M.2 2280 NVMe SSD

Product Name: **UM28P3TNN**

Capacity : **128GB、256GB、512GB、1TB、2TB**

Revision History

Revision	Date	Description	Editor
1.0	July. 6, 2022	Initial release	

Table of Contents

1.0 General Description 5
1.1 Functional Block 5
2.0 Mechanical Specifications 6
2.1 Physical Dimensions and Weights 6
2.2 Product Dimensions 6
3.0 Product Specifications 7
3.1 Interface and Configurations 7
3.2 Capacity 7
3.3 Performance 7
3.3.1 ATTO Performance 7
3.3.2 CDM Performance 7
3.3.3 IOPS Performance 8
3.3.4 AS-SSD Performance 8
3.4 Electrical Specifications 8
3.4.1 Operating Voltage 8
3.4.2 Power Consumption 8
3.5 Environmental Conditions 9
3.6 Reliability 9
3.7 Endurance 9
4.0 Support Command Sets 10
4.1 Identify Command 10
4.2 SMART/Health Information 11
5.0 Pin Assignment and Descriptions 14
6.0 Ordering Information 15
7.0 Package Specification 15

Key Features

- **Capacity:**
  - 128GB, 256GB, 512GB, 1TB, 2TB
- **NAND Flash:** 3D TLC 112L
- **Form Factor:** M.2 2280
- **Host Interface:**
  - PCIe Gen 3 (8Gb/s) x4 Lane
  - Compliant with NVMe 1.4 register interface and command set
  - Compliant with PCIe Express 3.1
- **Flash Management:**
  - LDPC ECC engine
  - RAID engine
  - Enhanced endurance by static /dynamic 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
- **NVMe Features support:**
  - HMB
- **Performance:**
  - Sequential Read: Up to 2500 MB/s
  - Sequential Write: Up to 2400 MB/s
  - Random 4K Read: Up to 196K IOPS
  - Random 4K Write: Up to 158K IOPS
- **Power Consumption:**
  - L0: 0.656W
  - L1: 0.036W
  - L1.2: 0.0007W
  - Sequential Read/Write: 2.89W/4.22W
  - Random Read/Write: 2.00W/1.91W
- **Temperature:**
  - Industrial: -40°C ~ 85°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 1920TB

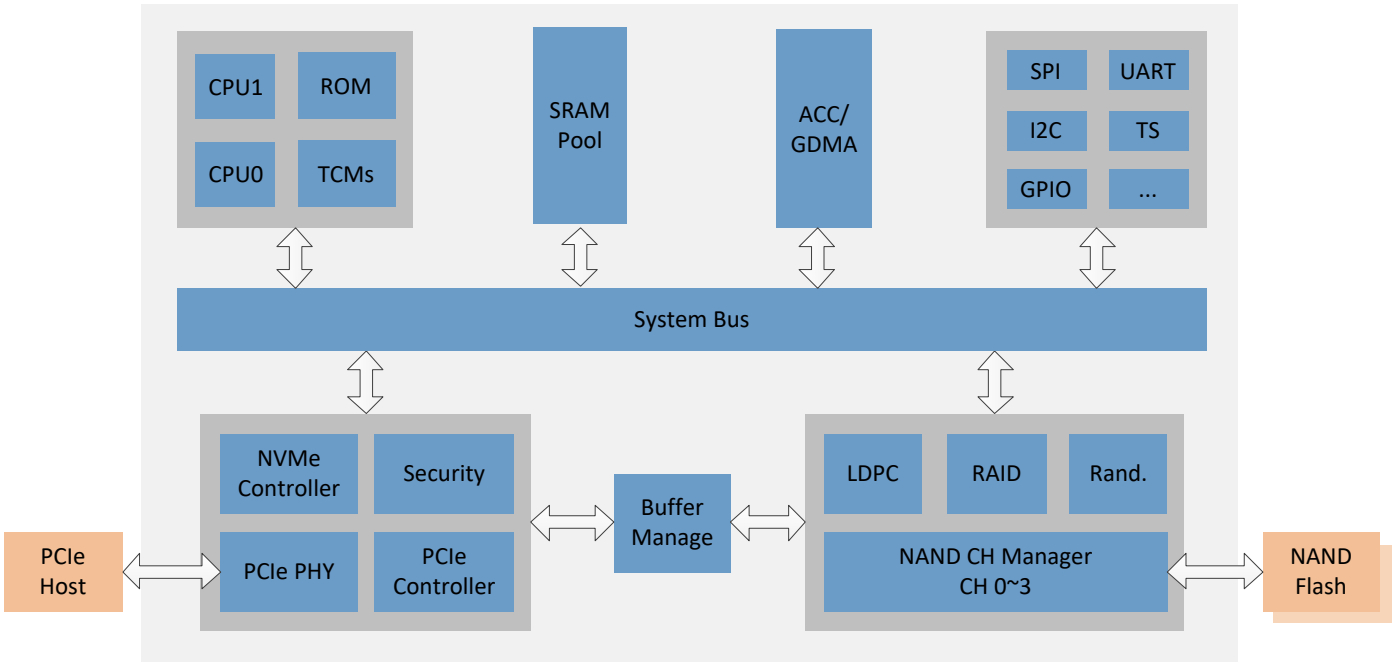
1.0 General Description

The YTY UNiCORE UM28P3TNN M.2 2280 solid state drive utilizes 3D NAND flash to provide improved power efficiency and rugged reliability. It sports read/write speeds of up to 2500/2400MB per second, and with support for LDPC ECC technology, it can safeguard data integrity and maintain high performance.

The YTY UNiCORE SSD validation process ensures quality, compatibility, and reliability with functionality testing and reliability assurance.

1.1 Functional Block

Figure 1-1 Functional Block



2.0 Mechanical Specifications

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

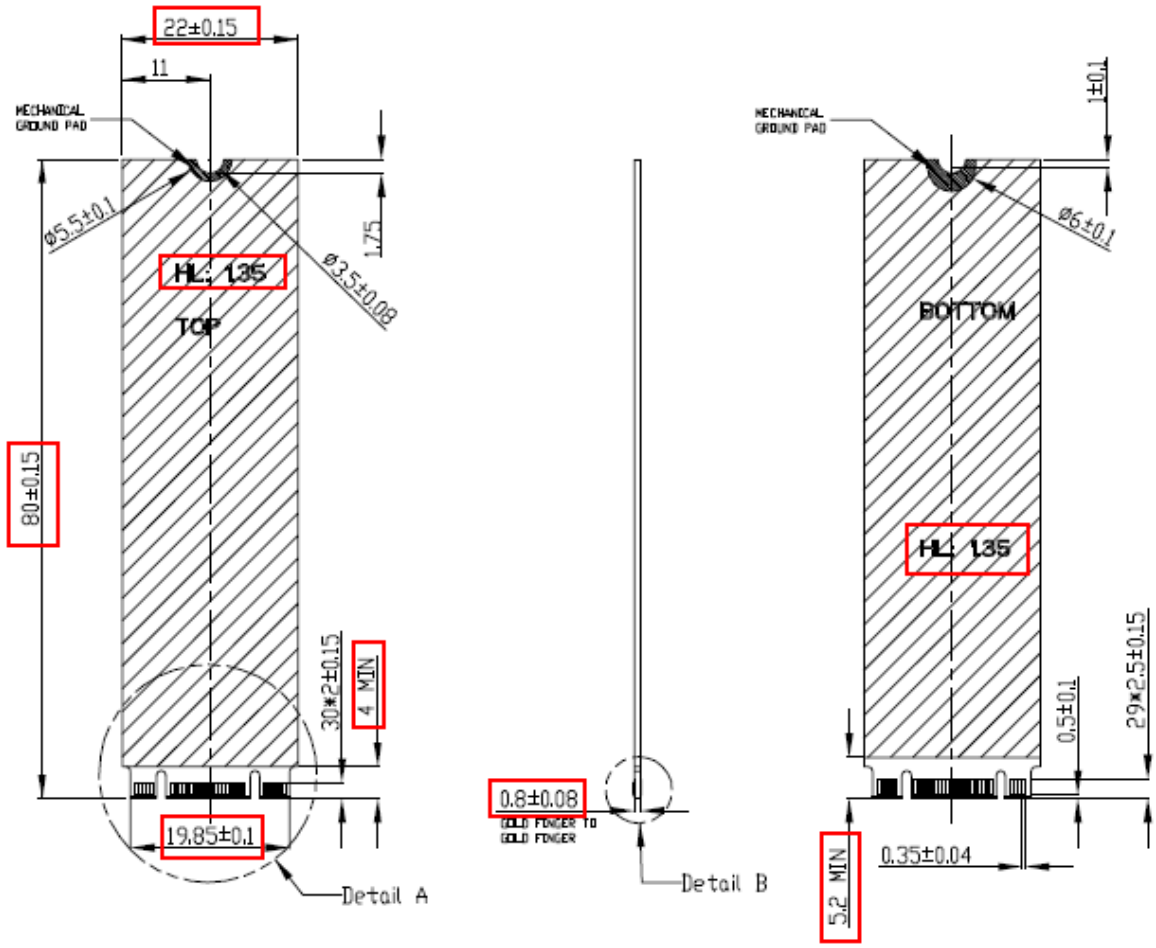
2.1 Physical Dimensions and Weights

Table 2-1 Dimensions and Weights

Capacity(GB)	Length(mm)	Width(mm)	Height(mm)	Weight(gram)
128	80±0.15	22±0.15	Max 3.6	Max 6.9±1g
256	80±0.15	22±0.15	Max 3.6	Max 6.9±1g
512	80±0.15	22±0.15	Max 3.6	Max 6.9±1g
1024	80±0.15	22±0.15	Max 3.6	Max 6.9±1g
2048	80±0.15	22±0.15	Max 3.6	Max 6.9±1g

2.2 Product Dimensions

Figure 2-1 Product Dimensions



3.0 Product Specifications

3.1 Interface and Configurations

- Compliant with PCI Express M.2 Specification Revision 1.1.
- Compliant with NVMe 1.4 register interface and command set.
- Compliant with PCIe Express 3.1.

3.2 Capacity

Table 3-1 User Addressable Sectors

Model	**UM28P3TNN**				
Unformatted Capacity	128GB	256GB	512GB	1TB	2TB
Total User Addressable Sectors (LBA Mode)	250,069,680	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 ATTO Performance

Table 3-2 Read/Write Performance (ATTO)

	128GB	**256GB**	**512GB**	**1TB**	**2TB**	**Unit**
Sequential Read	1900	2690	2500	2660	TBD	MB/s
Sequential Write	1100	1290	1820	2550	TBD	MB/s

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

3.3.2 CDM Performance

Table 3-3 Read/Write Performance (CDM)

	128GB	**256GB**	**512GB**	**1TB**	**2TB**	**Unit**
Sequential Q32 Read	1100	2200	2490	2520	TBD	MB/s
Sequential Q32 Write	370	750	1500	2420	TBD	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

	128GB	256GB	512GB	1TB	2TB	Unit
4K Random Read	46K	90K	165K	196K	TBD	IOPS
4K Random Write	55K	69K	158K	139K	TBD	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 AS-SSD Performance

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

	128GB	256GB	512GB	1TB	2TB	Unit
Sequential Read	890	1630	1830	1800	TBD	MB/s
Sequential Write	340	650	1160	1750	TBD	MB/s
4K-64 Thrd Read	280	560	1050	1370	TBD	MB/s
4K-64 Thrd Write	320	620	1110	1280	TBD	MB/s

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

3.4 Electrical Specifications

3.4.1 Operating Voltage

Table 3-6 Operating Voltage

Operating Voltage	
Input Power	DC 3.3V ± 5%
Maximum Allowable Ripple	100mV p-p

3.4.2 Power Consumption

Table 3-7 Power Consumption (Typical)

	128GB	256GB	512GB	1TB	2TB	Unit
L0	0.640	0.646	0.656	0.635	TBD	**W**
L1	0.034	0.034	0.033	0.036	TBD	
L1.2	0.00066	0.00066	0.00066	0.00066	TBD	
Sequential Read	1.33	1.59	2.01	2.89	TBD	
Sequential Write	1.44	1.80	2.58	4.22	TBD	
Random Read	1.29	1.52	1.80	2.00	TBD	
Random Write	1.41	1.67	1.84	1.91	TBD	

- 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 and 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

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

Table 3-11 Terabytes Written

Capacity	128GB	256GB	512GB	1TB	2TB	Unit
TBW	120	240	480	960	1920	TB

4.0 Support Command Sets

4.1 Identify Command

ADATA 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

The following table defines the vendor specific data in byte 2 to 361 of the 512-byte SMART data.

Table 4-2 SMART/Health Information log

<table>
<tr><th>Byte</th><th>Description</th></tr>
<tr><td>0</td><td>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.
<table>
<tr><th>Bit</th><th>Definition</th></tr>
<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>
</table></td></tr>
<tr><td>2:1</td><td>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 (refer to section 5.15.1.4).
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.</td></tr>
<tr><td>3</td><td>Available Spare: Contains a normalized percentage (0 to 100%) of the remaining spare capacity available.</td></tr>
<tr><td>4</td><td>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%).</td></tr>
<tr><td>5</td><td>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).</td></tr>
</table>

	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 may not include time that the controller was powered and in a non-operational power state.
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

	in Figure 90. 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 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	**Temperature Sensor 1:** Contains the current temperature reported by temperature sensor 1. This field is defined by Figure 81.
203:202	**Temperature Sensor 2:** Contains the current temperature reported by temperature sensor 2. This field is defined by Figure 81.
205:204	**Temperature Sensor 3:** Contains the current temperature reported by temperature sensor 3. This field is defined by Figure 81.
207:206	**Temperature Sensor 4:** Contains the current temperature reported by temperature sensor 4. This field is defined by Figure 81.
209:208	**Temperature Sensor 5:** Contains the current temperature reported by temperature sensor 5. This field is defined by Figure 81.
211:210	**Temperature Sensor 6:** Contains the current temperature reported by temperature sensor 6. This field is defined by Figure 81.
213:212	**Temperature Sensor 7:** Contains the current temperature reported by temperature sensor 7. This field is defined by Figure 81.
215:214	**Temperature Sensor 8:** 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 Ordering Information

Table 6-1 Ordering Information

Model Name	Capacity	P/E cycles	Type	Remark
UM28P3TNN-128GWM45	128GB	3K	M.2 2280	-40℃~85℃
UM28P3TNN-256GWM45	256GB	3K	M.2 2280	
UM28P3TNN-512GWM45	512GB	3K	M.2 2280	
UM28P3TNN-001TWM45	1TB	3K	M.2 2280	
UM28P3TNN-002TWM45	2TB	3K	M.2 2280	

7.0 Package Specification

Figure 7-1 Package Specification