No connect
27	GND	Ground
28	N/C	No connect
29	PETn1	PCIe TX Differential signal defined by the PCI Express M.2 spec
30	N/C	No connect

31	PETp1	PCIe TX Differential signal defined by the PCI Express M.2 spec
32	N/C	No connect
33	GND	Ground
34	N/C	No connect
35	PERn1	PCIe RX Differential signal defined by the PCI Express M.2 spec
36	N/C	No connect
37	PERp1	PCIe RX Differential signal defined by the PCI Express M.2 spec
38	N/C	No connect
39	GND	Ground
40	N/C	No connect
41	PETn0	PCIe TX Differential signal defined by the PCI Express M.2 spec
42	N/C	No connect
43	PETp0	PCIe TX Differential signal defined by the PCI Express M.2 spec
44	N/C	No connect
45	GND	Ground
46	N/C	No connect
47	PERn0	PCIe RX Differential signal defined by the PCI Express M.2 spec
48	N/C	No connect
49	PERp0	PCIe RX Differential signal defined by the PCI Express M.2 spec
50	PERST#(I/O)(0/3.3V)	PE-Reset is a functional reset to the card as defined by the PCIe Mini CEM specification.
51	GND	Ground
52	CLKREQ#(I/O)(0/3.3V)	Clock Request is a reference clock request signal as defined by the PCIe Mini CEM specification; Also used by L1 PM Substates.
53	REFCLKn	PCIe Reference Clock signals (100 MHz) defined by the PCI Express M.2 spec.
54	PEWAKE#(I/O)(0/3.3V)	PCIe PME Wake. Open Drain with pull up on platform; Active Low.
55	REFCLKp	PCIe Reference Clock signals (100 MHz) defined by the PCI Express M.2 spec.


56	Reserved for MFG DATA	Manufacturing Data line. Used for SSD manufacturing only. Not used in normal operation. Pins should be left N/C in platform Socket.
57	GND	Ground
58	Reserved for MFG CLOCK	Manufacturing Clock line. Used for SSD manufacturing only. Not used in normal operation. Pins should be left N/C in platform Socket.
59	Module Key	Module Key
60	Module Key	
61	Module Key	
62	Module Key	
63	Module Key	
64	Module Key	
65	Module Key	
66	Module Key	
67	N/C	No connect
68	SUSCLK(32KHz) (I){0/3.3V}	32.768 kHz clock supply input that is provided by the platform chipset to reduce power and cost for the module.
69	PEDET (NC-PCIe)	Host I/F Indication; No Connect for PCIe.
70	3.3V	3.3V source
71	GND	Ground
72	3.3V	3.3V source
73	GND	Ground
74	3.3V	3.3V source
75	GND	Ground

Table 7 - Pin Assignments


Appendix A: Ordering Information

1. Part Number List

◆ APRO M.2 2280 PCIe Module – PHANES-I Series

Product Picture	Grade	Standard grade (0°C ~ 70°C)	Wide Temp. Grade (-40°C ~ +85°C)
	128GB	SBMDP128G-PICTMB-80(C)	WBMDP128G-PICTMB-80C
	256GB	SBMDP256G-PICTMB-80(C)	WBMDP256G-PICTMB-80C
	512GB	SBMDP512G-PICTMB-80(C)	WBMDP512G-PICTMB-80C

◆ APRO M.2 22110 PCIe Module – PHANES-I Series

Product Picture	Grade	Standard grade (0°C ~ 70°C)	Wide Temp. Grade (-40°C ~ +85°C)
	256GB	SBMDP256G-PICTMB-11(C)	WBMDP256G-PICTMB-11C
	512GB	SBMDP512G-PICTMB-11(C)	WBMDP512G-PICTMB-11C
	1TB	SBMDP001T-PICTMB-11(C)	WBMDP001T-PICTMB-11C

2. Part Number Decoder:

**X1 X2 X3 X4 X5 X6 X7 X8 X9** — **X11 X12 X13 X14 X15 X16** — **Z1 Z2** — **C**

**X1** : Grade

S: Standard Grade – operating temp. 0° C ~ 70 ° C

W: Wide Temp Grade- operating temp. -40° C ~ +85 ° C

**X2** : The material of case

B : Bare

**X3 X4 X5** : Product category

MDP : M.2 NGFF PCIe Module

**X6 X7 X8 X9** : Capacity

128G:            128GB            001T:            001TB

256G:            256GB

512G:            512GB

**X11** : Controller

P : PHANES Series

**X12** : Controller version

A, B, C.....

**X13** : Controller Grade

C : Commercial grade

I : Wide Temperature Grade

**X14** : Flash IC

T : Toshiba Flash IC

**X15** : Flash IC grade / Type

M : MLC-NAND Flash IC

**X16** : Flash IC grade / Type

B : 15nm Flash IC

**Z1 Z2** : Form Factor Type

80 : 2280 form factor

11 : 22110 form factor

**C** : Reserved for specific requirement

C : Conformal-coating

### ***Appendix B: Limited Warranty***

APRO warrants your M.2 PCIe Module against defects in material and workmanship for the life of the drive. The warranty is void in the case of misuse, accident, alteration, improper installation, misapplication or the result of unauthorized service or repair. The implied warranties of merchantability and fitness for a particular purpose, and all other warranties, expressed or implied, except as set forth in this warranty, shall not apply to the products delivered. In no event shall APRO be liable for any lost profits, lost savings or other incidental or consequential damages arising out of the use of, or inability to use, this product.

***BEFORE RETURNING PRODUCT, A RETURN MATERIAL AUTHORIZATION (RMA) MUST BE OBTAINED FROM APRO.***

Product shall be returned to APRO with shipping prepaid. If the product fails to conform based on customers' purchasing orders, APRO will reimburse customers for the transportation charges incurred.

### ***WARRANTY PERIOD:***

- **MLC ( Standard grade / Wide temp. grade )      2 years / Within 3K Erasing Counts**

***The warranty period is able to extend. Please contact APRO and/or Your APRO distributors for more information.***