

# UD info Corp.

Industrial M.2 2280 SATA Drive

M2S-80UA Series

Product DataSheet

**UD info CORP.**

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## Revision History

Revision	Draft Date	History	Author
1.0	2016/1/25	New release	Golden Lee
1.1	2016/4/21	1. Add 1TB data 2. Update TBW data	Golden Lee



## Product Overview

- **Capacity**
  - MLC: 64GB up to 1TB  
(60GB up to 960GB)
- **SATA Interface**
  - SATA Revision 3.2
  - SATA 1.5Gbps, 3Gbps, and 6Gbps interface
- **Flash Interface**
  - Flash Type: MLC
- **Performance**
  - Read up to 540 MB/s
  - Write up to 520 MB/s
- **Power Consumption<sup>Note1</sup>**
  - Active mode: < 3950mW
  - Idle mode: < 1400mW
- **TBW (Terabyte Written)**
  - MLC: 2057 TBW for 1TB(960GB)
- **MTBF**
  - MLC: 2,000,000 hours
- **Advanced Flash Management**
  - Static and Dynamic Wear Leveling
  - Bad Block Management
  - TRIM
  - SMART
  - Over-Provision
- **Low Power Management**
  - DIPM/HIPM Mode
- **Temperature Range**
  - Operation (Standard): 0°C ~ 70°C
  - Storage: -40°C ~ 85°C
- **Compliant**
  - RoHS
  - CE & FCC

### Notes:

1. Please see "Power Consumption" for details.

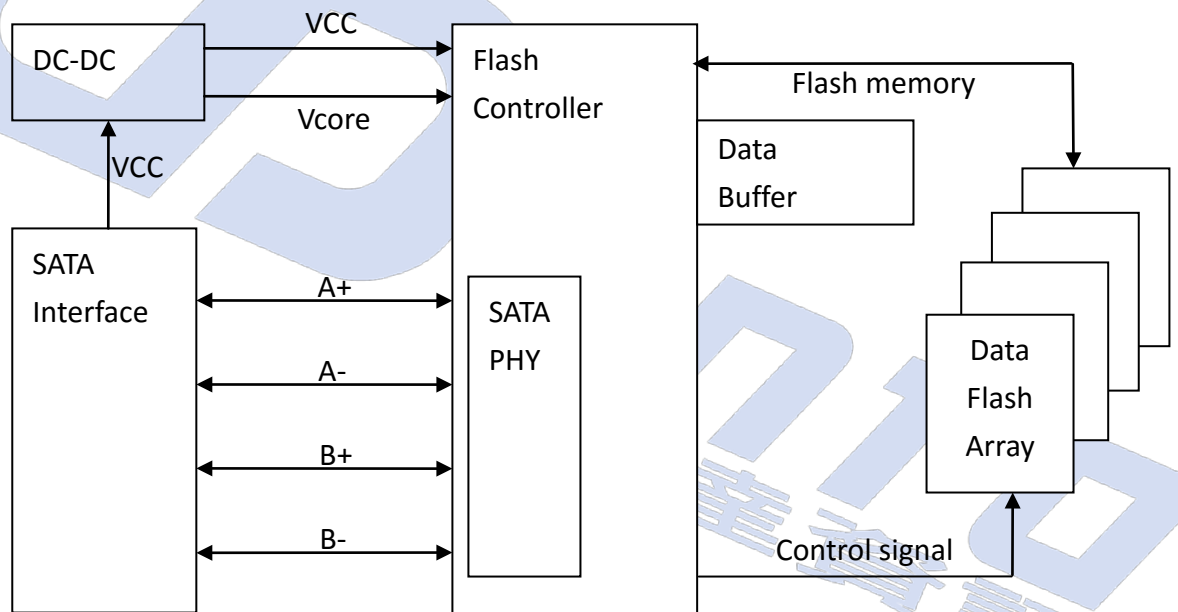
## 1. INTRODUCTION



### 1.1. General Description

UDinfo's M.2 2280 SATA Drive delivers all the advantages of Flash Disk technology with the Serial ATA I/II/III interface and is fully compliant with the standard *Next Generation Form Factor* (NGFF) called M.2 Card Format, which is generated by Intel. The M.2 2280 SATA Drive is designed to operate at a maximum operating frequency of 300MHz with 30MHz external crystal. Its capacity could provide a wide range up to 512GB. Moreover, it can reach up to 540MB/s read as well as 520MB/s write high performance based on Toshiba NAND flash (with 512MB DDR enabled and measured by CrystalDiskMark v3.0). The power consumption of the M.2 2280 is much lower than traditional Hard Drives, making it the best embedded solution for new platforms.

### 1.2. Block Diagram



**M.2 2280 SATA Drive Block Diagram**

## 2. PRODUCT SPECIFICATIONS



- **Capacity**
  - MLC: From 64GB(60GB) up to 1TGB(960GB) (support 48-bit addressing mode)
- **Electrical/Physical Interface**
  - SATA Interface
    - ◆ Compliant with SATA Revision 3.2
    - ◆ Compatible with SATA 1.5Gbps, 3Gbps and 6Gbps interface
    - ◆ Support power management
    - ◆ Support expanded register for SATA protocol 48 bits addressing mode
- **Supported NAND Flash**
  - Toshiba MLC, Toggle1.0 and Toggle2.0
  - Supports MLC large block 16K/page NAND flash
- **ECC Scheme**
  - Up to 120 bits / 2K Byte
- **UART function**
- **GPIO**
- **Support SMART and TRIM commands**
- **Capacity Information**

Capacity	Cylinders	Heads	Sectors	Total Sectors	User Data Size
60GB	16,383	16	63	117,231,408	Depended on file management
64GB	16,383	16	63	125,045,424	
120GB	16,383	16	63	234,441,648	
128GB	16,383	16	63	250,069,680	
240GB	16,383	16	63	468,862,128	
256GB	16,383	16	63	500,118,192	
480GB	16,383	16	63	937,703,088	
512GB	16,383	16	63	1,000,215,216	
960GB	16,383	16	63	1,875,385,008	
1TB	16,383	16	63	2,000,409,264	

- Performance

- MLC:

Capacity	Flash Structure	Flash Type	Sequential	
			Read (MB/s)	Write (MB/s)
64GB (60GB)	32GB x 2	15nm, BGA	540	100
128GB (120GB)	32GB x 4	15nm, BGA	540	200
256GB (240GB)	64GB x 4	15nm, BGA	540	390
512GB (480GB)	128GB x 4	15nm, BGA	540	520
1TB (960GB)	256GB x 4	15nm, BGA	540	510

**Notes:**

1. The performance was measured using CrystalDiskMark with SATA 6Gbps host.
2. Samples were built using Toshiba Toggle MLC NAND.
3. Performance may differ according to flash configuration, DDR configuration, and platform.
4. The table above is for reference only. The criteria for MP (mass production) and for accepting goods shall be discussed based on different flash configuration.

- TBW (Terabytes Written)

- MLC:

Capacity	Flash Structure	TBW
64GB (60GB)	32GB x 2	128
128GB (120GB)	32GB x 4	257
256GB (240GB)	64GB x 4	514
512GB (480GB)	128GB x 4	1028
1TB (960GB)	256GB x 4	2057

**Notes:**

1. Samples were built using Toshiba 15nm Toggle MLC NAND flash.
2. TBW may differ according to flash configuration, DDR 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.

### 3. ENVIRONMENTAL SPECIFICATIONS



#### 3.1. Environmental Conditions

##### 3.1.1. Temperature and Humidity

- Temperature:
  - ◆ Storage: -40°C to 85°C
  - ◆ Operational (Standard grade): 0°C to 70°C
- Humidity:
  - ◆ Standard grade: RH 93% under 40°C (operational)

##### ■ High Temperature Test Condition

	Temperature	Humidity	Test Time
Operation (Standard)	70°C	0% RH	72 hours
Storage (Standard)	85°C	0% RH	72 hours

Result: Passed

##### ■ Low Temperature Test Condition

	Temperature	Humidity	Test Time
Operation (Standard)	0°C	0% RH	72 hours
Storage (Standard)	-40°C	0% RH	72 hours

Result: Passed

##### ■ High Humidity Test Condition

	Temperature	Humidity	Test Time
Operation (Standard)	40°C	93% RH	24 hours
Storage (Standard)	40°C	95% RH	72 hours

Result: Passed

##### ■ Temperature Cycle Test

	Temperature	Test Time	Cycle
Operation (Standard)	0°C	30 min	10 cycles
	70°C	30 min	
Storage (Standard)	-40°C	30 min	10 cycles
	85°C	30 min	

Result: Passed



### 3.1.2. Shock

#### ■ Shock Specification

	Acceleration Force	Half Sin Pulse Duration
Non-Operational	1500G	0.5ms
Operational	1500G	0.5ms

Result: Passed

### 3.1.3. Vibration

#### ■ Vibration Specification

	Condition		Vibration Orientation
	Frequency/Displacement	Frequency/Acceleration	
Operational	20Hz~80Hz/1.52mm	80Hz~2000Hz/20G	X, Y, Z axis/60 min for each

Result: Passed

### 3.1.4. Drop

#### ■ Drop Specification

	Height of Drop	Number of Drop
Non-operational	80cm free fall	12 times each unit

Result: Passed

### 3.1.5. Bending

#### ■ Bending Specification

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

Result: Passed

### 3.1.6. Electrostatic Discharge (ESD)

#### ■ Contact ESD Specification

Device	Capacity	Contact	Air	Result
M.2 2280	512GB	±4KV each item 25 times	±8KV, 10 times	Passed

### 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. The predicted result of UDinfo's M.2 2280 SATA Drive is up to 2,000,000 hours.

### 3.3. Certification

- RoHS
- CE / FCC

### 3.4. Compliance

- SATA III (SATA Rev. 3.2)
- Up to ATA/ATAPI-8 (Including S.M.A.R.T)

## 4. ELECTRICAL SPECIFICATIONS



### 4.1. Supply Voltage

Parameter	Rating
Operating Voltage	3.3V

### 4.2. Power Consumption

#### ■ MLC

Capacity	Flash Structure	Flash Type	Read	Write	Partial	Idle
64GB (60GB)	32GB x 2	15nm, BGA	2015	2305	305	405
128GB (120GB)	32GB x 4	15nm, BGA	2065	2355	305	410
256GB (240GB)	64GB x 4	15nm, BGA	2085	3565	265	370
512GB (480GB)	128GB x 4	15nm, BGA	2385	3625	275	375
1TB (960GB)	256GB x 4	15nm, BGA	2700	3950	275	1400

Unit: mW

#### NOTES:

1. It's average value of power consumption is achieved based on 100% conversion efficiency.
2. The measured power voltage is 3.3V.
3. Samples were built using Toshiba NAND flash and measured under normal temperature.
4. Sequential R/W is measured while testing 4000MB sequential R/W 5 times by CrystallDiskMark.
5. Power Consumption may differ according to flash configuration and platform.

## 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 1.0 of the PCI-SIG.

Pin #	SATA Pin	Description
1	CONFIG_3 = GND	Ground
2	3.3V	Supply pin
3	GND	Ground
4	3.3V	Supply pin
5	N/C	No Connect
6	N/C	No Connect
7	N/C	No Connect
8	N/C	No Connect
9	N/C or GND <sup>Note</sup>	No Connect or Ground
10	DAS/DSS# (O) (OD)	Status indicators via LED devices that will be provided by the system Active Low. A pulled-up LED with series current limiting resistor should allow for 9mA when On.
11	N/C	No Connect
12	Module Key	
13	Module Key	
14	Module Key	
15	Module Key	
16	Module Key	
17	Module Key	
18	Module Key	
19	Module Key	
20	N/C	No Connect
21	CONFIG_0 = GND	Ground
22	N/C	No Connect
23	N/C	No Connect
24	N/C	No Connect
25	N/C	No Connect
26	N/C	No Connect
27	GND	Ground
28	N/C	No Connect

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Pin #	SATA Pin	Description
29	N/C	No Connect
30	N/C	No Connect
31	N/C	No Connect
32	N/C	No Connect
33	GND	Ground
34	N/C	No Connect
35	N/C	No Connect
36	N/C	No Connect
37	N/C	No Connect
38	DEVSLP (I) (0/3.3V)	Device Sleep, Input. When driven high the host is informing the SSD to enter a low power state
39	GND	Ground
40	N/C	No Connect
41	SATA-B+	SATA differential signals in the SATA specification
42	N/C	No Connect
43	SATA-B-	SATA differential signals in the SATA specification
44	N/C	No Connect
45	GND	Ground
46	N/C	No Connect
47	SATA-A-	SATA differential signals in the SATA specification
48	N/C	No Connect
49	SATA-A+	SATA differential signals in the SATA specification
50	N/C	No Connect
51	GND	Ground
52	N/C	No Connect
53	N/C	No Connect
54	N/C	No Connect
55	N/C	No Connect
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

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Pin #	SATA Pin	Description
59	Module Key	
60	Module Key	
61	Module Key	
62	Module Key	
63	Module Key	
64	Module Key	
65	Module Key	
66	Module Key	
67	N/C	No Connect
68	SUSCLK (I) (0/3.3V)	32kHz clock supply input that is provided by PCH to reduce power and cost for the module.
69	CONFIG_1 = GND	Defines module type
70	3.3V	Supply pin
71	GND	Ground
72	3.3V	Supply pin
73	GND	Ground
74	3.3V	Supply pin
75	CONFIG_2 = GND	Ground

**Note:** N/C for Socket 2, and GND for Socket 3.



## 6. SUPPORTED COMMANDS



### 6.1. ATA Command List

Op-Code		Command Description	Op-Code		Command Description
00h		NOP	60h		Read FPDMA Queued
06h		Data Set Management	61h		Write FPDMA Queued
10h		Recalibrate	70h		Seek
20h		Read Sectors	90h		Execute Device Diagnostic
21h		Read Sectors without Retry	91h		Initialize Device Parameters
24h		Read Sectors EXT	92h		Download Microcode
25h		Read DMA EXT	93h		Download Microcode DMA
27h		Read Native Max Address EXT	B0h		SMART
29h		Read Multiple EXT	B0h	D0h	SMART READ DATA
2Fh		Read Log EXT	B0h	D1h	SMART READ DATA ATTRIBUTE THRESHOLD
30h		Write Sectors	B0h	D2h	SMART ENABLE/DISABLE ATTRIBUTE AUTOSAVE
31h		Write Sectors without Retry	B0h	D3h	SMART SAVE ATTRIBUTE VALUES
34h		Write Sectors EXT	B0h	D4h	SMART EXECUTE OFF-LINE IMMEDIATE
35h		Write DMA EXT	B0h	D5h	SMART READ LOG
37h		Set Native Max Address EXT	B0h	D6h	SMART WRITE LOG
39h		Write Multiple EXT	B0h	D8h	SMART ENABLE OPERATIONS
3Dh		Write DMA FUA EXT	B0h	D9h	SMART DISABLE OPERATIONS
3Fh		Write Long EXT	B0h	DAh	SMART RETURN STATUS
40h		Read Verify Sectors	B0h	DBh	SMART ENABLE/DISABLE AUTOMATIC OFF-LINE
41h		Read Verify Sectors without Retry	B1h		DEVICE CONFIGURATION OVERLAY
42h		Read Verify Sectors EXT	B1h	C0h	DEVICE CONFIGURATION RESTORE
45h		Write Uncorrectable EXT	B1h	C1h	DEVICE CONFIGURATION FREEZE LOCK
47h		Read Log DMA EXT	B1h	C2h	DEVICE CONFIGURATION IDENTIFY
57h		Write Log DMA EXT	B1h	C3h	DEVICE CONFIGURATION SET
B1h	C4h	DEVICE CONFIGURATION IDENTIFY DMA	ECh		Identify Device
B1h	C5h	DEVICE CONFIGURATION SET DMA	EFh		Set Features
C4h		Read Multiple	EFh	02h	Enable 8-bit PIO transfer mode

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Op-Code		Command Description	Op-Code		Command Description
C5h		Write Multiple	EFh	03h	Set transfer mode based on value in Count field
C6h		Set Multiple Mode	EFh	05h	Enable advanced power management
C8h		Read DMA	EFh	10h	Enable use of Serial ATA feature
C9h		Read DMA without Retry	EFh	10h 02h	Enable DMA Setup FIS Auto-Activate optimization
CAh		Write DMA	EFh	10h 03h	Enable Device-initiated interface power state (DIPM) transitions
CBh		Write DMA without Retry	EFh	10h 06h	Enable Software Settings Preservation (SSP)
CEh		Write Multiple FUA EXT	EFh	10h 07h	Enable Device Automatic Partial to Slumber transitions
E0h		Standby Immediate	EFh	10h 09h	Enable Device Sleep
E1h		Idle Immediate	EFh	55h	Disable read look-ahead feature
E2h		Standby	EFh	66h	Disable reverting to power-on defaults
E3h		Idle	EFh	82h	Disable write cache
E4h		Read Buffer	EFh	85h	Disable advanced power management
E5h		Check Power Mode	EFh	90h	Disable use of Serial ATA feature set
E6h		Sleep	EFh	90h 02h	Disable DMA Setup FIS Auto-Activate optimization
E7h		Flush Cache	EFh	90h 03h	Disable Device-initiated interface power state (DIPM) transitions
E8h		Write Buffer	EFh	90h 06h	Disable Software Settings Preservation (SSP)
E9h		Read Buffer DMA	EFh	90h 07h	Disable Device Automatic Partial to Slumber transitions
EAh		Flush Cache EXT	EFh	90h 09h	Disable Device Sleep
EBh		Write Buffer DMA	EFh	AAh	Enable read look-ahead feature
EFh	CCh	Enable reverting to power-on defaults	F4h		Security Erase Unit
F1h		Security Set Password	F5h		Security Freeze Lock
F2h		Security Unlock	F6h		Security Disable Password
F3h		Security Erase Prepare	F8h		Read Native Max Address



## 6.2. Identify Device Data

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

Word	F: Fixed V: Variable X: Both	Default Value	Description
0	F	0040h	General configuration bit-significant information
1	X	*1	Obsolete – Number of logical cylinders
2	V	C837h	Specific configuration
3	X	0010h	Obsolete – Number of logical heads (16)
4-5	X	00000000h	Retired
6	X	003Fh	Obsolete – Number of logical sectors per logical track (63)
7-8	V	00000000h	Reserved for assignment by the Compact Flash Association
9	X	0000h	Retired
10-19	F	Varies	Serial number (20 ASCII characters)
20-21	X	0000h	Retired
22	X	0000h	Obsolete
23-26	F	Varies	Firmware revision (8 ASCII characters)
27-46	F	Varies	Model number (xxxxxxx)
47	F	8010h	7:0- Maximum number of sectors transferred per interrupt on MULTIPLE commands
48	F	4000h	Reserved
49	F	2F00h	Capabilities
50	F	4000h	Capabilities
51-52	X	00000000h	Obsolete
53	F	0007h	Words 88 and 70:64 valid
54	X	*1	Obsolete – Number of logical cylinders
55	X	0010h	Obsolete – Number of logical heads (16)
56	X	003Fh	Obsolete – Number of logical sectors per track (63)
57-58	X	*2	Obsolete – Current capacity in sectors
59	F	0110h	Number of sectors transferred per interrupt on MULTIPLE commands
60-61	F	*3	Maximum number of sector ( 28bit LBA mode)
62	X	0000h	Obsolete
63	F	0407h	Multi-word DMA modes supported/selected
64	F	0003h	PIO modes supported
65	F	0078h	Minimum Multiword DMA transfer cycle time per word

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Word	F: Fixed V: Variable X: Both	Default Value	Description
66	F	0078h	Manufacturer's recommended Multiword DMA transfer cycle time
67	F	0078h	Minimum PIO transfer cycle time without flow control
68	F	0078h	Minimum PIO transfer cycle time with IORDY flow control
69	F	5F20h	Additional Supported
70	F	0000h	Reserved
71-74	F	0000000000000000 0h	Reserved for the IDENTIFY PACKET DEVICE command
75	F	001Fh	Queue depth
76	F	E70Eh	Serial SATA capabilities
77	F	0006/0004/0002h	Supported Serial ATA Phy speed
78	F	054Ch	Serial ATA features supported
79	V	0040H	Serial ATA features enabled
80	F	03F8h	Major Version Number
81	F	0000h	Minor Version Number
82	F	746Bh	Command set supported
83	F	7D09h	Command set supported
84	F	4163h	Command set/feature supported extension
85	V	7469h	Command set/feature supported or enabled
86	V	BC09h	Command set/feature supported or enabled
87	V	4163h	Command set/feature supported or enabled
88	V	007Fh	Ultra DMA Modes
89	F	0001h	Time required for Normal Erase mode SECURITY ERASE UNIT command
90	F	0001h	Time required for an Enhanced Erase mode SECURITY ERASE UNIT command
91	V	00FEh	Current advanced power management value
92	V	FFFEh	Master Password Revision Code
93	F	0000h	Hardware reset result. The contents of the bits (12:0) of this word can be changed only during the execution of hardware reset.
94	V	0000h	Vendor's recommended and actual acoustic management value
95	F	0000h	Stream Minimum Request Size

Word	F: Fixed V: Variable X: Both	Default Value	Description
96	V	0000h	Streaming Transfer Time – DMA
97	V	0000h	Streaming Access Latency – DMA and PIO
98-99	F	0000h	Streaming Performance Granularity
100-103	V	*4	Maximum user LBA for 48 bit Address feature set
104	V	0000h	Streaming Transfer Time – PIO
105	F	0008h	Maximum number of 512-byte blocks per DATA SET MANAGEMENT command
106	F	4000h	Physical sector size/Logical sector size
107	F	0000h	Inter-seek delay for ISO-7779 acoustic testing in microseconds
108-111	F	0000000000000000 0h	Unique ID
112-115	F	0000000000000000 0h	Reserved
116	V	0000h	Reserved
117-118	F	00000000h	Words per logical Sector
119	F	401Ch	Supported settings
120	F	401Ch	Command set/Feature Enabled/Supported
121-126	F	0h	Reserved
127	F	0h	Removable Media Status Notification feature set support
128	V	0021h	Security status
129-159	X	0h	Vendor specific
160	F	0h	Compact Flash Association (CFA) power mode 1
161-167	X	0h	Reserved for assignment by the CFA
168	F	3h 2.5 inch 4h 1.8 inch 5h Less than 1.8 inch	Device Nominal Form Factor
169	F	0001h	DATA SET MANAGEMENT command is supported
170-173	F	0h	Additional Product Identifier
174-175		0h	Reserve
176-205	V	0h	Current media serial number
206	F	0039h	SCT Command Transport(
207-208	F	0h	Reserved
209	F	4000h	Alignment of logical blocks within a physical block

Word	F: Fixed V: Variable X: Both	Default Value	Description
210-211	V	0000h	Write-Read-Verify Sector Count Mode 3 (not support)
212-213	F	0000h	Write-Read-Verify Sector Count Mode 2 (not support)
214-216		0000h	NV Cache relate (not support)
217	F	0001h	Non-rotating media device
218	F	0h	Reserved
219	F	0h	NV Cache relate (not support)
220	V	0h	Write read verify feature set current mode
221		0h	Reserved
222	F	107Fh	Transport major version number
223	F	0h	Transport minor version number
224-229		0h	reserved
230-233		0h	Extend number of user addressable sectors
234		0001h	Minimum number of 512-byte data blocks per DOWNLOAD MICROCODE command for mode 03h
235		FFFFh	Maximum number of 512-byte data blocks per DOWNLOAD MICROCODE command for mode 03h
236-242	F	0h	Reserved
243		4000h	Security feature 4000 : Self Encrypting Drive
244-254	F	0h	Reserved
255	X	XXA5h XX is variable	Integrity word (Checksum and Signature)

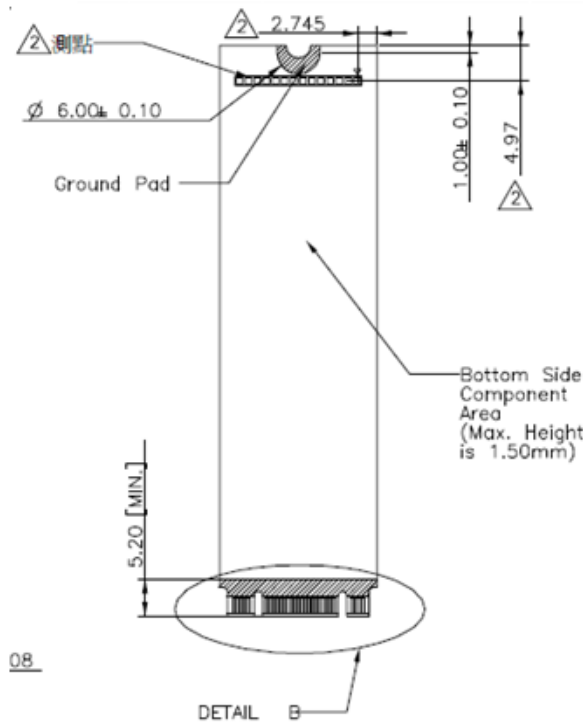
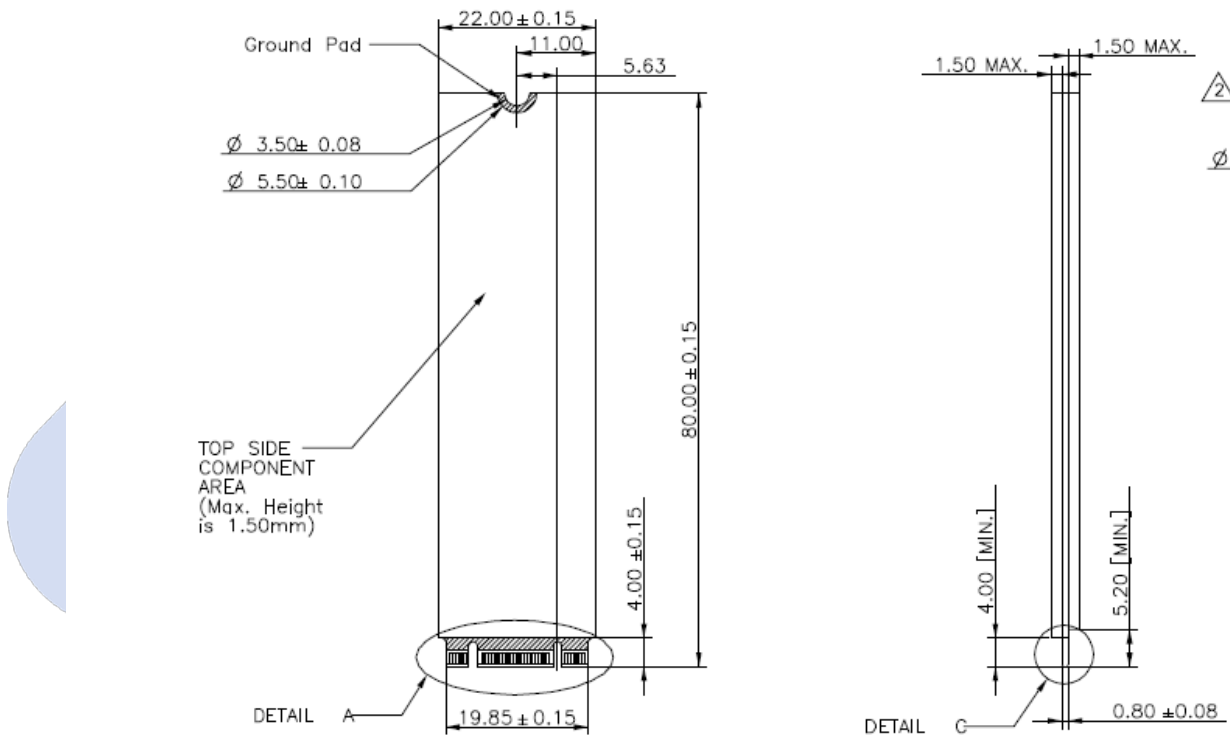
## ■ List of Device Identification for Each Capacity

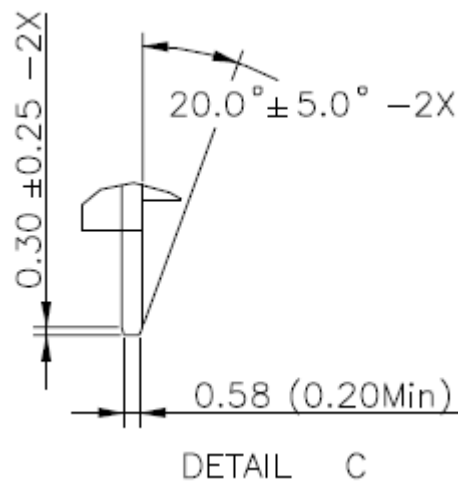
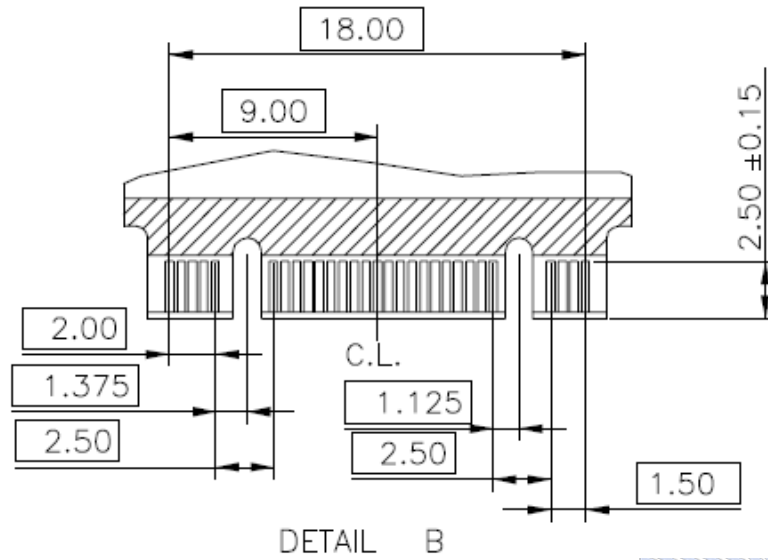
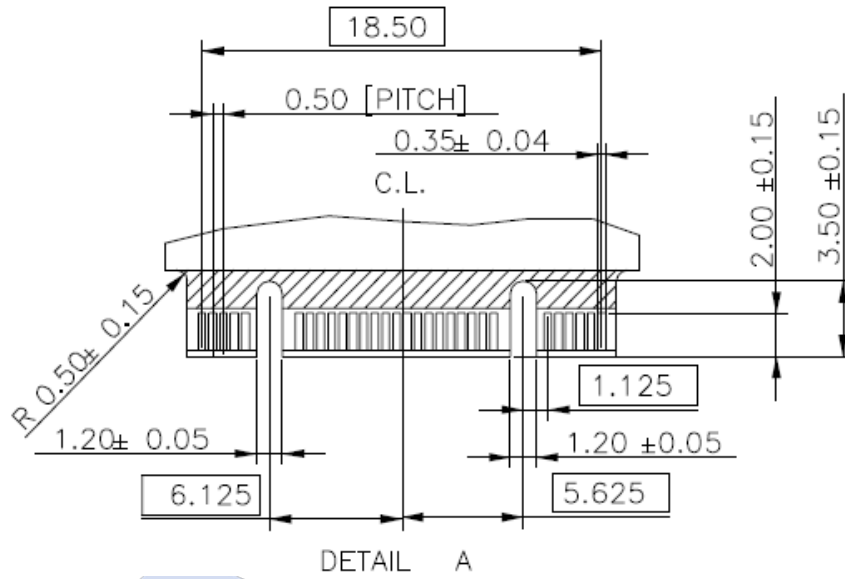
Capacity (GB)	*1 (Word 1/Word 54)	*2 (Word 57–58)	*3 (Word 60–61)	*4 (Word 100–103)
64	3FFFh	FBFC10h	7740AB0h	7740AB0h
128	3FFFh	FBFC10h	EE7C2B0h	EE7C2B0h
256	3FFFh	FBFC10h	0FFFFFFFh	1DCF32B0h
512	3FFFh	FBFC10h	0FFFFFFFh	3B9E12B0h
1024	3FFFh	FBFC10h	0FFFFFFFh	6FC81AB0h

**7. PHYSICAL DIMENSION**



Dimension: 80mm(L) x 22mm(W) x 3.8mm(H)





Unit : mm

## 8. TERMINOLOGY



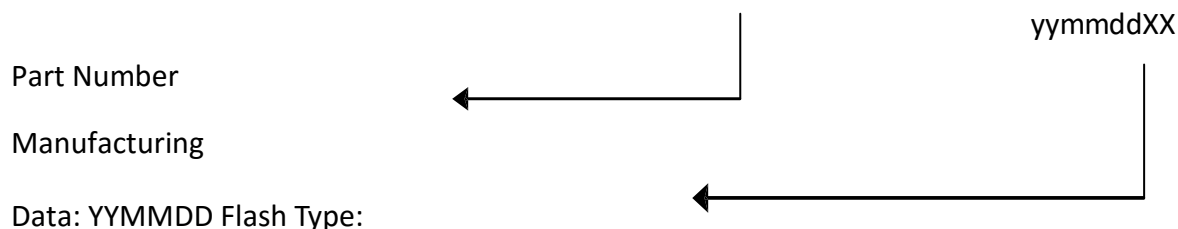
The following table is to list out the acronyms that have been applied throughout the document.

Term	Definitions
ATTO	Commercial performance benchmark application
DDR	Double data rate (SDRAM)
DIPM	Device initiated power management
HIPM	Host initiated power management
LBA	Logical block addressing
MB	Mega-byte
MTBF	Mean time between failures
NCQ	Native command queue
SATA	Serial advanced technology attachment
S.M.A.R.T.	Self-monitoring, analysis and reporting technology
SSD	Solid state disk

## 9. BARCODE DESCRIPTION



M 2 S 8 0 U A 0 0 1 T B K 4 P



## 10. PARTNUMBER DECODER



M2S-80UAX<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>
M2S	80	UA	060GB 064GB 120GB 128GB 240GB 256GB 480GB 512GB 960GB 001TB	K: MLC Standard (0°C ~ +70°C)	4	P	blank

