

# M.2 2280 PCIe SSD

Product Name: UM28P3TND

Capacity : 256GB 、 512GB 、 1TB 、 2TB

Revision History

<b>Revision</b>	<b>Date</b>	<b>Description</b>	<b>Editor</b>
<b>0</b>	Apr. 23, 2021	Initial Release	

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## Key Features

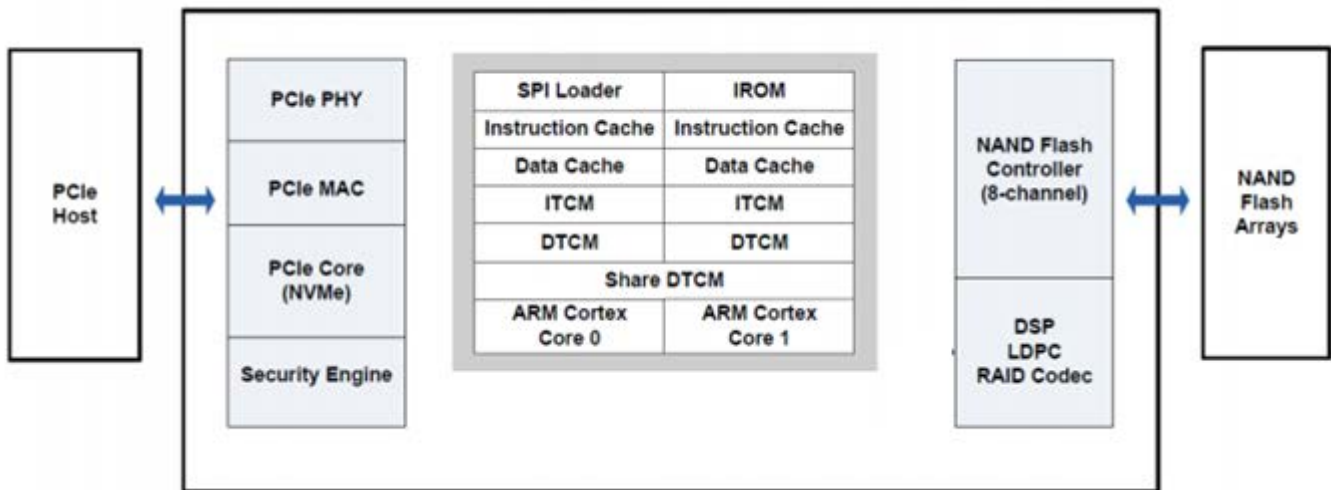
- **Capacity:**
  - 256GB, 512GB, 1TB, 2TB
- **NAND Flash:** 3D TLC 96L
- **DRAM Buffer:** DDR3
- **Form Factor:** M.2 2280
- **Host Interface:**
  - PCIe Gen 3 (8Gb/s) x 4 Lane
  - Compliant with NVMe 1.3 register interface and command set
  - Compliant with PCIe Express 3.1
- **Flash Management:**
  - LDPC ECC Engine
  - RAID Engine
  - Global Wear leveling
  - Bad block Management
  - Garbage collection
  - TRIM Command
  - SLC Cache Technology
- **Data Integrity:**
  - Thermal Throttling
  - S.M.A.R.T Monitor
  - End to End data path protection
- **Performance:**
  - Sequential Read: Up to 3400 MB/s
  - Sequential Write: Up to 2800 MB/s
  - Random 4K Read: Up to 150K IOPS
  - Random 4K Write: Up to 100K IOPS
- **Power Consumption:**
  - L0: 0.7W
  - L1: 0.02W
  - L1.2: 0.004W
  - Sequential Read/Write: 5.2W/5.8W
  - Random Read/Write: 3.7W/3W
- **Temperature:**
  - Standard: 0°C ~ 70°C
  - Non-operation: -55°C ~ 95°C
- **Reliability:**
  - Shock: 1500G/0.5ms
  - Vibration 20G Peak, 20~2000Hz
  - MTBF: 3,000,000 hours
- **Endurance:**
  - TBW : Up to 2000TB

# 1.0 General Description

The UNiCORE UM28P3TND NVMe 1.3 PCIe Gen3x4 M.2 2280 solid state drive utilizes 3D NAND flash and provides superb R/W performance of up to 3400/2800MB per second. Its P/E cycle has been upgraded to 3K and can operate normally in harsh environment from 0°C to 70°C for excellent endurance, reliability, and stability. In addition, it supports RAID Engine and End to End (E2E) Data Protection for data integrity and safety. For enhanced data security, the UM28P3TND comes with AES 256-bit encryption (optional) and meets TCG Opal standard (optional). Not only is the UM28P3TND suitable for notebooks, desktops, servers and data centers of all types, it can also serve as a boot drive for surveillance and transportation systems. To safeguard quality, compatibility, and reliability, ADATA uses a rigorous SSD validation process that encompasses performance testing and quality assurance to ensure its SSDs meet the exacting requirements of industrial applications.

## 1.1 Functional Block

Figure 1-1 Functional Block



## 2.0 Mechanical Specification

All product specifications not covered in this document (electrical performance, appearance, etc.) are in accordance with YTY UNICORE's defined norms and standards.

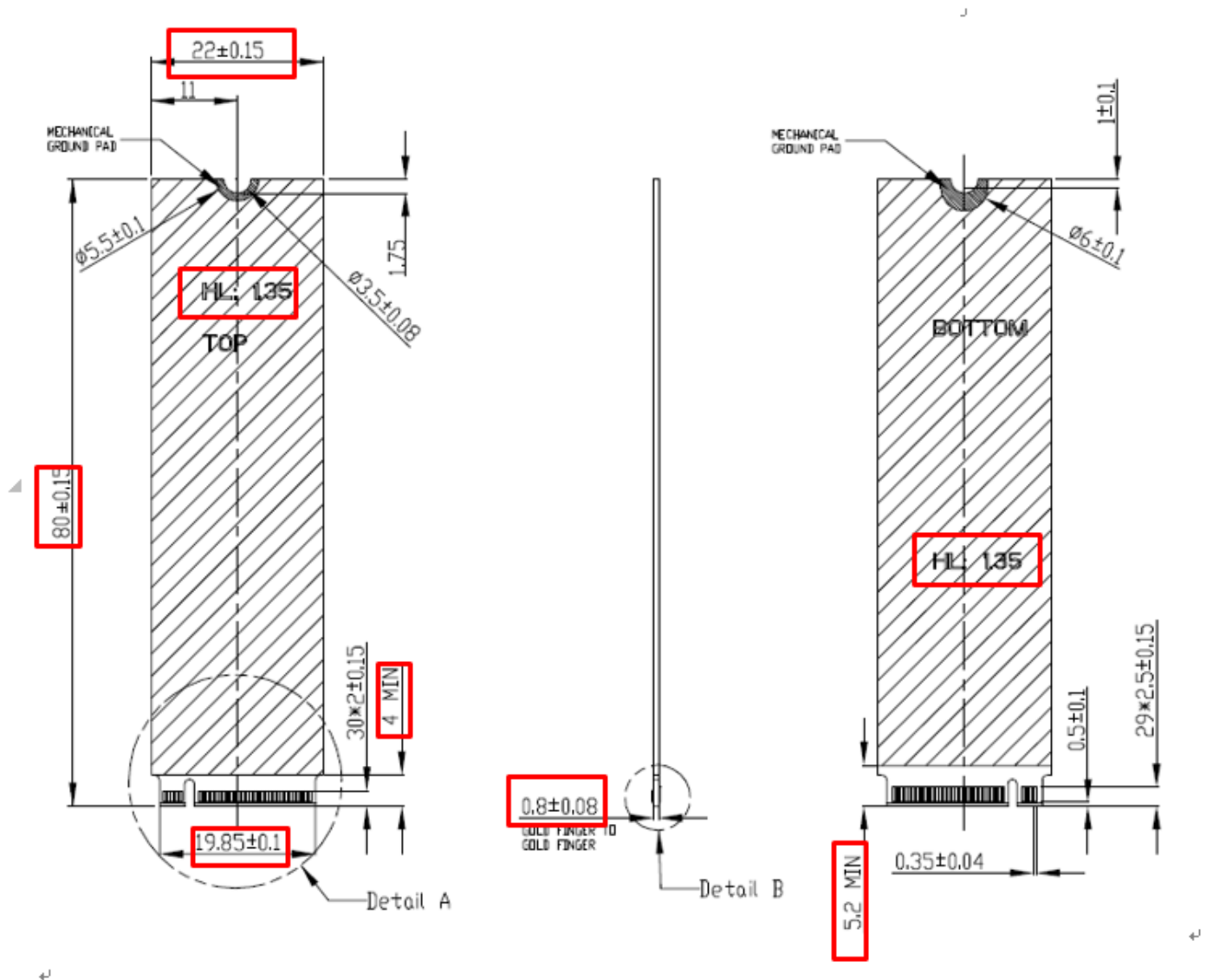
### 2.1 Physical dimensions and Weight

Table 2-1 Dimensions and Weight

Model	Length (mm)	Width (mm)	Height (mm)	Weight (gram)
256	80.00 +/- 0.15	22.00 +/- 0.15	Max 2.25	6.2 +/- 0.2
512	80.00 +/- 0.15	22.00 +/- 0.15	Max 2.25	6.9 +/- 0.2
1024	80.00 +/- 0.15	22.00 +/- 0.15	Max 2.25	7.0 +/- 0.2
2048	80.00 +/- 0.15	22.00 +/- 0.15	Max 2.25	7.0 +/- 0.2

### 2.2 Product Dimensions

Figure 2-1 Product Dimensions



## 3.0 Product Specification

### 3.1 Interface and configuration

- Compliant with PCI Express M.2 Specification Revision 1.1.
- Compliant with NVMe 1.3 register interface and command set.
- Compliant with PCIe Express 3.1.

### 3.2 Capacity

**Table 3-1 User Addressable Sectors**

Model	UM28P3TND			
Unformatted Capacity	256GB	512GB	1TB	2TB
Total User Addressable Sectors (LBA Mode)	500,118,192	1,000,215,216	2,000,409,264	4,000,797,360

Total useable capacity may be less (duo to formatting, flash management, and other functions).  
1GB=1,000,000,000 bytes; 1sector = 512bytes.

### 3.3 Performance

#### 3.3.1 Read/Write & ATTO Performance

**Table 3-2 Read/Write Performance (ATTO)**

	256GB	512GB	1TB	2TB	Unit
Sequential Read	3300	3300	3300	3300	MB/s
Sequential Write	1200	2400	1900	2800	MB/s

-Seq. Read & Write speed test by ATTO  
-The system conditions and test environment may affect test result

#### 3.3.2 Read/Write & CDM Performance

**Table 3-3 Read/Write Performance (CDM)**

	256GB	512GB	1TB	2TB	Unit
Sequential Q32 Read	3400	3400	3400	3400	MB/s
Sequential Q32 Write	1200	2300	1800	2800	MB/s

-Seq. Read & Write speed test by Crystal Disk Mark 5.1.2

### 3.3.3 IOPS Performance

**Table 3-4 Read/Write & IOPS Performance**

	<b>256GB</b>	<b>512GB</b>	<b>1TB</b>	<b>2TB</b>	<b>Unit</b>
<b>4K Random Read</b>	110K	145K	145K	150K	IOPS
<b>4K Random Write</b>	70K	100K	100K	100K	IOPS

- Seq. Read & Write speed test by IOmeter 2010 with "00" pattern (Queue depth of 32; Measurements are performed on 10% capacity of LBA range. Write cache enable)
- IOPS Test Utility: IOmeter 2010 (Queue depth of 32; Measurements are performed on 10% capacity of LBA range. Write cache enable)
- Different system conditions and test environments may affect test results

### 3.3.4 Read/Write & AS-SSD Performance

**Table 3-5 Read/Write Performance (AS-SSD)**

	<b>256GB</b>	<b>512GB</b>	<b>1TB</b>	<b>2TB</b>	<b>Unit</b>
<b>Sequential Read</b>	2800	2800	2800	2800	MB/s
<b>Sequential Write</b>	1000	2100	1700	2300	MB/s
<b>4K-64 Thrd Read</b>	640	1200	1000	1200	MB/s
<b>4K-64 Thrd Write</b>	490	1300	1300	1200	MB/s

- Seq. Read & Write speed test by AS-SSD with Random pattern

## 3.4 Electrical

### 3.4.1 Operating Voltage

**Table 3-6 Operating Voltage**

<b>Operating Voltage</b>	
<b>Input Power</b>	DC 3.3V ± 5%
<b>Maximum Ripple</b>	100mV p-p or less



### 3.4.2 Power Consumption (Typical)

**Table 3-7 Power Consumption (Typical)**

	256GB	512GB	1TB	2TB	Unit
L0	0.7	0.7	0.7	0.7	W
L1	0.02	0.02	0.02	0.02	W
L1.2	0.004	0.004	0.004	0.004	W
Sequential Read	5.6	4.6	5.2	5.2	W
Sequential Write	3.8	5.2	4.5	5.8	W
Random Read	3.6	4.1	3.5	3.7	W
Random Write	1.9	2.3	3.0	3.0	W

- The typical value means to measure the power consumption by using IO Meter with 128KB Sequential and 4K Random read/write transfers within 15 minutes.
- The measurement may vary among different host systems and settings.

### 3.5 Environmental Conditions

**Table 3-8 Temperature, Humidity**

Feature	Operating	Non-Operating
Standard Temperature	0°C to 70°C	-55°C to 95°C
Humidity	5%~95% RH, non-condensing	

### 3.6 Reliability

**Table 3-9 Shock and Vibration**

Parameter	Conditions	Reference Standards
Shock	1500G, 3 axes, duration 0.5ms, Half Sine Wave	JESD22-B110
Vibration	20G , 3 axes , Peak, 20~2000Hz	JESD22-B103

**Table 3-10 MTBF**

Parameter	Conditions	Hours
MTBF	MIL-HDBK-217	3,000,000

### 3.7 Endurance

Endurance for the SSD can be predicted based on the operating workload .The tables as below shows the drive lifetime for each SSD capacity based JESD219 client workload.

**Table 3-10 Tera Byte Written**

	256GB	512GB	1TB	2TB	Unit
Total Byte Written (TBW)	250	500	1000	2000	TB

## 4.0 Supported Command Sets

### 4.1 Identify Command

UNiCORE SSD follows NVMe 1.3 Specification and responds to identify command with a pre-defined string of information listed in Identify Controller Data structure.

**Table 4-1 Identify Controller Data Structure Table**

Bytes	Description
0-1	PCI Vendor ID(VID)
2-3	PCI Subsystem Vendor ID(SSVID)
4-23	Serial Number (SN)
24-63	Model Number (MN)
64-71	Firmware Revision (FR)
72	Recommended Arbitration Burst (RAB)
73-75	IEEE OUI Identifier (IEEE)
76	Multi-Interface Capabilities (MIC)
77	Max Data Transfer Size (MDTS)
256-257	Optional Admin Command Support (OACS)
258	Abort Command Limit (ACL)
259	Asynchronous Event Request Limit(AERL)
260	Firmware Update(FRMW)
261	Log Page Attributes(LPA)
262	Error Log Page Entries(ELPE)
263	Number of Power States Support(NPSS)
512	Submission Queue Entry Size
513	Completion Queue Entry Size
516-519	Number of Namespaces(NN)
520-521	Optional NVM command Support(ONCS)
522-523	Fused Operation Support(FUSES)
524	Format NVM Attributes(FNA)
525	Volatile Write Cache(VWC)
526-527	Atomic Write Unit Normal(AWUN)
528-529	Atomic Write Unit Power Fail(AWUPF)
2048-2079	Power State 0 Descriptor(PSD0)

## 4.2 SMART/Health Information

Table 4-2 SMART/Health Information log

Byte	Description														
0	<p><b>Critical Warning:</b> 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.</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>Definition</th> </tr> </thead> <tbody> <tr> <td>00</td> <td>If set to '1', then the available spare space has fallen below the threshold.</td> </tr> <tr> <td>01</td> <td>If set to '1', then a temperature is above an over temperature threshold or below an under temperature threshold (refer to section 5.15.1.4).</td> </tr> <tr> <td>02</td> <td>If set to '1', then the NVM subsystem reliability has been degraded due to significant media related errors or any internal error that degrades NVM subsystem reliability.</td> </tr> <tr> <td>03</td> <td>If set to '1', then the media has been placed in read only mode.</td> </tr> <tr> <td>04</td> <td>If set to '1', then the volatile memory backup device has failed. This field is only valid if the controller has a volatile memory backup solution.</td> </tr> <tr> <td>07:05</td> <td>Reserved</td> </tr> </tbody> </table>	Bit	Definition	00	If set to '1', then the available spare space has fallen below the threshold.	01	If set to '1', then a temperature is above an over temperature threshold or below an under temperature threshold (refer to section 5.15.1.4).	02	If set to '1', then the NVM subsystem reliability has been degraded due to significant media related errors or any internal error that degrades NVM subsystem reliability.	03	If set to '1', then the media has been placed in read only mode.	04	If set to '1', then the volatile memory backup device has failed. This field is only valid if the controller has a volatile memory backup solution.	07:05	Reserved
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04	If set to '1', then the volatile memory backup device has failed. This field is only valid if the controller has a volatile memory backup solution.														
07:05	Reserved														
2:1	<p><b>Composite Temperature:</b> 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 (refer to section 5.15.1.4).</p> <p>Warning and critical overheating composite temperature threshold values are reported by the WCTEMP and CCTEMP fields in the Identify Controller data structure in Figure 90.</p>														
3	<p><b>Available Spare:</b> Contains a normalized percentage (0 to 100%) of the remaining spare capacity available.</p>														
4	<p><b>Available Spare Threshold:</b> 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%).</p>														
5	<p><b>Percentage Used:</b> 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).</p> <p>Refer to the JEDEC JESD218A standard for SSD device life and endurance measurement techniques.</p>														

31:6	Reserved
47:32	<p><b>Data Units Read:</b> 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.</p> <p>For the NVM command set, logical blocks read as part of Compare and Read operations shall be included in this value.</p>
63:48	<p><b>Data Units Written:</b> 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.</p> <p>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.</p>
79:64	<p><b>Host Read Commands:</b> Contains the number of read commands completed by the controller.</p> <p>For the NVM command set, this is the number of Compare and Read commands.</p>
95:80	<p><b>Host Write Commands:</b> Contains the number of write commands completed by the controller.</p> <p>For the NVM command set, this is the number of Write commands.</p>
111:96	<p><b>Controller Busy Time:</b> 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.</p>
127:112	<p><b>Power Cycles:</b> Contains the number of power cycles.</p>
143:128	<p><b>Power On Hours:</b> Contains the number of power-on hours. This may not include time that the controller was powered and in a non-operational power state.</p>
159:144	<p><b>Unsafe Shutdowns:</b> Contains the number of unsafe shutdowns. This count is incremented when a shutdown notification (CC.SHN) is not received prior to loss of power.</p>
175:160	<p><b>Media and Data Integrity Errors:</b> 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.</p>
191:176	<p><b>Number of Error Information Log Entries:</b> Contains the number of Error Information log entries over the life of the controller.</p>
195:192	<p><b>Warning Composite Temperature Time:</b> 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 in Figure 90.</p> <p>If the value of the WCTEMP or CCTEMP field is 0h, then this field is always cleared to 0h</p>

	regardless of the Composite Temperature value.
199:196	<b>Critical Composite Temperature Time:</b> Contains the amount of time in minutes that the controller is operational and the Composite Temperature is greater than 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	<b>Temperature Sensor 1:</b> Contains the current temperature reported by temperature sensor 1. This field is defined by Figure 81.
203:202	<b>Temperature Sensor 2:</b> Contains the current temperature reported by temperature sensor 2. This field is defined by Figure 81.
205:204	<b>Temperature Sensor 3:</b> Contains the current temperature reported by temperature sensor 3. This field is defined by Figure 81.
207:206	<b>Temperature Sensor 4:</b> Contains the current temperature reported by temperature sensor 4. This field is defined by Figure 81.
209:208	<b>Temperature Sensor 5:</b> Contains the current temperature reported by temperature sensor 5. This field is defined by Figure 81.
211:210	<b>Temperature Sensor 6:</b> Contains the current temperature reported by temperature sensor 6. This field is defined by Figure 81.
213:212	<b>Temperature Sensor 7:</b> Contains the current temperature reported by temperature sensor 7. This field is defined by Figure 81.
215:214	<b>Temperature Sensor 8:</b> Contains the current temperature reported by temperature sensor 8. This field is defined by Figure 81.
511:216	Reserved

## 5.0 Pin assignment and descriptions

**Table 5-1 Pin assignment and descriptions**

Top Side			Bottom Side		
NO.	Pin	Descriptions	Descriptions	Pin	NO.
75	GND	System Ground			
73	GND	System Ground	+3.3V	POWER	74
71	GND	System Ground	+3.3V	POWER	72
69	PDEDC	PDEDC	+3.3V	POWER	70
67	NC	NC	SUSCLK	SUSCLK	68
M-KEY					
57	GND	System Ground	MFG_CLK	UART	58
55	Diff	RefCLKP	MFG_DATA	UART	56
53	Diff	RefCLKN	PEWAKE#	PEWAKE	54
51	GND	System Ground	CLKREQ#	CLKREQ	52
49	Diff	P0RXP	PERST#	PERST	50
47	Diff	P0RXN	NC	NC	48
45	GND	System Ground	NC	NC	46
43	Diff	P0TXP	ALERT#	ALERT	44
41	Diff	P0TXN	SMB_DATA	I2C	42
39	GND	System Ground	SMB_CLK	I2C	40
37	Diff	P1RXP	NC	NC	38
35	Diff	P1RXN	NC	NC	36
33	GND	System Ground	NC	NC	34
31	Diff	P1TXP	NC	NC	32
29	Diff	P1TXN	NC	NC	30
27	GND	System Ground	NC	NC	28
25	Diff	P2RXP	NC	NC	26
23	Diff	P2RXN	NC	NC	24
21	GND	System Ground	NC	NC	22
19	Diff	P2TXP	NC	NC	20
17	Diff	P2TXN	+3.3V	POWER	18
15	GND	System Ground	+3.3V	POWER	16
13	Diff	P3RXP	+3.3V	POWER	14
11	Diff	P3RXN	+3.3V	POWER	12
9	GND	System Ground	LED1#(OPTION)	INDICATE	10
7	Diff	P3TXP	NC	NC	8
5	Diff	P3TXN	NC	NC	6
3	GND	System Ground	+3.3V	POWER	4
1	GND	System Ground	+3.3V	POWER	2

## 6.0 Product Line up

Table 6-1 Product Line up

Model Name	Capacity	P/E cycles	Type	Remark
UM28P3TND-256GNS8	256GB	3K	M.2 2280	0°C~70°C
UM28P3TND-512GNS8	512GB	3K	M.2 2280	
UM28P3TND-001TNS8	1TB	3K	M.2 2280	
UM28P3TND-002TNS8	2TB	3K	M.2 2280	

## 7.0 Package Specifications

Figure 7-1 Package Specification

