DELKIN DEVICES®

M.2 2280
PCIe Industrial
Solid State Drive

Engineering Specification

Document Number: 401-0578-00

Revision: A

Product Overview

- **Capacity**
  - 128GB up to 2TB
- **Form Factor**
  - M.2 2280 S2- M
- **PCIe Interface**
  - NVMe PCIe Gen 3 x 4
- **Compliance**
  - NVMe 1.3d
  - PCI Express Base 3.1
- **Flash Interface**
  - Flash type: 3D TLC
- **Performance[1]**
  - Read: up to 2450 MB/s
  - Write: up to 1900 MB/s
- **Reliability**
  - Mean Time Between Failure (MTBF) More than 2,000,000 hrs
  - Uncorrectable Bit Error Rate (UBER) < 1 sector per 10^{16} bits read
  - DWPD ≥ 0.4
- **ECC Performance**
  - LDPC/ RAID ECC
  - Low density parity check code (>120bit/K Bytes)
- **Power Consumption[3]**
  - Power supply of M.2 SSD: DC+3.3V±5%
  - Active Write (Typ.) < 4,000 mW
  - Active Read (Typ.) < 4,000 mW
  - Idle mode: < 1,500 mW
- **RoHS compliant**
- **Features Support List:**
  - Dynamic SLC Cache
  - Support AES/TCG OPAL Note3
  - Secure Erase
  - Bad Block Management
  - TRIM
  - SMART
- **Temperature Range[2]**
  - Operation: -40°C ~ 85°C
  - Storage: -40°C ~ 85°C

Notes:

1. Refer to Chapter 2 for more details.
2. Temperature is measured by SMART temperature. Active airflow is recommended within the system for maintaining proper device operating temperature on heavier workloads.
3. Supported by a separate firmware version.

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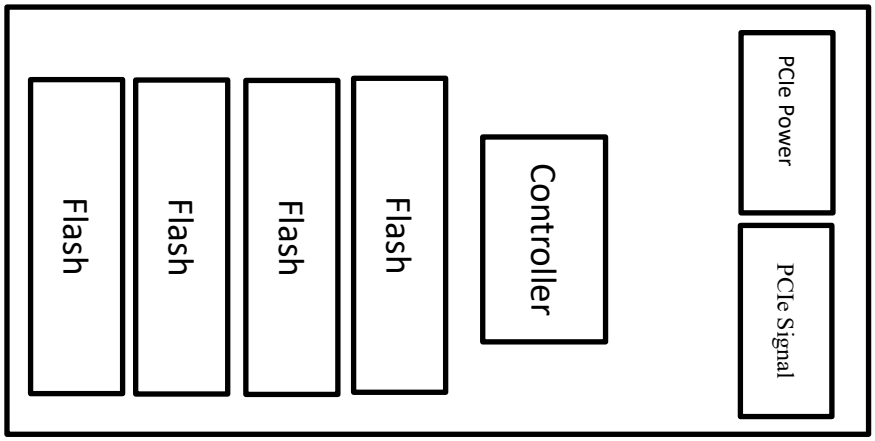
1. INTRODUCTION

1.1. General Description

Delkin Devices' M.2 2280 Industrial 3D TLC Solid State Drive (SSD) delivers all advantages of flash disk technology with PCIe Gen3 x4 interface and is fully compliant with the standard Next Generation Form Factor (NGFF) or M.2. The Delkin M.2 is available in capacity range of 128GB to 2TB and can reach up to 2450 MB/s read, and 1900 MB/s write.

1.2. Product Block Diagram



Front Side

Figure 1-1 Product Block Diagram

1.3. Advanced Technology and Features

1.3.1. Error Correction Code (ECC)

Flash memory cells will deteriorate with use, which might generate random bit errors in the stored data. Thus, Delkin's M.2 2280 SSD applies the LDPC (Low Density Parity Check) of ECC algorithm, which can detect and correct during the read process, ensuring data has been read correctly, as well as protect data from corruption..

1.3.2. Wear Leveling

NAND flash devices can only undergo a limited number of program/erase cycles, and in most cases, the flash media are not used evenly. If some areas are updated more frequently than others, the lifetime of the device would be reduced significantly. Thus, Wear Leveling is applied to extend the

lifespan of NAND flash by evenly distributing write and erase cycles across the media.

Delkin utilizes advanced Wear Leveling algorithms, which can efficiently distribute flash usage through the whole flash media area. Moreover, by implementing both dynamic and static Wear Leveling algorithms, the life expectancy of the NAND flash is greatly improved.

1.3.3. Bad Block Management

Bad blocks are blocks that include one or more invalid bits, and their reliability is not guaranteed. Blocks that are identified and marked as bad by the manufacturer are referred to as “Initial Bad Blocks”. Bad blocks that are developed during usage of the flash are named “Later Bad Blocks”. Delkin implements an efficient bad block management algorithm to detect the factory-produced bad blocks and manages any bad blocks that appear with use. This practice further prevents data being stored into bad blocks and improves data reliability.

1.3.4. TRIM

TRIM is a feature which helps improve the read/write performance and speed of solid-state drives (SSD). Unlike hard disk drives (HDD), SSDs are not able to overwrite existing data, so the available space gradually becomes smaller with each use. With the TRIM command, the operating system can inform the SSD which blocks of data are no longer in use and can be removed permanently. Thus, the SSD will perform an erase action, which prevents unused data from occupying blocks.

1.3.5. SMART

SMART, an acronym for Self-Monitoring, Analysis and Reporting Technology, is an open standard that allows a drive to automatically detect its health and report potential failures. When a failure is recorded by SMART, users can choose to replace the drive to prevent unexpected outage or data loss. Moreover, SMART can inform users of impending failures while there is still time to perform proactive actions, such as copy data to another device.

1.3.6. Dynamic SLC Cache

Delkin’s firmware design currently adopts dynamic caching to deliver better performance and consumer user experience..

1.3.7. Thermal Throttling

The purpose of thermal throttling is to prevent any components in a SSD from over-heating during read and write operations. Delkin’s Controller is designed with an on-die thermal sensor, and can

provide different levels of throttling to achieve protection efficiently and proactively via SMART reading.

1.4. Advanced Device Security Features

1.4.1. Secure Erase

Secure Erase is a standard NVME format command and will write “0xFF” to fully wipe all the data on hard drives and SSDs. When this command is issued, the SSD controller will erase its storage blocks and return to its factory default settings.

1.5. SSD Lifetime Management

1.5.1. Terabytes Written (TBW)

TBW (Terabytes Written) is a measurement of SSDs’ expected lifespan, which represents the amount of data written to the device. To calculate the TBW of a SSD, the following equation is applied:

TBW = [(NAND Endurance) x (SSD Capacity) x (WLE)] / WAF

NAND Endurance: NAND endurance refers to the P/E (Program/Erase) cycle rating of NAND flash, per the manufacturer’s specification.

SSD Capacity: The SSD capacity is the specific capacity in total of a SSD.

WLE: Wear Leveling Efficiency (WLE) represents the ratio of the average amount of erases on all the blocks to the erases on any block at maximum.

WAF: Write Amplification Factor (WAF) is a numerical value representing the ratio between the amount of data that a SSD controller writes to the flash and the amount of data that the host’s flash controller writes. A better WAF, which is near 1, guarantees better endurance and lower frequency of data written to flash memory.

2. PRODUCT SPECIFICATIONS

- **Capacity**
  - From 128GB up to 2TB

- **Electrical/Physical Interface**
  - PCIe Interface
    - Compliant with NVMe 1.3d
    - PCIe Express Base Ver 3.1
    - PCIe Gen 3 x 4 lane & backward compatible to PCIe Gen 2 and Gen 1

- **ECC Scheme**
  - LDPC (Low Density Parity Check) of ECC algorithm

- **Supports SMART and TRIM commands**

- **Performance**

Capacity	Sequential Performance (Up to)	
	CrystalDiskMark	
	Read (MB/s)	Write (MB/s)
128GB	1150	550
256GB	2300	1100
512GB	2400	1800
1TB	2450	1900
2TB	2450	1900

[Notes]

1. Performance may differ according to flash configuration, use condition, environment and platform.
2. Tested with CrystalDiskMark 6.0, QD32T1, 1GB range.
3. Performance specification is under Thermal Throttling inactivated.
4. Operating System: Windows 10 Professional (x64), Version 1809
5. Measurement environment: Room temperature: 20~25℃, humidity: 40~60%RH, DC+3.3V condition.

• Endurance - TBW (Terabytes Written)

Capacity	TBW
128GB	110
256GB	240
512GB	520
1TB	1120
2TB	2400

NOTES:

1. TBW is measured by JEDEC Client 219A workload and calculated with PE count = 3000.
2. TBW may differ according to flash configuration and platform configuration.
3. DWPD is calculated based on 5-year lifetime.
4. DWPD (Drive Write Per Day) = TBW/ (365 x 5 years x User Capacity)
   = TBW (TB*103)/[365 x 5 years x User Capacity(=GB*1000)]
5. The SSD supports trim function. If Operation System does not support trim command, performance and TBW will be affected. (Like certain Windows OS, Linux kernel version before 2.6.33, other OS please reference each own user manual)
6. The endurance of SSD could be estimated based on user behavior, NAND endurance cycles, and write amplification factor.

• Part Numbers

M.2 2280 Industrial TLC SSD
Industrial Temperature (-40 to 85°C)

Capacity	Part Number
128GB	MP1HFTTMN-80000-2
256GB	MP2HFTUMN-80000-2
512GB	MP5HFTVMN-80000-2
1TB	MP1TFTVMN-80000-2
2TB	MP2TFTWMN-80000-2

3. ENVIRONMENTAL SPECIFICATIONS

3.1. Environmental Conditions

3.1.1. Temperature and Humidity

- Temperature:
  - Storage: -40°C to 85°C
  - Operational: -40°C to 85°C

- Humidity:
  - RH 95% under 55°C (operational)

3.1.2. Shock & Vibration

- Shock Specification
  - 1500G, 0.5ms duration

- Vibration Specification
  - 20Hz ~80Hz/1.52mm displacement
  - 80Hz~2000Hz / 20G Acceleration

3.1.3. Electrostatic Discharge (ESD)

- +/- 4KV

3.1.4. EMI Compliance

- 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, an acronym for Mean Time Between Failures, is a measure of a device's reliability. Its value represents the average time between a repair and the next failure. The measure is typically in units of hours. The higher the MTBF value, the higher the reliability of the device.

3.3. Certification & Compliance

- RoHS

WARNING: This product may contain chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm. For more information go to www.p65warnings.ca.gov.

4. ELECTRICAL SPECIFICATIONS

4.1. Supply Voltage

Table 4-1 Supply Voltage

Parameter	Rating
Operating Voltage	3.3V DC,+/- 5%
Rise Time (Max/min)	100ms / 0.1ms
Fall Time (Max/min)	5s / 1ms
Min. Off Time[1]	1s

NOTE:

1.Minimum time between power removed from SSD (Vcc < 100 mV) and power re-applied to the drive.

2. Ensure the voltage of each power domain in SSD has enough time to discharge less than 0.1V.

3. Rise Time during from 10% to 90% of 3.3V.

4. Fall Time during from 90% to 10% of 3.3V.

4.2. Power Consumption

Table 4-2 Power Consumption

Capacity	Read (Max)	Write (Max)
128GB	2000	1600
256GB	3000	2200
512GB	3100	3000
1TB	3300	3200
2TB	3500	3400

Unit: mW

NOTES:

1. .Use CrystalDiskMark 6.0.0 with the setting of 1G B. Sequentially read and write the disk for 5 times, and measure power consumption during sequential Read [1/5]~[5/5] or sequential Write [1/5]~[5/5]
2. The measured power voltage of SSD is 3.3V.
3. Power consumption may differ according to flash configuration, use condition, environment and platform configuration.
4. Measurement environment: Room temperature: 20~25℃, humidity: 40~60%RH..

5. INTERFACE

5.1. Pin Assignment and Descriptions

Table 5-1 defines the signal assignment of the internal NGFF connector for SSD usage, described in the PCI Express M.2 Specification, version 1.0 of the PCI-SIG.

Table 5-1 Pin Assignment and Descriptions for M.2

Pin #	PCIe Pin	Description
1	GND	CONFIG_3 = GND
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
29	PETn1	PCIe RX Differential signal defined by the PCI Express M.2 spec
30	N/C	No Connect
31	PETp1	PCIe RX 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. 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	Module Key
61	Module Key M	Module Key
62	Module Key M	Module Key
63	Module Key M	Module Key
64	Module Key M	Module Key
65	Module Key M	Module Key
66	Module Key M	Module Key
67	N/C	No Connect
68	SUSCLK (I) (0/3.3V) (I)(0/3.3V)	32.768 kHz clock supply input that is provided by the platform chipset to reduce power and cost for the module.
69	NC	CONFIG_1 = No connect
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	CONFIG_2 = Ground

6. SUPPORTED COMMANDS

6.1. NVMe Command List

Table 6-1 Admin Commands

Opcode	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
0Dh	-	Namespace Management
10h	O	Firmware Activate
11h	O	Firmware Image Download
14h	O	Device Self-test
15h	-	Namespace Attachment
18h	O	Keep Alive

Table 6-2 Admin Commands – NVM Command Set Specific

Op Code	Command Description
80h	Format NVM
81h	Security Send
82h	Security Receive
84h	Sanitize

Table 6-3 NVM Commands

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

6.2. Identify Device Data

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

Table 6-4 Controller Data Structure Identification

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)	SN
63:24	M	Model Number (MN)	Model Number
71:64	M	Firmware Revision (FR)	FW Name
72	M	Recommended Arbitration Burst (RAB)	0x01
75:73	M	IEEE OUI Identifier (IEEE)	Assigned by IEEE/RAC
76	O	Controller Multi-Path I/O and Namespace Sharing Capabilities (CMIC)	0x00
77	M	Maximum Data Transfer Size (MDTS)	0x06
79:78	M	Controller ID (CNTLID)	0x1
83:80	M	Version (VER)	0x00010300
87:84	M	RTD3 Resume Latency (RTD3R)	0x124F80
91:88	M	RTD3 Entry Latency (RTD3E)	0x2191C0
95:92	M	Optional Asynchronous Events Supported (OAES)	0x00000000
99:96	M	Controller Attributes (CTRATT)	0x0
111:100	-	Reserved	0x00
127:112	O	FRU Globally Unique Identifier (FGUID)	0x00
239:128	-	Reserved	0x00
255:240	-	Refer to the NVMe Management Interface Specification for definition	0
257:256	M	Optional Admin Command Support (OACS)	0x0017
258	M	Abort Command Limit (ACL)	0x00
259	M	Asynchronous Event Request Limit (AERL)	0x03
260	M	Firmware Updates (FRMW)	0x12
261	M	Log Page Attributes (LPA)	0x0A
262	M	Error Log Page Entries (ELPE)	0x0F
263	M	Number of Power States Support (NPSS)	0x00
264	M	Admin Vendor Specific Command Configuration (AVSCC)	0x01
265	O	Autonomous Power State Transition Attributes (APSTA)	0x00
267:266	M	Warning Composite Temperature Threshold (WCTEMP)	0x166
269:268	M	Critical Composite Temperature Threshold (CCTEMP)	0x170
271:270	O	Maximum Time for Firmware Activation (MTFA)	0x64

275:272	O	Host Memory Buffer Preferred Size (HMPRE)	0x00000000(HMB off)Depend on Disk Size(HMB on)
279:276	O	Host Memory Buffer Minimum Size (HMMIN)	0x00000000(HMB off)Depend on Disk Size(HMB on)
295:280	O	Total NVM Capacity (TNVMCAP)	non-zero
311:296	O	Unallocated NVM Capacity (UNVMCAP)	0
315:312	O	Replay Protected Memory Block Support (RPMBS)	0x1F1F0002
317:316	O	Extended Device Self-test Time (EDSTT)	0x001E
318	O	Device Self-test Options (DSTO	0x01
319	M	Firmware Update Granularity (FWUG)	0x4
321:320	M	Keep Alive Support (KAS)	0x0001
323:322	O	Host Controlled Thermal Management Attributes (HCTMA)	1
325:324	O	Minimum Thermal Management Temperature (MNTMT)	0x111
327:326	O	Maximum Thermal Management Temperature (MXTMT)	0x166
331:328	O	Sanitize Capabilities (SANICAP)	0x7
511:316	-	Reserved	0
NVM Command Set Attributes			
512	M	Submission Queue Entry Size (SQES)	0x66
513	M	Completion Queue Entry Size (CQES)	0x44
515:514	M	Maximum Outstanding Commands (MAXCMD	0
519:516	M	Number of Namespaces (NN)	0x00000001
521:520	M	Optional NVM Command Support (ONCS)	0x5E
523:522	M	Fused Operation Support (FUSES)	0
524	M	Format NVM Attributes (FNA)	0x5
525	M	Volatile Write Cache (VWC)	0x01
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	Reserved	0x00
533:532	O	Atomic Compare & Write Unit (ACWU)	0x0000
535:534	M	Reserved	0x0000

539:536	O	SGL Support (SGLS)	0x00000000
767:540	M	Reserved	0x0
IO Command Set Attributes			
2047:704	M	Reserved	0x0
2048:2079	M	Power State 0 Descriptor	0x0081031600401C5200 0000000000002580000025 800000316
2111:2080	O	Power State 1 Descriptor	0x0081031600401C5201 0101010000002580000025 800000316
2143:2112	O	Power State 2 Descriptor	0x0081031600401C5202 0202020000002580000025 800000316
2175:2144	O	Power State 3 Descriptor	0x0081031600401C5203 030303000003E8000003 E8030003E8
2207:2176	O	Power State 4 Descriptor	0x0081031600401C5224 040404000186A0000013 8803000032
…	-	(N/A)	0
3071:3040	O	Power State 31 Descriptor	0
Vendor Specific			
4095:3072	O	Vendor Specific (VS)	Reserved

Table 6-5 Identify Namespace Data Structure & NVM Command Set Specific

Bytes	O/M	Description	Default Value
7:0	M	Namespace Size (NSZE)	
15:8	M	Namespace Capacity (NCAP)	
23:16	M	Namespace Utilization (NUSE)	
24	M	Namespace Features (NSFEAT)	0x0
25	M	Number of LBA Formats (NLBAF)	0x1
26	M	Formatted LBA Size (FLBAS)	
27	M	Metadata Capabilities (MC)	0x0
28	M	End-to-end Data Protection Capabilities (DPC)	0x0
29	M	End-to-end Data Protection Type Settings (DPS)	0x0
30	O	Namespace Multi-path I/O and Namespace Sharing Capabilities (NMIC)	0x0

31	O	Reservation Capabilities (RESCAP)	0x0
32	O	Format Progress Indicator (FPI)	0x0
33	O	Deallocate Logical Block Features (DLFEAT)	0x8
35:34	O	Namespace Atomic Write Unit Normal (NAWUN)	0xFF
37:36	O	Namespace Atomic Write Unit Power Fail (NAWUPF)	0x0
39:38	O	Namespace Atomic Compare & Write Unit (NAWWU)	0x0
41:40	O	Namespace Atomic Boundary Size Normal (NABSN)	0xFF
43:42	O	Namespace Atomic Boundary Offset (NABO)	0x0
45:44	O	Namespace Atomic Boundary Size Power Fail (NABSPF)	0x0
47:46	O	Namespace Atomic Optimal IO Boundary (NOIOB)	0x0
63:48	O	NVM Capacity (NVMCAP)	-
103:64	-	Reserved	0x0
119:104	O	Namespace Globally Unique Identifier (NGUID)	-
127:120	O	IEEE Extended Unique Identifier (EUI64)	-
131:128	M	LBA Format 0 Support (LBAF0)	0x1090000
135:132	O	LBA Format 1 Support (LBAF1)	0xC0000
139:136	O	LBA Format 2 Support (LBAF2)	0x0
143:140	O	LBA Format 3 Support (LBAF3)	0x0
147:144	O	LBA Format 4 Support (LBAF4)	0x0
151:148	O	LBA Format 5 Support (LBAF5)	0x0
155:152	O	LBA Format 6 Support (LBAF6)	0x0
159:156	O	LBA Format 7 Support (LBAF7)	0x0
163:160	O	LBA Format 8 Support (LBAF8)	0x0
167:164	O	LBA Format 9 Support (LBAF9)	0x0
171:168	O	LBA Format 10 Support (LBAF10)	0x0
175:172	O	LBA Format 11 Support (LBAF11)	0x0
179:176	O	LBA Format 12 Support (LBAF12)	0x0
183:180	O	LBA Format 13 Support (LBAF13)	0x0
187:184	O	LBA Format 14 Support (LBAF14)	0x0
191:188	O	LBA Format 15 Support (LBAF15)	0x0
383:192	-	Reserved	0x00
4095:384	O	Vendor Specific (VS)	0x00

Table 6-6 List of Identify Namespace Data Structure for Each Capacity

Capacity (GB)	Byte[7:0]: Namespace Size (NSZE)
128	EE7C2B0h
256	1DCF32B0h
512	3B9E12B0h
1024	773BD2B0h
2048	EE7752B0h

6.3. SMART Attributes

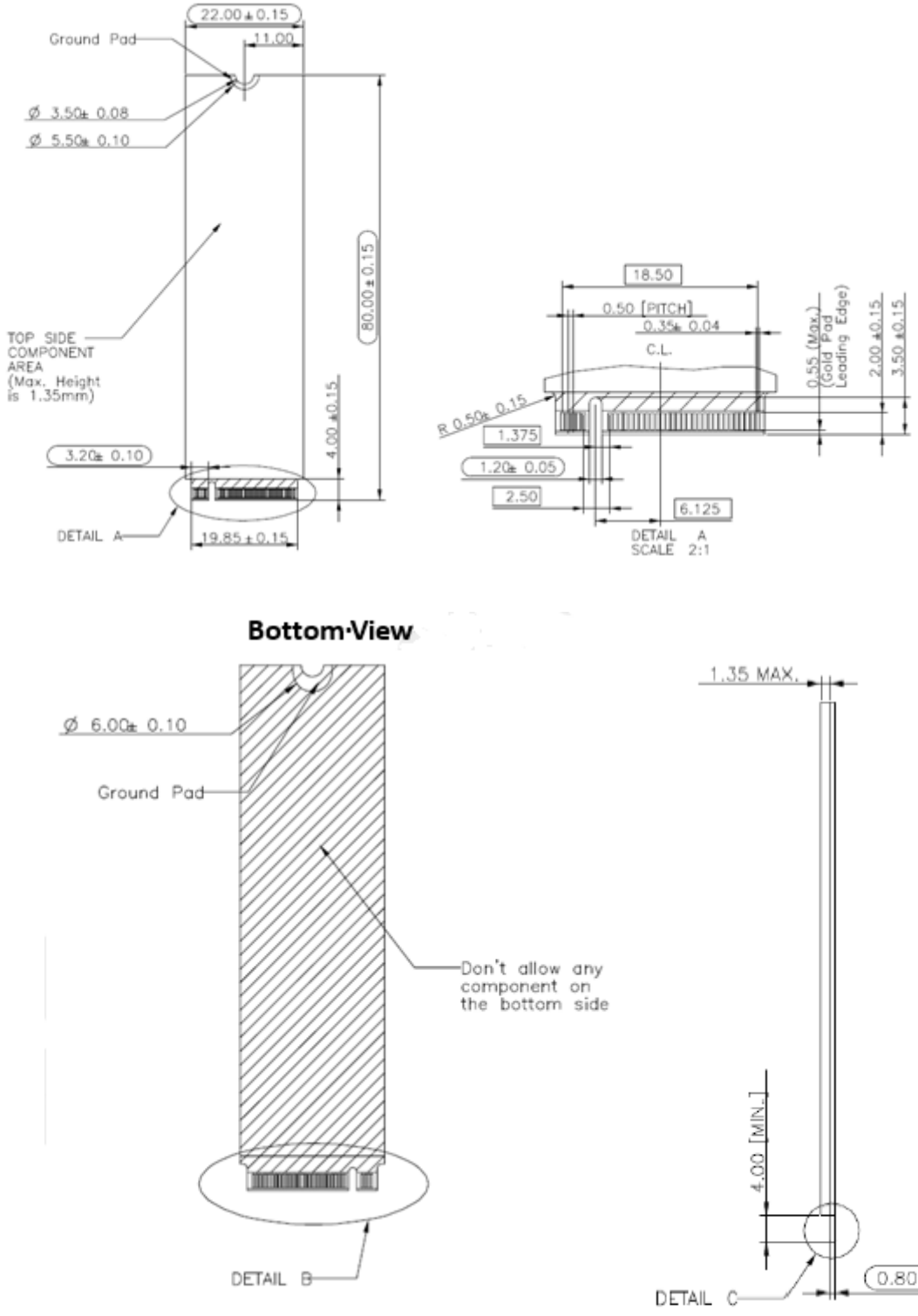
Table 6-7 SMART Attributes (Log Identifier 02h)

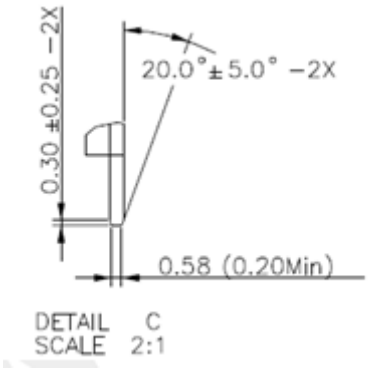
Bytes Index	Bytes	Description
[0]	1	Critical Warning: Error occurred if value of the bits are not zero
[2:1]	2	Composite Temperature: Flash temp value will be detected on-board thermal sensor(Unit: K)
[3]	1	Available Spare: Remaining spare capacity available. (Unit: %)
[4]	1	Available Spare Threshold: Spare capacity threshold. (Unit: %)
[5]	1	Percentage Used: Average of the Flash's block erase count / NAND EOL erase count (Unit: %)
[31:6]	26	Reserved
[47:32]	16	Data Units Read (in LBAs): Contains the number of 512byte data units the host has read from the controller. This value is reported in thousands (i.e, a value of 1 corresponds to 1000 units of 512 bytes read).
[63:48]	16	Data Units Written (in LBAs): Contains the number of 512byte data units the host has written from the controller. This value is reported in thousands (i.e, a value of 1 corresponds to 1000 units of 512 bytes written).
[79:64]	16	Host Read Commands: The number of read commands completed by the controller.
[95:80]	16	Host Write Commands: The number of read commands completed by the controller.
[111:96]	16	Controller Busy Time: The amount of time the controller is busy with I/O commands.

[127:112]	16	Power Cycles: Normal power on/off cycles count
[143:128]	16	Power On Hours (Unit: hour)
[159:144]	16	Unsafe Shutdowns: Abnormal power on/off cycles count
[175:160]	16	Media and Data Integrity Errors: The number of occurrences where the controller detected an unrecovered data integrity error.
[191:176]	16	Number of Error Information Log Entries: The number of Error Information log entries over the life of the controller.
[195:192]	4	Warning Composite Temperature Time: The amount of time that temp. over warning threshold 85°C) but less than critical threshold (95°C). (Unit: min)
[199:196]	4	Critical Composite Temperature Time: The amount of time that temp. over critical threshold (95°C). (Unit: min)
[201:200]	2	Temperature Sensor 1 (Current Temperature) (Unit: K)
[511:216]	2	Reserved

7. PHYSICAL DIMENSIONS

Dimension: 80mm (L) x 22mm (W)





Unit : mm

Notes :
1. = Max Component Height
2. = No Component
3. = No Component / Signal Vias / Signal Copper / Printing
4.General Tolerance ±0.15mm
5. are critical dimensions