

# UD info Corp.

Industrial M.2 2280 PCIe SSD

M2P-80DG Series

Product DataSheet



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## Revision History

Revision	Draft Date	History	Author
1.0	2022/3/1	New release	Golden Lee
1.1	2023/2/24	Added 4TB for single side & 8TB for double side	Golden Lee
1.2	2023/5/15	Added Kioxia 4TB double side 32CE performance/power consumption	Golden Lee



## Product Overview

- **Capacity**
  - 500/512GB up to 8000GB/8192GB
- **Form Factor**
  - E18 M.2 2280-S2-M (BGA132 x4)
  - E18 M.2 2280-D2-M (BGA132 x8)
- **PCIe Interface**
  - PCIe Gen4 x4
- **Compliance**
  - NVMe 1.4
  - PCI Express Base 4.0
- **Flash Interface**
  - Transfer rate up to 1600MBps
  - Up to 8pcs of BGA132 flash
- **Performance**<sup>Note1</sup>
  - Read up to 7,200 MB/s
  - Write up to 6,850 MB/s
- **Power Consumption**<sup>Note2</sup>
  - L1.2 < 3mW
- **Power Management**
  - Support APST
  - Support ASPM
  - Support L1.2
- **Advanced Flash Management**
  - Static and Dynamic Wear Leveling
  - Bad Block Management
  - TRIM
  - SMART
  - Over-Provision
- **Reliability**
  - MTBF 1,600,000 hours
  - Uncorrectable Bit Error Rate (UBER)  
< 1 sector per 10<sup>16</sup> bits read
- **Temperature Range**<sup>Note3</sup>
  - Operation: 0°C ~ 70°C
  - Storage: -40°C ~ 85°C
- **RoHS Compliant**
- **Features Support List**
  - End to end data path protection
  - Thermal throttling
  - SmartECC™
  - SmartRefresh™
  - Drive log
  - Support of TCG Pyrite
  - Support of TCG OPAL<sup>Note4</sup>

### Notes:

1. Refer to Chapter 2 for more details.
2. Refer to Chapter 4, section 4.2 power consumption for more details.
3. Operation temperature is measured by device temperature sensor.
4. Support by a separate firmware version. Further information available upon request.

## 1. INTRODUCTION

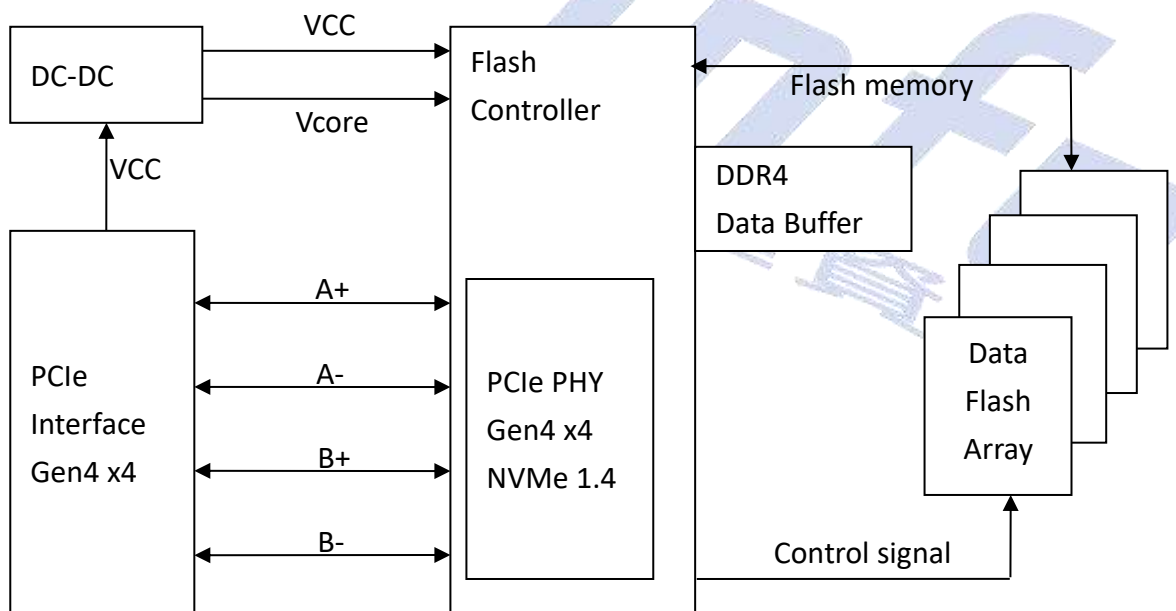
### 1.1. General Description

UDinfo's M.2 2280 PCIe solid state Drive delivers all the advantages of flash disk technology with PCIe Gen4 x4 interface and is fully compliant with the standard Next Generation Form Factor (NGFF) called M.2 Card Format. The M.2 2280 could provide a wide range capacity up to 8TB and its performance can reach up to 7,200MB/s read and 6,850MB/s write based on 3D TLC NAND flash with the choice of 512MB/1GB/2GB DDR4. Moreover, the power consumption of the M.2 2280 is much lower than traditional hard drives, making it the best embedded solution for new platforms.

**Notes:**

1. Achieved by 2000GB SSD with external 2GB DDR4 at FOB (fresh-out-of-box) state on CrystalDiskMark v7.0.0.
2. The choice of DDR4 depends on drive capacity.
  - DDR size = 0.1% of SSD capacity 512G to 2TB DS.
  - DDR size = 0.05% of SSD capacity 2TB SS and 4TB.
  - DDR size = 0.025% of SSD capacity 4TB SS and 8TB.

### 1.2. Block Diagram



**M.2 2280 PCIe SSD Block Diagram**

## 2. PRODUCT SPECIFICATIONS



- **Capacity**
  - 500/512GB up to 8000GB/8192GB
- **Electrical/Physical Interface**
  - PCIe Gen4 x 4 lane & backward compatible to PCIe Gen3, Gen2 and Gen1
  - Compliant with NVMe 1.4
  - 8 IO queues supported(1 admin queue and 8 IO queue). Each IO queue support 256 entries.
  - Support power management
- **Supported NAND Flash**
  - Support up to 32 Flash Chip Enables (CE) within a single design
  - Support up to 8pcs of BGA132 flash (M.2 2280-D2)
  - Support ONFI 2.3, ONFI 3.0, ONFI 3.2, ONFI 4.0 and ONFI 4.2 interface
  - Support Toggle 1.0, Toggle 2.0, Toggle 3.0 and Toggle 4.0 interface
- **ECC Scheme**
  - Applies the fourth LDPC generation of ECC algorithm
- **Sector Size Support**
  - 512 Bytes
  - 4K Bytes
- **Support SMART and TRIM commands**
- **Certification & Compliance**
  - RoHS
  - WHQL
  - PCI Express Base 4.0
  - UNH-IOL NVM Express Logo

- LBA Range

- IDEMA standard

Capacity	IDEMA Standard		User Data Size
	512Bytes/Sector	4KBytes/Sector	
	Total Sectors (LBA)	Total Sectors (LBA)	
500GB	976,773,168	122,096,646	Depended on file management
512GB	1,000,215,216	125,026,902	
1000GB	1,953,535,168	244,191,896	
1024GB	2,000,409,264	250,051,158	
2000GB	3,907,029,168	488,378,646	
2048GB	4,000,797,360	500,099,670	
4000GB	7,814,037,168	976,754,646	
4096GB	8,001,573,552	1,000,196,694	
8000GB	15,628,053,168	1,953,506,646	
8192GB	16,003,125,936	2,000,390,742	

**Notes:**

1. 1 Gigabyte (GB) is equal to 1,000,000,000 Bytes; 1 sector is equal to 512 Bytes.
2. The calculation is following IDEMA Standard.
3. The total actual user data size of the SSD may be less than device capacity due to SSD format, SSD partition, operating system.  
EX: OS shows 447.13GB (NTFS) with 480GB SSD.



- **TBW (Terabytes Written)**

- **Micron**

Capacity	Flash Type	TBW
500GB/512GB	B47R TLC	350
1000GB/1024GB	B47R TLC	700
2000GB/2048GB	B47R TLC	1,400
4000GB/4096GB	B47R TLC	3,000

- **Kioxia**

Capacity	Flash Type	TBW
500GB/512GB	BiCS5 TLC	350
1000GB/1024GB	BiCS5 TLC	700
2000GB/2048GB	BiCS5 TLC	1,400
4000GB/4096GB	BiCS5 TLC	3,000
8000GB/8192GB	BiCS5 TLC	6,000

**Notes:**

1. The test followed JEDEC219A client endurance workload.
2. TBW may differ according to flash configuration and platform.
3. 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.



- Performance

- Micron

Form Factor	Capacity	Flash Configuration (BGA Package)	Performance			
			CrystalDiskMark (MB/s)		IOMeter (IOPS)	
			Read	Write	Read	Write
Single Side	500GB/512GB	128GB x4, 8CE, DDP	7,000	3,000	450K	700K
	1000GB/1024GB	256GB x4, 16CE, QDP	7,200	6,000	750K	1000K
	2000GB/2048GB	512GB x4, 32CE, ODP	7,200	6,850	1000K	1000K
Double Side	2000GB/2048GB	256GB x8, 32CE, QDP	7,200	6,850	1000K	1000K
	4000GB/4096GB	512GB x8, 32CE, ODP	7,200	6,850	940K	1000K

- Kioxia

Form Factor	Capacity	Flash Configuration (BGA Package)	Performance			
			CrystalDiskMark (MB/s)		IOMeter (IOPS)	
			Read	Write	Read	Write
Single Side	500GB/512GB	128GB x4, 8CE, DDP	7,000	3,750	450K	920K
	1000GB/1024GB	256GB x4, 16CE, QDP	7,200	6,000	750K	1000K
	2000GB/2048GB	512GB x4, 32CE, ODP	7,200	6,850	1000K	1000K
	4000GB/4096GB	1TB x4, 16CE, ODP	7,200	6,400	550K	1000K
	4000GB/4096GB	1TB x4, 32CE, ODP	7,200	6,850	1000K	1000K
Double Side	2000GB/2048GB	256GB x8, 32CE, QDP	7,200	6,850	1000K	1000K
	4000GB/4096GB	512GB x8, 32CE, ODP	7,200	6,850	1000K	1000K
	4000GB/4096GB	512GB x8, 32CE, QDP	7,200	6,850	1000K	1000K
	8000GB/8192GB	1TB x8, 32CE, ODP	7,000	5,900	900K	1000K

**Notes:**

1. Performance may differ according to flash configuration and platform.
2. The tables are for reference only. Any criteria for accepting goods shall be further discussed based on different flash configurations.
3. Performance is based on AMD Gen4 X570 + 8 Core CPU + DDR4 (3200Hz) 16GB.
4. Performance is measured on a fresh slave drive and based on the following conditions:
  - (a) CrystalDiskMark 7.0.0, 1GB range, QD=16, Thread=1
  - (b) IOMeter, 1GB range, 4K data size, QD=128, 16 worker, 4k aligned

## 3. ENVIRONMENTAL SPECIFICATIONS



### 3.1. Environmental Conditions

#### 3.1.1. Temperature and Humidity

■ High Temperature Test Condition

	Temperature	Humidity
Operation	70°C	0% RH
Storage	85°C	0% RH

■ Low Temperature Test Condition

	Temperature	Humidity
Operation	0°C	0% RH
Storage	-40°C	0% RH

■ High Humidity Test Condition

	Temperature	Humidity
Operation	40°C	90% RH
Storage	40°C	93% RH

■ Temperature Cycle Test

	Temperature
Operation	0°C
	70°C <sup>Note1</sup>
Storage	-40°C
	85°C

Notes:

1. Operation temperature is measured by device temperature sensor. Airflow is suggested and it will allow device to be operated at appropriate temperature for each component during heavy workloads environment.

### 3.1.2. Shock

■ Shock Specification

	Acceleration Force
Non-Operational	1500G

### 3.1.3. Vibration

■ Vibration Specification

	Condition	
	Frequency/Displacement	Frequency/Acceleration
Non-Operational	20Hz~80Hz/1.52mm	80Hz~2000Hz/20G

### 3.1.4. Drop

■ Drop Specification

	Height of Drop	Number of Drop
Non-operational	80cm free fall	6 face of each unit

### 3.1.5. Bending

■ Bending Specification

	Force	Action
Non-operational	≥ 20N	Hold 1min/5times

### 3.1.6. Durability

■ Durability

	Condition
operational	1000 mating cycles

### 3.1.7. Electrostatic Discharge (ESD)

Specification	+/- 4KV
EN 55024, CISPR 24 EN 61000-4-2 and IEC 61000-4-2	Device functions are affected, but EUT will be back to its normal or operational state automatically.

### 3.1.8. EMI Compliance

Specification
EN 55032, CISPR 32 (CE)
AS/NZS CISPR 32 (CE)
ANSI C63.4 (FCC)
VCCI-CISPR 32 (VCCI)
CNS 13438 (BSMI)

### 3.2. MTBF

MTBF, Mean Time Between Failures, is a measure of reliability a device. Its value represents the average time between a repair and the next failure. The unit of MTBF is in hours. The higher the MTBF value, the higher the reliability of the device.

Our MTBF result is based on simulation software (Relex7.3). Please note that a lower MTBF should be expected for higher capacity drives, and we apply the lowest MTBF all capacities.

## 4. ELECTRICAL SPECIFICATIONS



### 4.1. Supply Voltage

Parameter	Rating
Operating Voltage	Min = 3.14V Max = 3.47V
Rise Time (Max/Min)	100ms / 0.1ms
Fall Time (Max/Min)	5s / 1ms
Min. off Time <sup>Note1</sup>	1s

**Notes:**

1. Minimum time between power removed from SSD ( $V_{cc} < 100\text{mW}$ ) and power re-applied to the drive.

### 4.2. Power Consumption

**■ Power Consumption of Micron B47R TLC**

Form Factor	Capacity	Flash Configuration	CE#	Read		Write	
				Max.	Avg.	Max.	Avg.
Single Side	500/512GB	128GB x4, DDP	8	6.4	6.3	5.3	5.2
	1000GB/1024GB	256GB x4, QDP	16	6.6	6.5	6.7	6.5
	2000GB/2048GB	512GB x4, ODP	32	8.1	7.9	7.4	7.3
Double Side	2000GB/2048GB	256GB x8, QDP	32	8.2	7.9	7.6	7.4
	4000GB/4096GB	512GB x8, ODP	32	9.3	9.0	8.7	8.6

Unit: W

**■ Power Consumption of Kioxia BiCS5 TLC**

Form Factor	Capacity	Flash Configuration	CE#	Read		Write	
				Max.	Avg.	Max.	Avg.
Single Side	500/512GB	128GB x4, DDP	8	8.5	8.4	7.0	6.9
	1000GB/1024GB	256GB x4, QDP	16	9.5	9.4	7.7	7.6
	2000GB/2048GB	512GB x4, ODP	32	9.8	9.6	9.6	9.2
	4000GB/4096GB	1TB x4, ODP	16	10.3	10.0	10.0	8.3
	4000GB/4096GB	1TB x4, ODP	32	11.2	10.9	10.8	8.9
Double Side	2000GB/2048GB	256GB x8, QDP	32	10.5	10.4	10.0	9.7
	4000GB/4096GB	512GB x8, ODP	32	11.3	11.0	10.9	9.0
	4000GB/4096GB	512GB x8, QDP	32	11.3	11.0	10.9	9.0

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	8000GB/8192GB	1TB x8, ODP	32	11.5	11.4	11.0	9.1
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Unit: W

### Notes

1. Based on EIFMxxxx-series under ambient temperature.
2. Use CrystalDiskMark 7.0.0, 1GB range, QD=16, Thread=1. Measure power consumption during sequential Read and sequential Write.
3. Power Consumption may differ according to flash configuration and platform.
4. The measured power voltage is 3.3V.
5. Power Consumption during read and write operation is measured on Gen4 X570 + 6 Core CPU

### ■ Power Consumption of Micron B47R TLC

Form Factor	Capacity	Flash Configuration	CE#	Active			PS3	PS4
				PS0	PS1	PS2		
Single Side	500/512GB	128GB x4, DDP	8	6,400	3,100	3,000	20	3
	1000GB/1024GB	256GB x4, QDP	16	6,700	3,100	3,000	25	3
	2000GB/2048GB	512GB x4, ODP	32	8,100	3,200	3,100	25	3
Double Side	2000GB/2048GB	256GB x8, QDP	32	8,200	3,300	3,100	30	3
	4000GB/4096GB	512GB x8, ODP	32	9,300	3,300	3,200	50	3

Unit: mW

### ■ Power Consumption of Kioxia BiCS5 TLC

Form Factor	Capacity	Flash Configuration	CE#	Active			PS3	PS4
				PS0	PS1	PS2		
Single Side	500/512GB	128GB x4, DDP	8	8,500	3,600	3,400	40	3
	1000GB/1024GB	256GB x4, QDP	16	9,500	3,900	3,500	40	3
	2000GB/2048GB	512GB x4, ODP	32	9,800	3,800	3,500	45	3
	4000GB/4096GB	1TB x4, ODP	16	10,000	4,200	3,700	50	3
	4000GB/4096GB	1TB x4, ODP	32	11,200	4,200	3,900	50	3
Double Side	2000GB/2048GB	256GB x8, QDP	32	10,500	3,800	3,600	45	3
	4000GB/4096GB	512GB x8, ODP	32	11,300	4,200	3,900	50	3
	4000GB/4096GB	512GB x8, QDP	32	11,300	4,200	3,900	50	3
	8000GB/8192GB	1TB x8, ODP	32	11,500	4,300	4,000	50	3

Unit: mW

### Notes

1. Based on EIFMxxxx-series under ambient temperature.
2. The average value of power consumption is achieved based on 100% conversion efficiency.
3. The measured power voltage is 3.3V.

4. The temperature of a storage device in PS1 should remain constant or should slightly decrease for all workloads so the actual power in PS1 should be lower than PS0.
5. The temperature of a storage device in PS2 should decrease sharply for all workloads so the actual power in PS2 should be lower than PS1.
6. Power Consumption during read and write operation is measured on Gen4 X570 + 6 Core CPU.





## 5. INTERFACE



### 5.1. Pin Assignment and Descriptions

The follow table defines the signal assignment of the internal NGFF connector for SSD usage, described in the PCI Express M.2 Specification version 1.1 of the PCI-SIG.

Pin #	SATA 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#	Open drain, active low signal. These signals are used to allow the add-in card to provide status indicators via LED devices that will be provided by the system.
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 signal 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 RX Differential signal defined by the PCI Express M.2 spec
18	3.3V	3.3V source
19	PETp2	PCIe RX 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

Pin #	SATA Pin	Description
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	SMB_CLK (I/O)(0/1.8V)	SMBus Clock; Open Drain with pull-up on platform.
41	PETn0	PCIe TX Differential signal defined by the PCI Express M.2 spec
42	SMB_DATA (I/O)(0/1.8V)	SMBus Data; Open Drain with pull-up on platform.
43	PETp0	PCIe TX Differential signal defined by the PCI Express M.2 spec
44	ALERT#(O)(0/1.8V)	Alert notification to master; Open Drain with pull-up on platform; Active low.
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)(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 Sub-states.
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.

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Pin #	SATA Pin	Description
		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 M	Module Key
60	Module Key M	
61	Module Key M	
62	Module Key M	
63	Module Key M	
64	Module Key M	
65	Module Key M	
66	Module Key M	
67	N/C	No Connect
68	N/C	No Connect
69	N/C	PEDET (NC-PCIe). 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

## 6. SUPPORTED COMMANDS



### 6.1. NVMe Command List

**Table 6-1 Admin Commands**

Identifier	O/M	Command Description	Supported
00h	M	Delete I/O Submission Queue	Supported
01h	M	Create I/O Submission Queue	Supported
02h	M	Get Log Page	Supported
04h	M	Delete I/O Completion Queue	Supported
05h	M	Create I/O Completion Queue	Supported
06h	M	Identify	Supported
08h	M	Abort	Supported
09h	M	Set Features	Supported
0Ah	M	Get Features	Supported
0Ch	M	Asynchronous Event Request	Supported
10h	O	Firmware Commit	Supported
11h	O	Firmware Image Download	Supported
14h	O	Device Self-test	Not Supported
80h	O	Format NVM	Supported
81h	O	Security Send	Supported
82h	O	Security Receive	Supported
84h	O	Sanitize	Not Supported

**Table 6-2 I/O Commands**

Identifier	O/M	Command Description	Supported
00h	O	Flush	Supported
01h	O	Write	Supported
02h	O	Read	Supported
04h	O	Write Uncorrectable	Not Supported
05h	O	Compare	Supported
08h	O	Write Zeroes	Supported
09h	O	Dataset Management	Supported

**Table 6-3 Set Feature Commands**

Identifier	O/M	Command Description	Supported
00h		Reserved	
01h	M	Arbitration	Supported
02h	M	Power Management	Supported
03h	O	LBA Range Type	Not Supported
04h	M	Temperature Threshold	Supported
05h	M	Error Recovery	Supported
06h	O	Volatile Write Cache	Supported
07h	M	Number of Queues	Supported
08h	M	Interrupt Coalescing	Supported
09h	M	Interrupt Vector Configuration	Supported
0Ah	M	Write Atomicity Normal	Supported
0Bh	M	Asynchronous Event Configuration	Supported
0Ch	O	Autonomous Power State Transition	Supported
0Dh	O	Host Memory Buffer	Not Supported
0Eh	O	Timestamp	Supported
10h	O	Host Controlled Thermal Management	Supported
11h	O	Non-Operational Power State Config	Supported
0Eh – 7Dh		Reserved	
80h	O	Software Progress Marker	Supported

**Table 6-4 Get Log Page Commands**

Identifier	O/M	Command Description	Supported
00h		Reserved	
01h	M	Error Information	Supported
02h	M	SMART / Health Information	Supported
03h	M	Firmware Slot Information	Supported
04h	O	Changed Namespace List	Not Supported
06h	O	Device Self-test	Supported
09h – 7Fh		Reserved	
81h	O	Sanitize Status	Not Supported
82h - FFh		Reserved	

## 6.2. Identify Device Command

The following table details the sector data returned by the IDENTIFY DEVICE command.

**Table 6-5 Identify Controller Data Structure**

Bytes	O/M	Description	Default Value
01:00	M	PCI Vendor ID (VID)	0x1987
03:02	M	PCI Subsystem Vendor ID (SSVID)	0x1987
23:04	M	Serial Number (SN)	TBD
63:24	M	Model Number (MN)	TBD
71:64	M	Firmware Revision (FR)	TBD
72	M	Recommended Arbitration Burst (RAB)	0x01
75:73	M	IEEE OUI Identifier (IEEE)	TBD *
76	O	Controller Multi-Path I/O and Namespace Sharing Capabilities (CMIC)	0x00
77	M	Maximum Data Transfer Size (MDTS)	0x09
79:78	M	Controller ID (CNTLID)	0x0001
83:80	M	Version (VER)	0x00010400
87:84	M	RTD3 Resume Latency (RTD3R)	0x00989680
91:88	M	RTD3 Entry Latency (RTD3E)	0x00989680
95:92	M	Optional Asynchronous Events Supported (OAES)	0x00000200
99:96	M	Controller Attributes (CTRATT)	0x0002
101:100	O	Read Recovery Level support bitmap (RRLS)	0x00
110:102	-	Reserved	0x00
111	M	Controller Type, if support NVMe 1.4 shall be set to other than 0 (cntrltype)	0x01
127:112	O	FRU Globally Unique Identifier (FGUID[16])	0x00
129:128	O	Command Retry Delay Time 1 (CRDT1)	0x00
131:130	O	Command Retry Delay Time 2 (CRDT2)	0x00
133:132	O	Command Retry Delay Time 3 (CRDT3)	0x00
255:134	-	Reserved	0x00
257:256	M	Optional Admin Command Support (OACS)	0x0017
258	M	Abort Command Limit (ACL)	0x03
259	M	Asynchronous Event Request Limit (AERL)	0x03
260	M	Firmware Updates (FRMW)	0x12
261	M	Log Page Attributes (LPA)	0x08
262	M	Error Log Page Entries (ELPE)	0x3E

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Bytes	O/M	Description	Default Value
263	M	Number of Power States Support (NPSS)	0x04
264	M	Admin Vendor Specific Command Configuration (AVSCC)	0x01
265	O	Autonomous Power State Transition Attributes (APSTA)	0x01
267:266	M	Warning Composite Temperature Threshold (WCTEMP)	0x0157 (70C)
269:268	M	Critical Composite Temperature Threshold (CCTEMP)	0x017F (110C)
271:270	O	Maximum Time for Firmware Activation (MTFA)	0x0064
275:272	O	Host Memory Buffer Preferred Size (HMPRE)	0x00000000
279:276	O	Host Memory Buffer Minimum Size (HMMIN)	0x00000000
295:280	O	Total NVM Capacity (TNVMCAP)	**
311:296	O	Unallocated NVM Capacity (UNVMCAP)	0x00
315:312	O	Replay Protected Memory Block Support (RPMBS)	0x00
317:316	O	Extended Device Self-test Time (EDSTT)	0x000A
318	O	Device Self-test Options (DSTO)	0x00
319	M	Firmware Update Granularity (FWUG)	0x01
321:320	M	Keep Alive Support (KAS)	0x0000
323:322	O	Host Controlled Thermal Management Attributes (HCTMA)	0x0001
325:324	O	Minimum Thermal Management Temperature (MNTMT)	0x0111
327:326	O	Maximum Thermal Management Temperature (MXTMT)	0x0160
331:328	O	Sanitize Capabilities (SANICAP)	0x00
335:332	O	Host Memory Buffer Min. Descriptor Entry Size (hmminds)	0x00
337:336	O	Host Memory Maximum Descriptor Entries (hmmamd)	0x00
339:338	O	NVM Set ID Maximum (nsetidmax)	0x00
341:340	O	Endurance Group ID Maximum (endgidmax)	0x00
342	O	ANA Maximum Transition Time (anatt)	0x00
343	O	Asymmetric Namespace Access Capabilities (ANACAP)	0x00
347:344	O	ANA Group ID Maximum (anagrpmx)	0x00

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Bytes	O/M	Description	Default Value
351:348	O	Number of ANA Group IDs (nanagrpId)	0x00
355:352	O	Persistent Event Log Size (PELS)	0x00
511:356	-	Reserved	0x00
<b>NVM Command Set Attributes</b>			
512	M	Submission Queue Entry Size (SQES)	0x66
513	M	Completion Queue Entry Size (CQES)	0x44
515:514	M	Maximum Outstanding Commands (MAXCMD)	0x0200
519:516	M	Number of Namespaces (NN)	0x00000001
521:520	M	Optional NVM Command Support (ONCS)	0x005D
523:522	M	Fused Operation Support (FUSES)	0x0000
524	M	Format NVM Attributes (FNA)	0x00
525	M	Volatile Write Cache (VWC)	0x07
527:526	M	Atomic Write Unit Normal (AWUN)	0x00FF
529:528	M	Atomic Write Unit Power Fail (AWUPF)	0x0000
530	M	NVM Vendor Specific Command Configuration (NVSCC)	0x01
531	M	Namespace Write Protection Capabilities (NWPC)	0x00
533:532	O	Atomic Compare & Write Unit (ACWU)	0x0000
535:534	-	Reserved	0x0000
539:536	O	SGL Support (SGLS)	0x00000000
543:540	O	Maximum Number of Allowed Namespace, if supports ANA Reporting shall not be 0 and less than NN (MNAN)	0x00
767:544	-	Reserved	0x00
<b>IO Command Set Attributes</b>			
1023:768	M	NVM Subsystem NVMe Qualified Name (SUBNQN)	0x00
1791:1024	-	Reserved	0x00
2047:1792	-	Refer to the NVMe over Fabrics specification	0x00
2079:2048	M	Power State 0 Descriptor (PSD0)	0x0370
2111:2080	O	Power State 1 Descriptor (PSD1)	[2081:2080] 0x02C6 [2095:2092] 0x01010101
2143:2112	O	Power State 2 Descriptor (PSD2)	[2113:2112] 0x0208 [2127:2124] 0x02020202
2175:2144	O	Power State 3 Descriptor (PSD3)	[2149:2144] 0x000007D0000007D01100026C [2159:2156] 0X03030303

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Bytes	O/M	Description	Default Value
2207:2176	O	Power State 4 Descriptor (PSD4)	[2185:2176] 0x000061A8000061A8110001B8 [2191:2188] 0x04040404
2239:2208	O	Power State 5 Descriptor (PSD5)	0x00
2271:2240	O	Power State 6 Descriptor (PSD6)	0x00
2303:2272	O	Power State 7 Descriptor (PSD7)	0x00
2335:2304	O	Power State 8 Descriptor (PSD8)	0x00
2367:2336	O	Power State 9 Descriptor (PSD9)	0x00
2399:2368	O	Power State 10 Descriptor (PSD10)	0x00
2431:2400	O	Power State 11 Descriptor (PSD11)	0x00
2463:2432	O	Power State 12 Descriptor (PSD12)	0x00
2495:2464	O	Power State 13 Descriptor (PSD13)	0x00
2527:2496	O	Power State 14 Descriptor (PSD14)	0x00
2559:2528	O	Power State 15 Descriptor (PSD15)	0x00
2591:2560	O	Power State 16 Descriptor (PSD16)	0x00
2623:2592	O	Power State 17 Descriptor (PSD17)	0x00
2655:2624	O	Power State 18 Descriptor (PSD18)	0x00
2687:2656	O	Power State 19 Descriptor (PSD19)	0x00
2719:2688	O	Power State 20 Descriptor (PSD20)	0x00
2751:2720	O	Power State 21 Descriptor (PSD21)	0x00
2783:2752	O	Power State 22 Descriptor (PSD22)	0x00
2815:2784	O	Power State 23 Descriptor (PSD23)	0x00
2847:2816	O	Power State 24 Descriptor (PSD24)	0x00
2879:2848	O	Power State 25 Descriptor (PSD25)	0x00
2911:2880	O	Power State26 Descriptor (PSD26)	0x00
2943:2912	O	Power State 27 Descriptor (PSD27)	0x00
2975:2944	O	Power State 28 Descriptor (PSD28)	0x00
3007:2976	O	Power State 29 Descriptor (PSD29)	0x00
3039:3008	O	Power State 30 Descriptor (PSD30)	0x00
3071:3040	O	Power State 31 Descriptor (PSD31)	0x00
<b>Vendor Specific</b>			
4095:3072	O	Vendor Specific (VS)	Vendor Reserved

\* The OUI shall be a valid IEEE/RAC assigned identifier that may be registered at <http://standards.ieee.org/develop/regauth/oui/public.html>.

\*\* Depends on the using of capacity

**Table 6-6 Identify Namespace Data Structure & NVM Command Set Specific**

Bytes	O/M	Description	Default Value
7:0	M	Namespace Size (NSZE)	TBD*
15:8	M	Namespace Capacity (NCAP)	TBD*
23:16	M	Namespace Utilization (NUSE)	TBD*
24	M	Namespace Features (NSFEAT)	0x00
25	M	Number of LBA Formats (NLBAF)	0x01
26	M	Formatted LBA Size (FLBAS)	0x00
27	M	Metadata Capabilities (MC)	0x00
28	M	End-to-end Data Protection Capabilities (DPC)	0x00
29	M	End-to-end Data Protection Type Settings (DPS)	0x00
30	O	Namespace Multi-path I/O and Namespace Sharing Capabilities (NMIC)	0x00
31	O	Reservation Capabilities (RESCAP)	0x00
32	O	Format Progress Indicator (FPI)	0x00
33	O	Deallocate Logical Block Features (dlfeat)	0x09
35:34	O	Namespace Atomic Write Unit Normal (NAWUN)	0x0000
37:36	O	Namespace Atomic Write Unit Power Fail (NAWUPF)	0x0000
39:38	O	Namespace Atomic Compare & Write Unit (NACWU)	0x0000
41:40	O	Namespace Atomic Boundary Size Normal (NABSN)	0x0000
43:42	O	Namespace Atomic Boundary Offset (NABO)	0x0000
45:44	O	Namespace Atomic Boundary Size Power Fail (NABSPF)	0x0000
47:46	O	Namespace Optimal IO Boundary (NOIOB)	0x0000
63:48	O	NVM Capacity (NVMCAP)	500GB: 0x7470C06000 1000GB: 0xE8E0DB6000 2000GB: 0x01D1C1116000 4000GB: 0x03A3817D6000
65:64	O	Namespace Preferred Write Granularity (NPWG)	0x00
67:66	O	Namespace Preferred Write Alignment (NPWA)	0x00
69:68	O	Namespace Preferred Deallocation(Trim) Granularity (NPDG)	0x00
71:70	O	Namespace Preferred Deallocation(Trim) Alignment (NPDA)	0x00

Bytes	O/M	Description	Default Value
73:72	O	Namespace Optimal Write Size (NOWS)	0x00
91:74	-	Reserved	0x00
95:92	O	ANA Groput Identifier (anagrpId)	0x00
98:96	-	Reserved	0x00
99	O	Namespace Attributes (NSATTR)	0x00
101:100	O	NVM Set Identifier (nvmsetid)	0x00
103:102	O	Endurance Group Identifier // NVMe 1.4 add (endgid)	0x00
119:104	O	Namespace Globally Unique Identifier (NGUID)	TBD **
127:120	O	IEEE Extended Unique Identifier (EUI64)	TBD **
131:128	M	LBA Format 0 Support (LBAF0)	0x02090000
135:132	O	LBA Format 1 Support (LBAF1)	0x010C0000
139:136	O	LBA Format 2 Support (LBAF2)	0x00000000
143:140	O	LBA Format 3 Support (LBAF3)	0x00000000
147:144	O	LBA Format 4 Support (LBAF4)	0x00000000
151:148	O	LBA Format 5 Support (LBAF5)	0x00000000
155:152	O	LBA Format 6 Support (LBAF6)	0x00000000
159:156	O	LBA Format 7 Support (LBAF7)	0x00000000
163:160	O	LBA Format 8 Support (LBAF8)	0x00000000
167:164	O	LBA Format 9 Support (LBAF9)	0x00000000
171:168	O	LBA Format 10 Support (LBAF10)	0x00000000
175:172	O	LBA Format 11 Support (LBAF11)	0x00000000
179:176	O	LBA Format 12 Support (LBAF12)	0x00000000
183:180	O	LBA Format 13 Support (LBAF13)	0x00000000
187:184	O	LBA Format 14 Support (LBAF14)	0x00000000
191:188	O	LBA Format 15 Support (LBAF15)	0x00000000
383:192	-	Reserved	0x00
4095:384	O	Vendor Specific (VS)	0x00

\* See IDEMA SPEC

\*\* See IEEE EUI-64 SPEC

■ List of Identify Namespace Data Structure for Each Capacity

Capacity (GB)	Byte[7:0]: Namespace Size (NSZE)
500	3A386030h
512	3B9E12B0h
1000	74706DB0h
1024	773BD2B0h
2000	E8E088B0h
2048	EE7752B0h
4000	1D1C0BEB0h
4096	1DCEE52B0h
8000	3A3812AB0h
8192	3B9DC52B0h

## 6.3. SMART Attributes

### ■ SMART Attributes (Log Identifier 02h)

Bytes Index	Bytes	Description
[0]	1	Critical Warning
[2:1]	2	Composite Temperature
[3]	1	Available Spare
[4]	1	Available Spare Threshold
[5]	1	Percentage Used
[31:6]	26	Reserved
[47:32]	16	Data Units Read
[63:48]	16	Data Units Written
[79:64]	16	Host Read Commands
[95:80]	16	Host Write Commands
[111:96]	16	Controller Busy Time
[127:112]	16	Power Cycles
[143:128]	16	Power On Hours
[159:144]	16	Unsafe Shutdowns
[175:160]	16	Media and Data Integrity Errors
[191:176]	16	Number of Error Information Log Entries
[195:192]	4	Warning Composite Temperature Time
[199:196]	4	Critical Composite Temperature Time
[201:200]	2	Temperature Sensor 1 (Current Temperature)
[203:202]	2	Temperature Sensor 2 (N/A)
[205:204]	2	Temperature Sensor 3 (N/A)
[207:206]	2	Temperature Sensor 4 (N/A)
[209:208]	2	Temperature Sensor 5 (N/A)
[211:210]	2	Temperature Sensor 6 (N/A)
[213:212]	2	Temperature Sensor 7 (N/A)
[215:214]	2	Temperature Sensor 8 (N/A)
[511:216]	296	Reserved

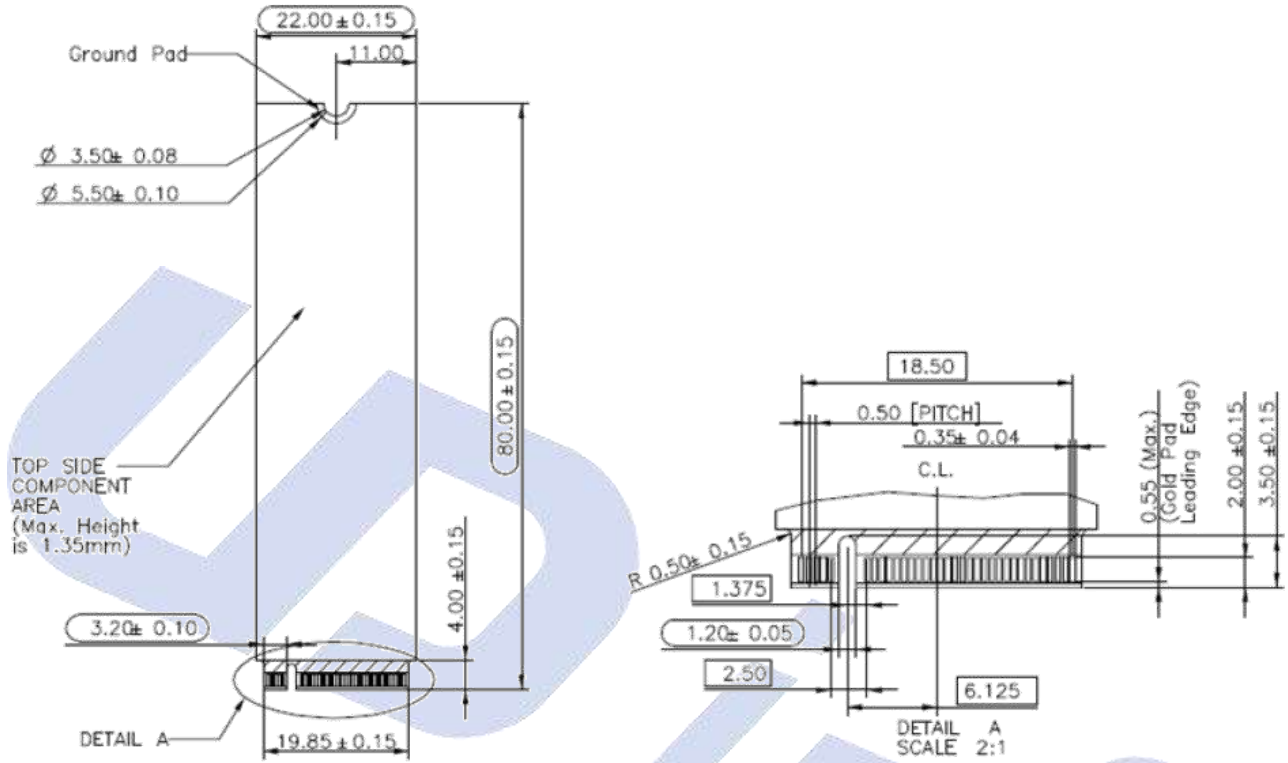


## 7. PHYSICAL DIMENSION

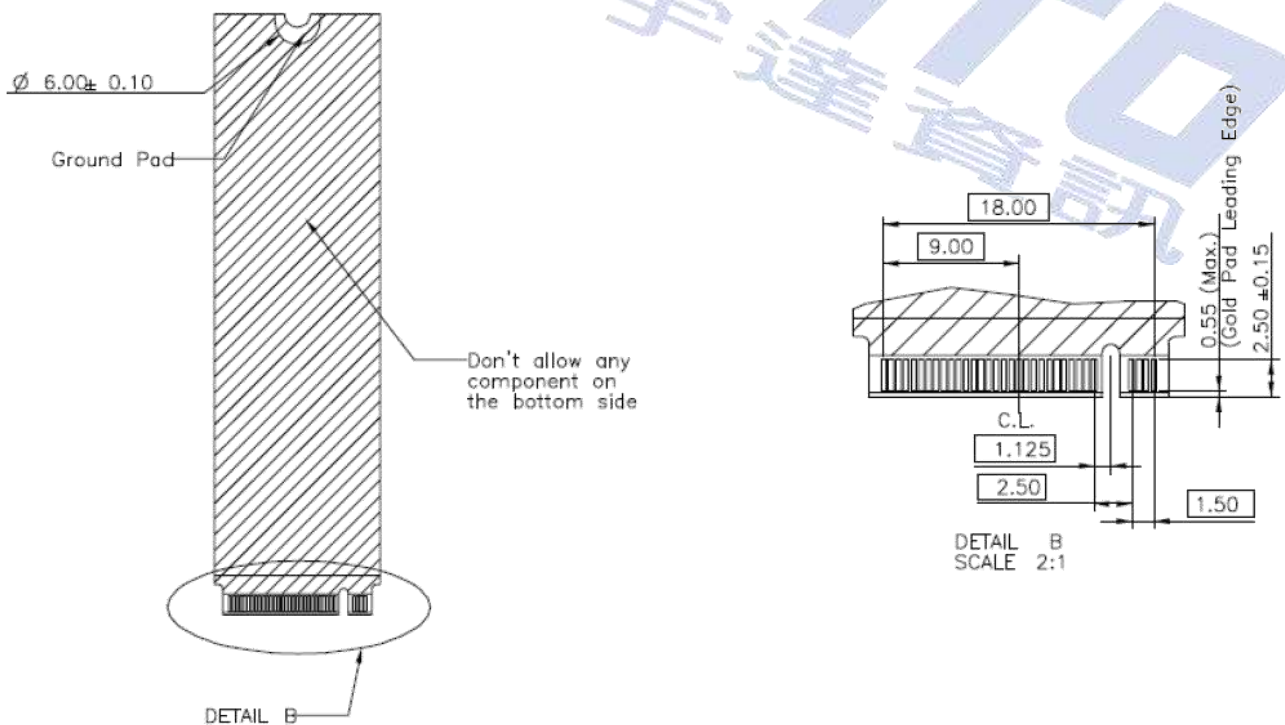
- Dimension of M.2 2280-S2-M: 80mm(L) x 22mm(W) x 2.15mm(H)

Top View

Unit : mm



Bottom View

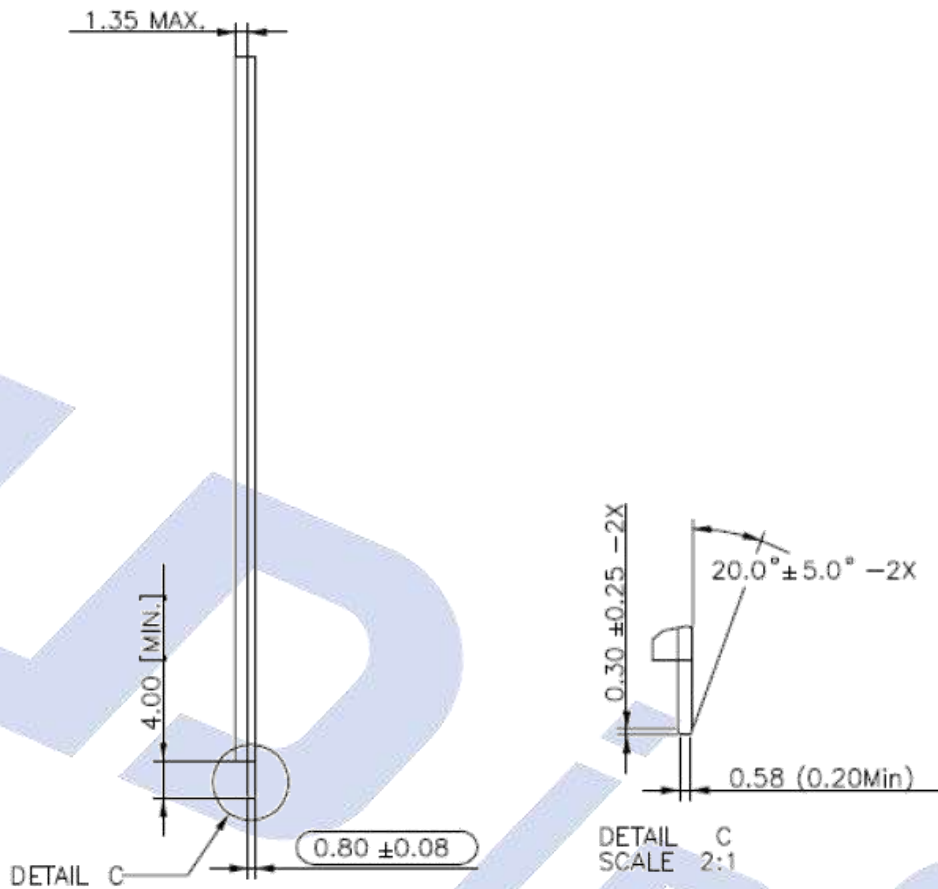


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**Side View**



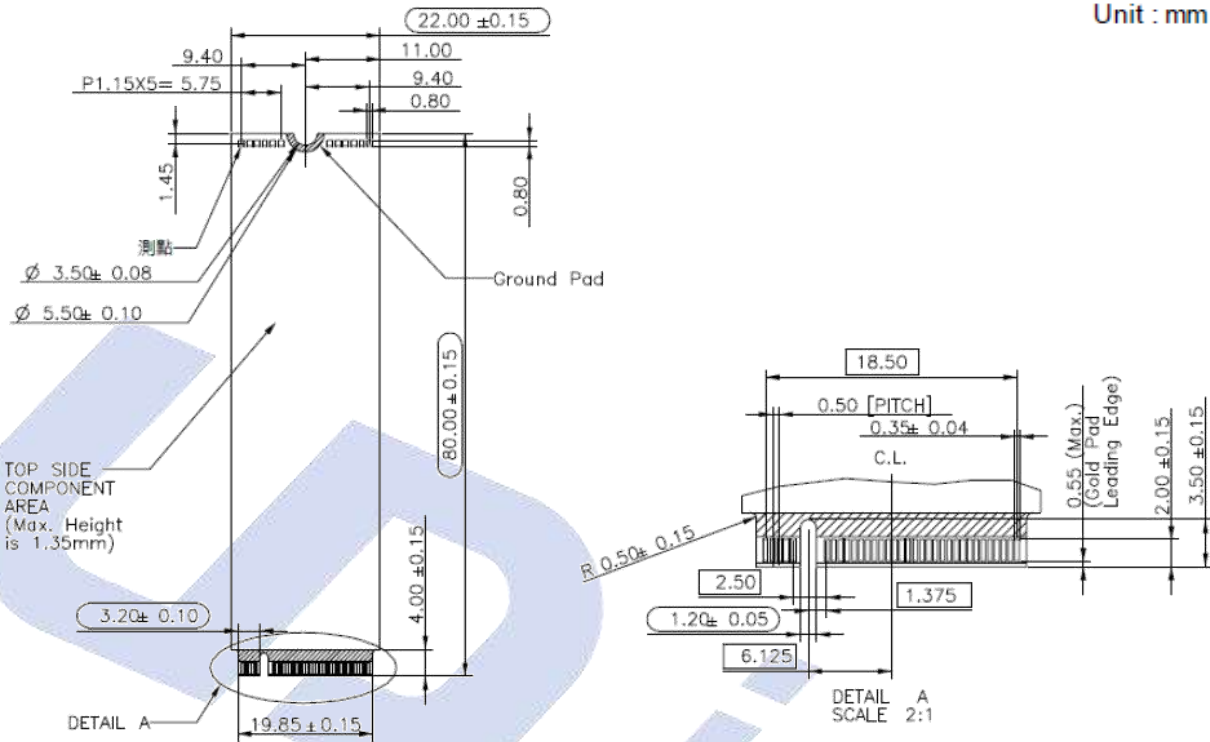
**\*Notes:**

1. General Tolerance: ±0.15mm
2.  is IQC inspection dimension

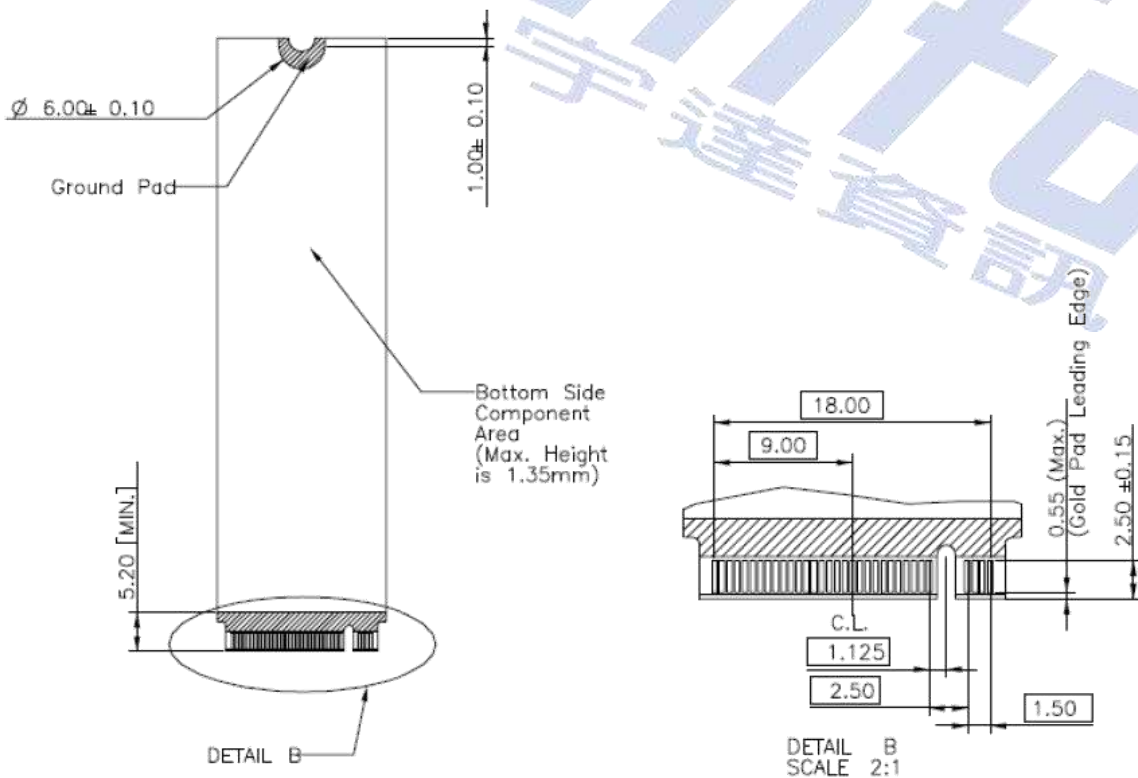
- Dimension of M.2 2280-D2-M: 80mm(L) x 22mm(W) x 3.5mm(H)

**Top View**

Unit : mm



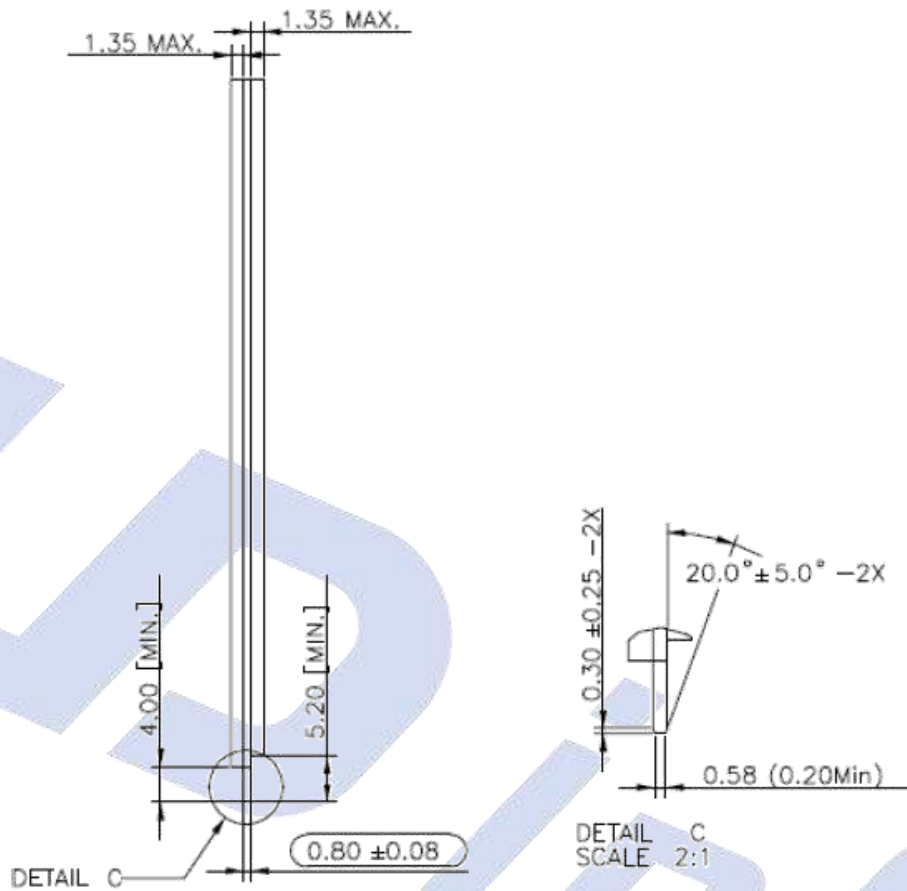
**Bottom View**




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**Side View**



**\*Notes:**

1. General Tolerance:  $\pm 0.15\text{mm}$
2.  is IQC inspection dimension

## 8. TERMINOLOGY



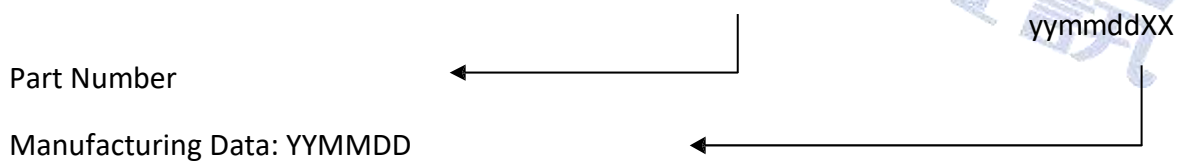
The following table is to list out the acronyms that have been applied throughout the document.

Term	Definitions
DDR	Double data rate (SDRAM)
ASPM	Active States Power Management
APST	Autonomous Power State Transition
LBA	Logical block addressing
MTBF	Mean time between failures
PCIe	PCI Express / Peripheral Component Interconnect Express
S.M.A.R.T.	Self-monitoring, analysis and reporting technology

## 9. BARCODE DESCRIPTION



M 2 P 8 0 D G 9 6 0 G B A F P



## 10. PARTNUMBER DECODER



M2P-80DGX<sup>8</sup>X<sup>9</sup>X<sup>10</sup>X<sup>11</sup>X<sup>12</sup>X<sup>13</sup>X<sup>14</sup>X<sup>15</sup>X<sup>16</sup>X<sup>17</sup>

X <sup>1</sup> X <sup>2</sup> X <sup>3</sup>	X <sup>4</sup> X <sup>5</sup>	X <sup>6</sup> X <sup>7</sup>	X <sup>8</sup> X <sup>9</sup> X <sup>10</sup> X <sup>11</sup> X <sup>12</sup>	X <sup>13</sup>	X <sup>14</sup>	X <sup>15</sup>	X <sup>16</sup> X <sup>17</sup>
M2P	80	DG	500GB 1000G 2000G 4000G 8000G	512GB 001TB 002TB 004TB 008TB	A: 3D TLC Standard (0°C ~ +70°C)	F	P blank

