

Amtron Technology, Inc.

Industrial Grade M.2 2280 PCIe SSD

AF Series

Product Datasheet

V1.1

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1. INTRODUCTION



1.1. Description

Amtron industrial AF series M.2 2280 PCIe SSD is designed with PCIe Gen3 x4 interface and is fully compliant with the standard Next Generation Form Factor (NGFF). It can reach up to 2100 MB/s read and 1600 MB/s write high performance. These M.2 PCIe modules are offered in standard temperature grade (0°C to +70°C) and wide temperature grade (-40°C to +85°C). The memory capacities are available from 120GB to 960GB.

1.2. Product Features

- M.2 2280-D2-M form factor
- PCI Express Base Version 3.1 and Compliant with NVMe 1.3
- PCIe Gen3 x 4 lane & backward compatible to PCIe Gen2 and Gen1
- RoHS compliant [Lead free]
- 3D Triple Level Cell (TLC) NAND Flash
- Capacity from 120GB up to 960GB
- High speed:
Read 2,100 MB/s max., Write 1,600 MB/s max.
- Endure severe thermal and dynamic environments
- Very low power consumption
- MTBF > 2,000,000 hours *
- Support SMART and TRIM Command
- Controlled Bill of Materials (BOM)

***Note:** Lower MTBF is expected for higher capacity drives. To be conservative, the lowest MTBF is reported in this document

1.3. Product Overview

- **PCIe Interface**
 - NVMe PCIe Gen3 x4
- **Form Factor**
 - M.2 2280-D2-M
- **Compliance**
 - NVMe 1.3
 - PCI Express Base 3.1
- **Capacity**
 - 120GB up to 960GB
- **Flash Interface**
 - Flash Type: 3D NAND
 - Transfer rate up to 667 MT/s
 - Up to 4 pcs of BGA152 flash
- **Performance**
 - Read up to 2,100 MB/s
 - Write up to 1,600 MB/s
- **Reliability**
 - MTBF ¹ > 2,000,000 hours
 - Uncorrectable Bit Error Rate(UBER) < 1 sector per 10¹⁶ bits read
- **Power Consumption ²**
 - Idle mode: < 1700mW
- **Advanced Flash Management**
 - Advanced Wear Leveling
 - Bad Block Management
 - TRIM
 - SMART
 - Over-Provision
- **Temperature Range**
 - Operation (standard): 0°C to 70°C
 - Operation (wide): -40°C to 85°C
 - Storage: -40°C to 85°C
- **Features Support List**
 - End to end data path protection
 - LDPC ECC engine
 - RAID ECC engine
 - Built-in AES256 encryption
 - Support of TCG OPAL 2.0
 - Built-in hardware SHA256 and True Random Number Generator (TRNG)
- **Compliant**
 - RoHS

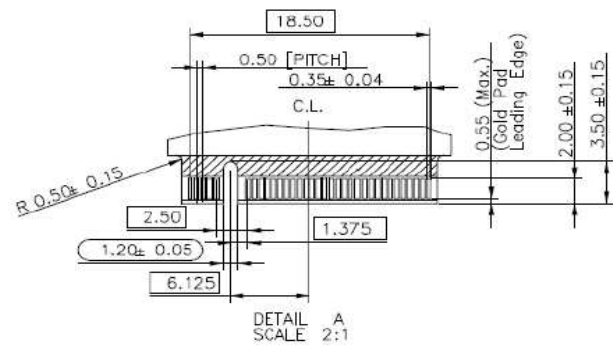
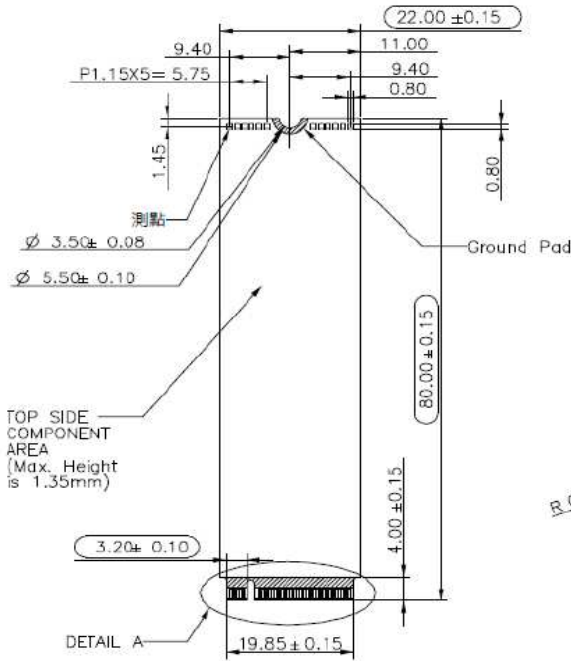
Note:

1. **MTBF** (mean time between failures) is a measure of how reliable a hardware product is. Its value represents the average time between a failure repair and the next failure. The unit of MTBF is typically in hours. The higher the MTBF value, the higher the reliability of the product. Please note that a lower MTBF is expected for higher capacity drives. To be conservative, the lowest MTBF is reported in this document.
2. See Section 4.2 “Power Consumption” for details.

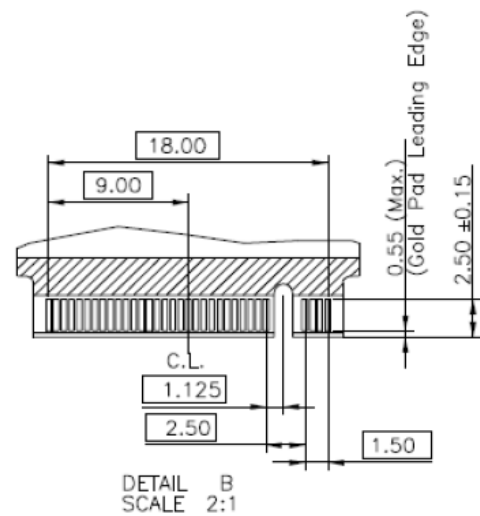
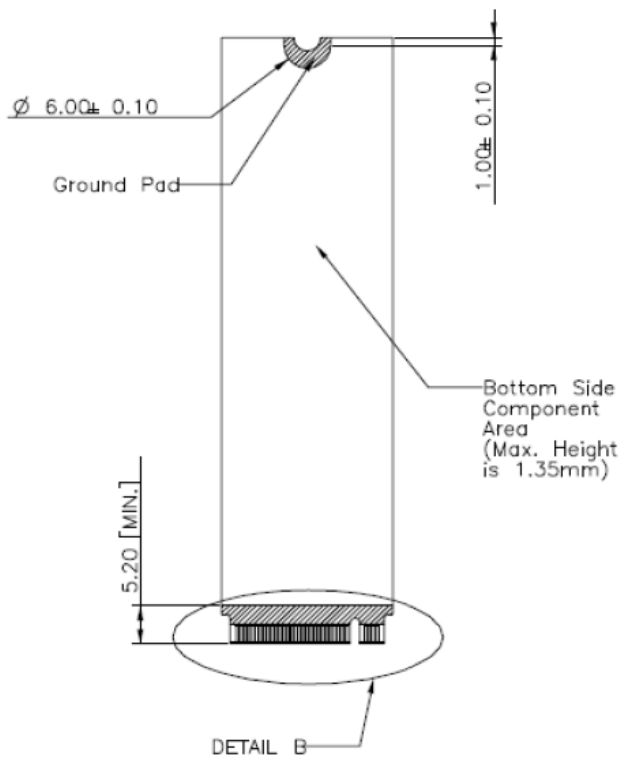
1.4. Product Dimension

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

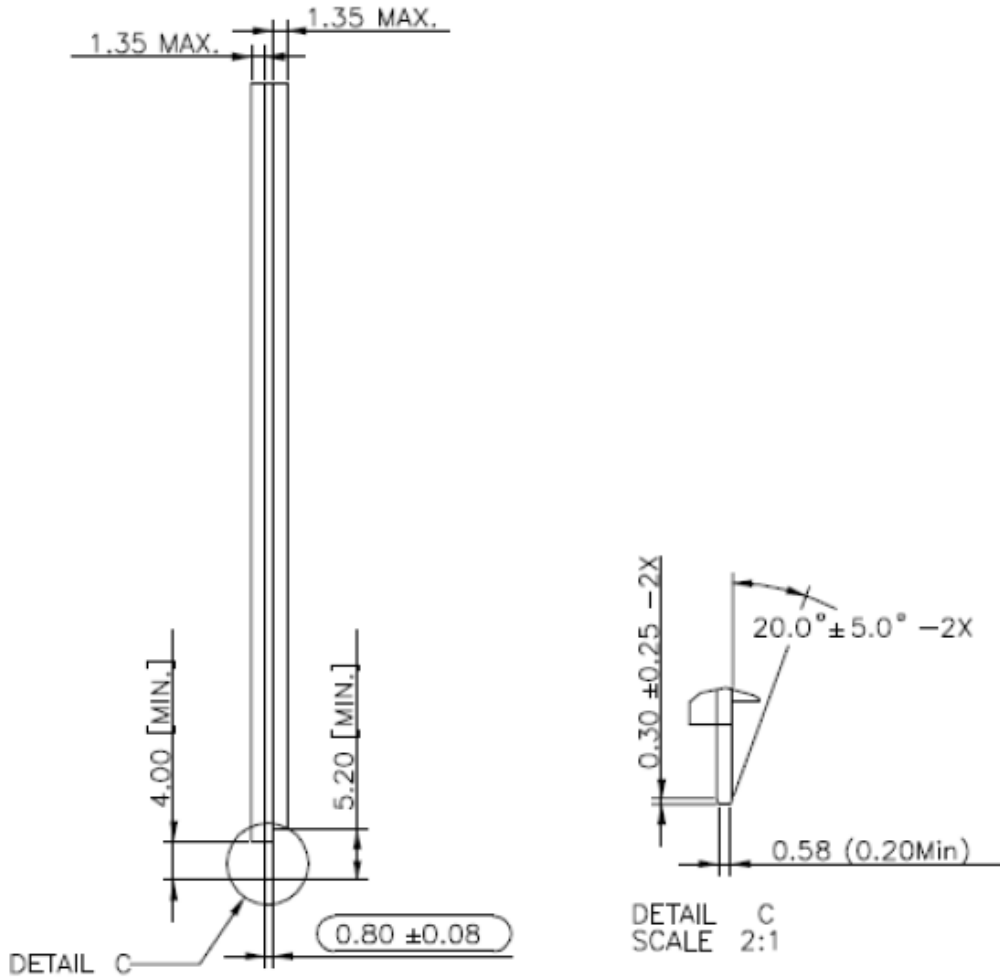
Unit : mm



Top View







Bottom View

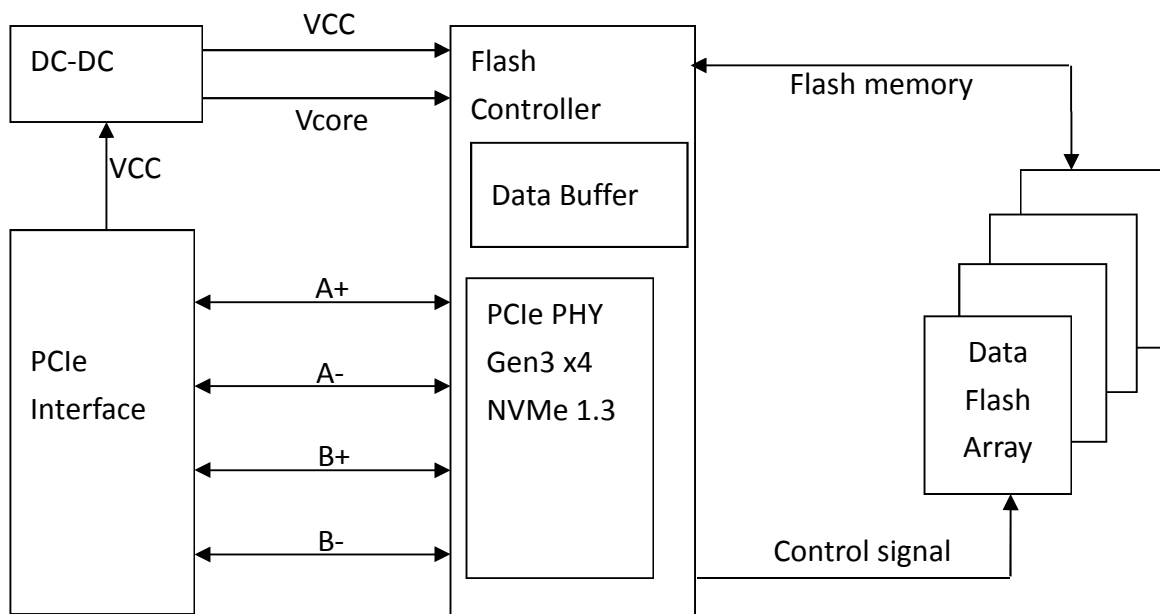


Side View

***Notes:**

1.  =Max Component Height
2.  =No Component
3.  =No Component / Signal Vias / Signal Copper / Printing
4. General Tolerance: ±0.15mm
5.  is IQC inspection dimension

1.5. Block Diagram



M.2 2280 PCIe SSD Block Diagram

2. PRODUCT SPECIFICATIONS



2.1. Specifications

- **Capacity**
 - 120GB up to 960GB
- **Electrical/Physical Interface**
 - PCI Express Base Ver 3.1
 - Compliant with NVMe 1.3
 - PCIe Gen3 x 4 lane & backward compatible to PCIe Gen2 and Gen1
 - Support power management
- **Supported NAND Flash**
 - Support ONFI 3.0/4.0 and Toggle 3.0/2.0 interface, frequency up to 667 MT/s
 - Support up to 4pcs of BGA132/152 flash (M.2 2280-D2)
- **Data Reliability**
 - Applies LDPC of ECC algorithm
 - End-to-end data path protection with CRC parity (512Byte + 2Byte)
 - SECDED^{Note1} SRAM ECC error handling and prevention on major memory buffers
 - RAID engine provides multi-page protection for NAND flash data
- **Data Integrity and Security^{Note2}**
 - Built-in AES-128/256 Encryption
 - TCG Opal 2.0 compliant
 - Built-in hardware SHA256 and True Random Number Generator (TRNG)
- **Power Management**
 - Supports different power states (PS0, PS1, PS2, PS3, PS4)
 - PS4 power consumption under 2mW
 - Thermal throttling is supported with configurable temperatures
- **Peripherals**
 - UART interface for debugging
 - Two temperature sensors at different locations on chip

Notes:

1. Single error correcting, double error detecting.
2. The functions will be activated by specific firmware versions.

- LBA Range
 - IDEMA standard

Capacity	Total Sectors (LBA)	User Data Size
120GB	234,441,648	Depended on file management
240GB	468,862,128	
480GB	937,703,088	
960GB	1,875,385,008	

- Performance

Capacity	Flash Structure	Flash Type	Sequential	
			Read (MB/s)	Write (MB/s)
120GB	64GB x 2	BGA, BiCS4, 256Gb DDP	2,000	550
240GB	128GB x 2	BGA, BiCS4, 512Gb DDP	2,000	490
480GB	256GB x 2	BGA, BiCS4, 512Gb QDP	2,100	860
960GB	256GB x 4	BGA, BiCS4, 512Gb QDP	2,100	1,600
120GB	64GB x 2	BGA, B17A, 512Gb SDP	950	500
240GB	128GB x 2	BGA, B17A, 512Gb DDP	1,900	1,000
480GB	128GB x 4	BGA, B17A, 512Gb DDP	2,100	1,500
960GB	256GB x 4	BGA, B17A, 512Gb QDP	2,100	1,600

Notes:

1. Performance may differ according to flash configuration and platform.
2. The table above is for reference only. Any criteria for accepting goods shall be discussed based on different flash configurations.
3. Performance is measured with the follow conditions
 - (a) CrystalDiskMark 6.0, 1GB range, QD=32, Thread=1

- **TBW (Terabytes Written)**

Capacity	Flash Type	TBW
120GB	BiCS4, BGA	111
240GB	BiCS4, BGA	220
480GB	BiCS4, BGA	439
960GB	BiCS4, BGA	878
120GB	B17A, BGA	88
240GB	B17A, BGA	176
480GB	B17A, BGA	352
960GB	B17A, BGA	704

Notes:

1. TBW may differ according to flash configuration and platform.
2. 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.

2.2. MTBF

MTBF (mean time between failures) is a measure of how reliable a hardware product is. Its value represents the average time between a failure repair and the next failure. The unit of MTBF is typically in hours. The higher the MTBF value, the higher the reliability of the product. Please note that a lower MTBF is expected for higher capacity drives. To be conservative, the lowest MTBF is reported in this document. The MTBF calculated in this document is based on a software tool, Relx 7.3 . The predicted MTBF for Amtron AF series M.2 PCIe SSD is >2,000,000 hours

3. ENVIRONMENTAL SPECIFICATIONS



3.1. Environmental Conditions

3.1.1. Temperature and Humidity

- ◆ Operational (Standard grade): 0°C to 70°C
- ◆ Operational (Wide grade): -40°C to 85°C
- ◆ Storage: -40°C to 85°C

■ High Temperature Test Condition

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

■ Low Temperature Test Condition

	Temperature	Humidity
Operation	0°C/-40°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/-40°C
	70°C/85°C
Storage	-40°C
	85°C

Notes:

1. Operation temperature shows in case temperature not ambient temperature.

3.1.2. Shock

■ Shock Specification

	Acceleration Force
Non-Operational	1500G
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. 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.

3.1.7. 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. Certification & Compliance

- RoHS

4. ELECTRICAL SPECIFICATIONS



4.1. Supply Voltage

Parameter	Rating
Operating Voltage	Min = 3.14V Max = 3.47V

4.2. Power Consumption

Capacity	Flash Structure	Flash Type	CE#	Read (Max.)	Write (Max.)	Idle (Max.)
120GB	64GB x 2	BGA, BiCS4, 256Gb DDP	4	3,100	2,200	1,000
240GB	128GB x 2	BGA, BiCS4, 512Gb DDP	4	4,000	2,800	1,200
480GB	256GB x 2	BGA, BiCS4, 512Gb QDP	8	4,200	3,100	1,100
960GB	256GB x 4	BGA, BiCS4, 512Gb QDP	16	4,200	3,100	1,700
120GB	64GB x 2	BGA, B17A, 512Gb SDP	2	2,000	1,900	600
240GB	128GB x 2	BGA, B17A, 512Gb DDP	4	2,800	2,500	600
480GB	128GB x 4	BGA, B17A, 512Gb DDP	8	2,900	3,000	600
960GB	256GB x 4	BGA, B17A, 512Gb QDP	16	2,900	3,100	600

Unit: mW

Notes

1. Use CrystalDiskMark 6.0 with the setting of 1000MB. Sequentially read and write the disk for 3 times, and measure power consumption during sequential Read [1/5]~[5/5] or sequential Write [1/5]~[5/5].
2. Power Consumption may differ according to flash configuration and platform.
3. The measured power voltage is 3.3V.

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
28	N/C	No connect

Pin #	SATA Pin	Description
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	NC	No connect
41	PETn0	PCIe TX Differential signal defined by the PCI Express M.2 spec
42	NC	No connect
43	PETp0	PCIe TX Differential signal defined by the PCI Express M.2 spec
44	NC	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)(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	NC	No connect
55	REFCLKp	PCIe Reference Clock signals (100 MHz) defined by the PCI Express M.2 spec.
56	NC	No connect
57	GND	Ground
58	NC	No connect
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

Op-Code	O/M	Command Description
00h	M	Delete I/O Submission Queue
01h	M	Create I/O Submission Queue
02h	M	Get Log Page
04h	M	Delete I/O Completion Queue
05h	M	Create I/O Completion Queue
06h	M	Identify
08h	M	Abort
09h	M	Set Features
0Ah	M	Get Features
0Ch	M	Asynchronous Event Request
10h	O	Firmware Activate
11h	O	Firmware Image Download
14h	O	Device Self-test
80h	O	Format NVM
81h	O	Security Send
82h	O	Security Receive
84h	O	Sanitize

Table 6-2 I/O Commands

Op-Code	O/M	Command Description
00h	O	Flush
01h	O	Write
02h	O	Read
04h	O	Write Uncorrectable
05h	O	Compare
08h	O	Write Zeroes
09h	O	Dataset Management

Table 6-3 Set Feature Commands

Op-Code	O/M	Command Description
00h		Reserved
01h	M	Arbitration
02h	M	Power Management
03h	O	LBA Range Type
04h	M	Temperature Threshold
05h	M	Error Recovery
06h	O	Volatile Write Cache
07h	M	Number of Queues
08h	M	Interrupt Coalescing
09h	M	Interrupt Vector Configuration
0Ah	M	Write Atomicity Normal
0Bh	M	Asynchronous Event Configuration
0Ch	O	Autonomous Power State Transition
0Dh	O	Host Memory Buffer
0Eh	O	Timestamp
10h	O	Host Controlled Thermal Management
11h	O	Non-Operational Power State Config
0Eh – 7Dh		Reserved
80h	O	Software Progress Marker

Table 6-4 Get Log Page Commands

Op-Code	O/M	Command Description
00h		Reserved
01h	M	Error Information
02h	M	SMART / Health Information
03h	M	Firmware Slot Information
04h	O	Changed Namespace List
06h	O	Device Self-test
09h – 7Fh		Reserved
81h	O	Sanitize Status
82h - FFh		Reserved

6.2. Identify Device Data

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

■ Identify Controller Data Structure

Bytes	O/M	Default Value	Description
01:00	M	0x1987	PCI Vendor ID (VID)
03:02	M	0x1987	PCI Subsystem Vendor ID (SSVID)
23:04	M	TBD	Serial Number (SN)
63:24	M	TBD	Model Number (MN)
71:64	M	TBD	Firmware Revision (FR)
72	M	0x01	Recommended Arbitration Burst (RAB)
75:73	M	TBD *	IEEE OUI Identifier (IEEE)
76	O	0x00	Controller Multi-Path I/O and Namespace Sharing Capabilities (CMIC)
77	M	0x09	Maximum Data Transfer Size (MDTS)
79:78	M	0x0001	Controller ID (CNTLID)
83:80	M	0x00010300	Version (VER)
87:84	M	0x001E8480(2sec)	RTD3 Resume Latency (RTD3R)
91:88	M	0x00989680(10sec)	RTD3 Entry Latency (RTD3E)
95:92	M	0x00000300	Optional Asynchronous Events Supported (OAES)
99:96	M	0x0002	Controller Attributes (CTRATT)
239:100	-	0x00	Reserved
255:240	-	0x00	Refer to the NVMe Management Interface Specification for definition
257:256	M	0x0017	Optional Admin Command Support (OACS)
258	M	0x03	Abort Command Limit (ACL)
259	M	0x03	Asynchronous Event Request Limit (AERL)
260	M	0x1F	Firmware Updates (FRMW)
261	M	0x0C	Log Page Attributes (LPA)
262	M	0x3E	Error Log Page Entries (ELPE)
263	M	4	Number of Power States Support (NPSS)
264	M	0x01	Admin Vendor Specific Command Configuration (AVSCC)
265	O	0x01	Autonomous Power State Transition Attributes (APSTA)
267:266	M	0x0157 (70C)	Warning Composite Temperature Threshold (WCTEMP)
269:268	M	0x0161 (80C)	Critical Composite Temperature Threshold (CCTEMP)
271:270	O	0x0000 (No report)	Maximum Time for Firmware Activation (MTFA)
275:272	O	0x00000000	Host Memory Buffer Preferred Size (HMPRE)
279:276	O	0x00000000	Host Memory Buffer Minimum Size (HMMIN)

Bytes	O/M	Default Value	Description
295:280	O	**	Total NVM Capacity (TNVMCAP)
311:296	O	**	Unallocated NVM Capacity (UNVMCAP)
315:312	O	0x00000000	Replay Protected Memory Block Support (RPMBS)
511:316	-	Non-zero	Reserved
NVM Command Set Attributes			
512	M	0x66	Submission Queue Entry Size (SQES)
513	M	0x44	Completion Queue Entry Size (CQES)
515:514	-	0x0000	Reserved
519:516	M	0x00000001	Number of Namespaces (NN)
521:520	M	0x001F	Optional NVM Command Support (ONCS)
523:522	M	0x0000	Fused Operation Support (FUSES)
524	M	0x00	Format NVM Attributes (FNA)
525	M	0x01	Volatile Write Cache (VWC)
527:526	M	TBD	Atomic Write Unit Normal (AWUN)
529:528	M	TBD	Atomic Write Unit Power Fail (AWUPF)
530	M	0x01	NVM Vendor Specific Command Configuration (NVSCC)
531	-	0x00	Reserved
533:532	O	0x0000	Atomic Compare & Write Unit (ACWU)
535:534	-	0x0000	Reserved
539:536	O	0x00000000	SGL Support (SGLS)
703:540	-	0x00	Reserved
IO Command Set Attributes			
2047:704	-	0x00	Reserved
2079:2048	M	TBD	Power State 0 Descriptor (PSD0)
2111:2080	O	0x00	Power State 1 Descriptor (PSD1)
2143:2112	O	0x00	Power State 2 Descriptor (PSD2)
2175:2144	O	0x00	Power State 3 Descriptor (PSD3)
2207:2176	O	0x00	Power State 4 Descriptor (PSD4)
2239:2208	O	0x00	Power State 5 Descriptor (PSD5)
2271:2240	O	0x00	Power State 6 Descriptor (PSD6)
2303:2272	O	0x00	Power State 7 Descriptor (PSD7)
2335:2304	O	0x00	Power State 8 Descriptor (PSD8)
2367:2336	O	0x00	Power State 9 Descriptor (PSD9)
2399:2368	O	0x00	Power State 10 Descriptor (PSD10)
2431:2400	O	0x00	Power State 11 Descriptor (PSD11)

Bytes	O/M	Default Value	Description
2463:2432	O	0x00	Power State 12 Descriptor (PSD12)
2495:2464	O	0x00	Power State 13 Descriptor (PSD13)
2527:2496	O	0x00	Power State 14 Descriptor (PSD14)
2559:2528	O	0x00	Power State 15 Descriptor (PSD15)
2591:2560	O	0x00	Power State 16 Descriptor (PSD16)
2623:2592	O	0x00	Power State 17 Descriptor (PSD17)
2655:2624	O	0x00	Power State 18 Descriptor (PSD18)
2687:2656	O	0x00	Power State 19 Descriptor (PSD19)
2719:2688	O	0x00	Power State 20 Descriptor (PSD20)
2751:2720	O	0x00	Power State 21 Descriptor (PSD21)
2783:2752	O	0x00	Power State 22 Descriptor (PSD22)
2815:2784	O	0x00	Power State 23 Descriptor (PSD23)
2847:2816	O	0x00	Power State 24 Descriptor (PSD24)
2879:2848	O	0x00	Power State 25 Descriptor (PSD25)
2911:2880	O	0x00	Power State 26 Descriptor (PSD26)
2943:2912	O	0x00	Power State 27 Descriptor (PSD27)
2975:2944	O	0x00	Power State 28 Descriptor (PSD28)
3007:2976	O	0x00	Power State 29 Descriptor (PSD29)
3039:3008	O	0x00	Power State 30 Descriptor (PSD30)
3071:3040	O	0x00	Power State 31 Descriptor (PSD31)
Vendor Specific			
4095:3072	O	Vendor Reserved	Vendor Specific (VS)

* 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

■ Identify Namespace Data Structure & NVM Command Set Specific

Bytes	O/M	Default Value	Description
7:0	M	TBD*	Namespace Size (NSZE)
15:8	M	TBD*	Namespace Capacity (NCAP)
23:16	M	TBD*	Namespace Utilization (NUSE)
24	M	0x00	Namespace Features (NSFEAT)
25	M	0x01	Number of LBA Formats (NLBAF)
26	M	0x00	Formatted LBA Size (FLBAS)
27	M	0x00	Metadata Capabilities (MC)
28	M	0x00	End-to-end Data Protection Capabilities (DPC)
29	M	0x00	End-to-end Data Protection Type Settings (DPS)
30	O	0x00	Namespace Multi-path I/O and Namespace Sharing Capabilities (NMIC)
31	O	0x00	Reservation Capabilities (RESCAP)
32	O	0x00	Format Progress Indicator (FPI)
33	-	0x00	Reserved
35:34	O	0x0000	Namespace Atomic Write Unit Normal (NAWUN)
37:36	O	0x0000	Namespace Atomic Write Unit Power Fail (NAWUPF)
39:38	O	0x0000	Namespace Atomic Compare & Write Unit (NACWU)
41:40	O	0x0000	Namespace Atomic Boundary Size Normal (NABSN)
43:42	O	0x0000	Namespace Atomic Boundary Offset (NABO)
45:44	O	0x0000	Namespace Atomic Boundary Size Power Fail (NABSPF)
47:46	-	0x0000	Reserved
63:48	O	0x00	NVM Capacity (NVMCAP)
103:64	-	0x00	Reserved
119:104	O	TBD **	Namespace Globally Unique Identifier (NGUID)
127:120	O	TBD **	IEEE Extended Unique Identifier (EUI64)
131:128	M	0x02090000	LBA Format 0 Support (LBAF0)
135:132	O	0x00000000	LBA Format 1 Support (LBAF1)
139:136	O	0x00000000	LBA Format 2 Support (LBAF2)
143:140	O	0x00000000	LBA Format 3 Support (LBAF3)
147:144	O	0x00000000	LBA Format 4 Support (LBAF4)
151:148	O	0x00000000	LBA Format 5 Support (LBAF5)
155:152	O	0x00000000	LBA Format 6 Support (LBAF6)
159:156	O	0x00000000	LBA Format 7 Support (LBAF7)
163:160	O	0x00000000	LBA Format 8 Support (LBAF8)
167:164	O	0x00000000	LBA Format 9 Support (LBAF9)

Bytes	O/M	Default Value	Description
171:168	O	0x00000000	LBA Format 10 Support (LBAF10)
175:172	O	0x00000000	LBA Format 11 Support (LBAF11)
179:176	O	0x00000000	LBA Format 12 Support (LBAF12)
183:180	O	0x00000000	LBA Format 13 Support (LBAF13)
187:184	O	0x00000000	LBA Format 14 Support (LBAF14)
191:188	O	0x00000000	LBA Format 15 Support (LBAF15)
383:192	-	0x00	Reserved
4095:384	O	0x00	Vendor Specific (VS)

* 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)
120	DF94BB0h
240	1BF244B0h
480	37E436B0h
960	6FC81AB0h

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. ACRONYMS



Acronym	Definition
AES	Advanced Encryption Standard
ATTO	Commercial performance benchmark application
DDR	Double Data Rate (SDRAM)
ASPM	Active States Power Management
APST	Autonomous Power State Transition
LBA	Logical Block Addressing
MTBF	Mean Time Between Failures
NVMe	Non-Volatile Memory Express
OPAL	Open Physics Abstraction Layer
PCIe	PCI Express / Peripheral Component Interconnect Express
PSID	Physical Security ID
SMART	Self-Monitoring, Analysis and Reporting Technology
TLC	Tipple Level Cell

8. PART NUMBER DECODER



M2P80-AFX¹X²X³X⁴X⁵X⁶X⁷

Item	Series	Capacity	NAND Flash & Temperature Grade	Option
		X¹ X² X³ X⁴	X⁵	X⁶ X⁷
M2P80	AF	120G (120GB) 240G (240GB) 480G (480GB) 960G (960GB)	A : 3D TLC , Standard (0°C to +70°C) B : 3D TLC , Wide (-40°C to +85°C)	See below
<p>X⁶ X⁷ (Reserved for specific requirement)</p> <p>Blank: Standard</p>				