

# UD info Corp.

Industrial mSATA Drive  
MHD-52US Series  
Product DataSheet

**UD info CORP.**

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## Revision History

Revision	Draft Date	History	Author
1.0	2018/1/3	New release	Golden Lee
1.1	2019/2/13	Modify LBA value	Golden Lee



## Product Overview

- **Capacity**
  - SLC: 4GB up to 64GB
  - MLC: 8GB up to 512GB
  - pSLC: 32GB up to 256GB
- **SATA Interface**
  - SATA Revision 3.1
  - SATA 1.5Gbps, 3Gbps, and 6Gbps interface
- **Flash Interface**
  - Flash Type: SLC / MLC
- **Performance**
  - Read up to 520MB/s
  - Write up to 430MB/s
- **Power Consumption**<sup>Note1</sup>
  - Active mode: < 3870mW
  - Idle mode: < 510mW
- **TBW (Terabyte Written)**
  - SLC: 1873 TBW for 64GB
  - MLC: 705 TBW for 512GB
  - pSLC: 3024 TBW for 256GB
- **MTBF**
  - SLC: 3,000,000 hours
  - MLC: 2,000,000 hours
  - pSLC: 2,500,000 hours
- **Advanced Flash Management**
  - Static and Dynamic Wear Leveling
  - Bad Block Management
  - TRIM
  - SMART
  - Over-Provision
- **Security (Optional)**
  - AES 256 hardware encryption
  - SHA 256
  - TCG OPAL 2.0 compliant
- **Low Power Management**
  - DIPM/HIPM Mode
- **Temperature Range**
  - Operation (Standard): 0°C ~ 70°C
  - Operation (Wide): -40°C ~ 85°C
  - Storage: -40°C ~ 85°C
- **Compliant**
  - RoHS
  - CE & FCC

### Notes:

1. Please see "Power Consumption" for details.

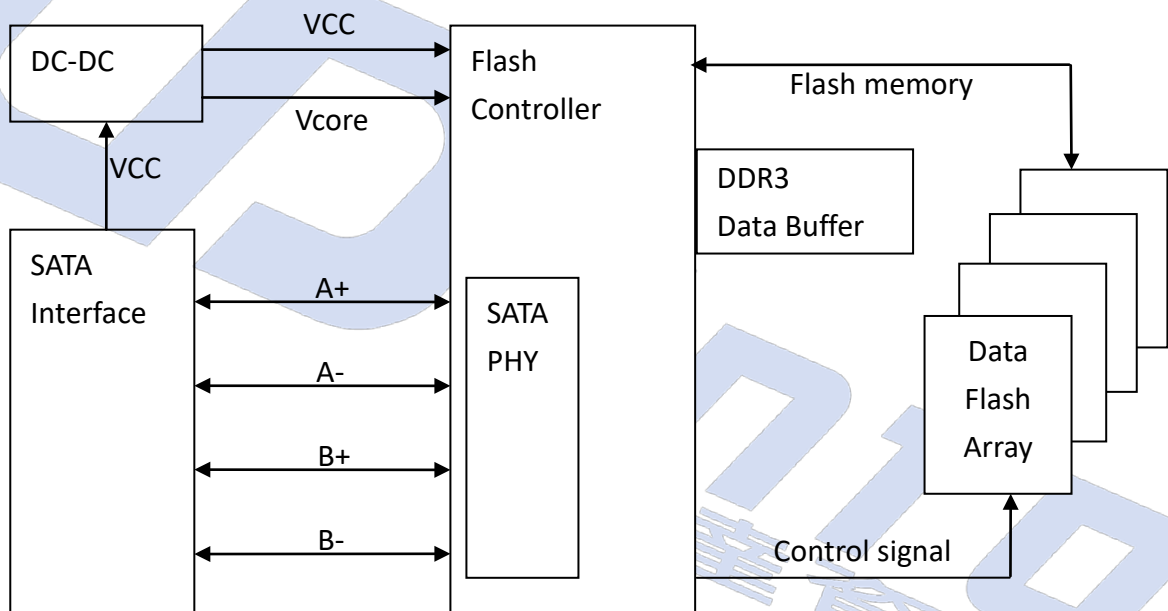
# 1. INTRODUCTION



## 1.1. General Description

UDinfo's mSATA delivers all the advantages of flash disk technology with the Serial ATA I/II/III interface and is fully compliant with the standard mSATA form factor, known as JEDEC MO-300 standard. The module is designed to operate at a maximum operating frequency of 50MHz external crystal. Its capacity could provide up to 512GB. Moreover, it can reach up to 520MB/s read as well as 430MB/s write high performance based on Toshiba's NAND flash (with 256MB/512MB DDR3 cache enabled and measured by CrystalDiskMark v5.0). The power consumption of the mSATA is much lower than traditional hard drives, making it the best embedded solution for new platforms.

## 1.2. Block Diagram



**mSATA Block Diagram**

## 2. PRODUCT SPECIFICATIONS



- **Capacity**
  - SLC: From 4GB up to 64GB (support 48-bit addressing mode)
  - MLC: From 8GB up to 512GB (support 48-bit addressing mode)
  - pSLC: From 32GB up to 256GB (support 48-bit addressing mode)
- **Electrical/Physical Interface**
  - SATA Interface
    - ◆ Compliant with SATA Revision 3.1
    - ◆ Industrial Standard ATA/ATAPI-8 and ACS-2 command compliant
    - ◆ Compatible with SATA 1.5Gbps, 3Gbps and 6Gbps interface
    - ◆ Native Command Queuing up to 32 commands
- **Supported NAND Flash**
  - Supports 1x/1y/2x/2y/3xnm SLC and MLC
  - Supports ONFI 3.0, Toggle 2.0
  - Supports 8KB and 16KB page size
  - Supports 1-plane, 2-plane, and 4-plane operation
- **ECC Scheme**
  - Up to 66 bits / 1K Byte
- **Support SMART and TRIM commands**
- **Support Power Loss Protection (Optional)**
  - Protect data loss, even the last data, during write process when power sudden off.
  - Add-on Polymer Tantalum Capacitors hold-up several milliseconds to keep DRAM data write to NAND Flash.

● Capacity Information

Capacity	Cylinders	Heads	Sectors	Total Sectors	User Data Size
4GB	7,671	16	63	7,732,368	Depended on file management
8GB	15,343	16	63	15,465,744	
16GB	16,383	15	63	30,932,992	
32GB	16,383	15	63	61,865,984	
64GB	16,383	15	63	123,731,968	
128GB	16,383	15	63	247,463,936	
256GB	16,383	15	63	494,927,872	
512GB	16,383	15	63	989,855,744	

● Performance

■ SLC

Capacity	Flash Structure	Flash Type	Sequential	
			Read (MB/s)	Write (MB/s)
4GB	4GB x 1	24nm, TSOP	38	20
8GB	8GB x 1	24nm, TSOP	40	38
	4GB x 2	24nm, TSOP	76	40
16GB	16GB x 1	24nm, TSOP	42	40
	8GB x 2	24nm, TSOP	85	80
32GB	16GB x 2	24nm, TSOP	85	80
64GB	32GB x 2	24nm, BGA	TBD	TBD

■ MLC:

Capacity	Flash Structure	Flash Type	Sequential	
			Read (MB/s)	Write (MB/s)
8GB	8GB x 1	15nm, TSOP	140	25
16GB	8GB x 2	15nm, TSOP	280	50
	16GB x 1	15nm, TSOP	140	23
32GB	16GB x 2	15nm, TSOP	280	45
	32GB x 1	15nm, BGA	280	45
64GB	32GB x 2	15nm, BGA	510	90
	64GB x 1	15nm, BGA	340	90
128GB	64GB x 2	15nm, BGA	520	180
256GB	128GB x 2	15nm, BGA	520	350
512GB	256GB x 2	15nm, BGA	520	430

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■ pSLC:

Capacity	Flash Structure	Flash Type	Sequential	
			Read (MB/s)	Write (MB/s)
32GB	32GB x 2	15nm, BGA	520	200
	64GB x 1	15nm, BGA	350	230
64GB	64GB x 2	15nm, BGA	520	430
128GB	128GB x 2	15nm, BGA	520	430
256GB	256GB x 2	15nm, BGA	520	430

**Notes:**

1. The performance was estimated based on Toshiba SLC / MLC NAND flash.
2. Performance may differ according to flash configuration and platform.
3. The table above is for reference only.



● **TBW (Terabytes Written)**

■ **SLC:**

Capacity	Flash Structure	TBW
4GB	4GB x 1	117
8GB	8GB x 1	234
16GB	8GB x 2	468
32GB	16GB x 2	936
64GB	32GB x 2	1873

■ **MLC:**

Capacity	Flash Structure	TBW
8GB	8GB x 1	11
16GB	16GB x 1	22
32GB	32GB x 1	44
64GB	32GB x 2	88
128GB	64GB x 2	176
256GB	128GB x 2	352
512GB	256GB x 2	705

■ **pSLC:**

Capacity	Flash Structure	TBW
32GB	32GB x 2	378
64GB	64GB x 2	756
128GB	128GB x 2	1512
256GB	256GB x 2	3024

**Notes:**

1. Samples were built using Toshiba SLC and MLC NAND flash.
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.

### 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
  - ◆ Operational (Wide grade): -40°C to 85°C
- Humidity:
  - ◆ Standard grade: RH 90% under 40°C (operational)
  - ◆ Wide grade: RH 95% under 55°C (operational)

##### ■ High Temperature Test Condition

	Temperature	Humidity	Test Time
Operation (Standard)	70°C	0% RH	72 hours
Operation (Wide)	85°C	0% RH	72 hours
Storage (Standard)	85°C	0% RH	72 hours
Storage (Wide)	85°C	0% RH	168 hours

Result: No any abnormality is detected.

##### ■ Low Temperature Test Condition

	Temperature	Humidity	Test Time
Operation (Standard)	0°C	0% RH	72 hours
Operation (Wide)	-40°C	0% RH	72 hours
Storage (Standard)	-40°C	0% RH	72 hours
Storage (Wide)	-40°C	0% RH	168 hours

Result: No any abnormality is detected.

##### ■ High Humidity Test Condition

	Temperature	Humidity	Test Time
Operation (Standard)	40°C	93% RH	24 hours
Operation (Wide)	55°C	95% RH	72 hours
Storage (Standard)	40°C	95% RH	72 hours
Storage (Wide)	55°C	95% RH	96 hours

Result: No any abnormality is detected.

■ Temperature Cycle Test

	Temperature	Test Time	Cycle
Operation (Standard)	0°C	30 min	10 cycles
	70°C	30 min	
Operation (Wide)	-40°C	30 min	20 cycles
	85°C	30 min	
Storage (Standard)	-40°C	30 min	10 cycles
	85°C	30 min	
Storage (Wide)	-40°C	30 min	50 cycles
	85°C	30 min	

Result: No any abnormality is detected.

3.1.2. Shock

■ Shock Specification

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

Result: No any abnormality is detected when power on.

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: No any abnormality is detected when power on.

3.1.4. Drop

■ Drop Specification

	Height of Drop	Number of Drop
Non-operational	80cm free fall	6 face of each unit, 2 times each

Result: No any abnormality is detected when power on.

### 3.1.5. Bending

■ Bending Specification

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

Result: No any abnormality is detected when power on.

### 3.1.6. Electrostatic Discharge (ESD)

■ Contact ESD Specification

Device	Capacity	Temperature	Relative Humidity	+/- 4KV	Result
mSATA	256GB	24.0°C	49% (RH)	Device functions are affected, but EUT will be back to its normal or operational state automatically.	PASS

### 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 mSATA is up to 3,000,000 hours.

### 3.3. Certification

- RoHS
- CE / FCC

### 3.4. Compliance

- SATA III (SATA Rev. 3.1)
- 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

#### ■ SLC

Capacity	Flash Structure	Flash Type	Read	Write	Idle
4GB	4GB x 1	24nm, TSOP	700	700	315
8GB	8GB x 1	24nm, TSOP	935	945	385
	4GB x 2	24nm, TSOP	790	790	320
16GB	16GB x 1	24nm, TSOP	935	935	385
	8GB x 2	24nm, TSOP	1300	1340	450
32GB	16GB x 2	24nm, TSOP	1170	1170	385
64GB	32GB x 2	24nm, BGA	TBD	TBD	TBD

Unit: mW

#### ■ MLC

Capacity	Flash Structure	Flash Type	Read	Write	Idle
8GB	8GB x 1	15nm, TSOP	830	850	350
16GB	8GB x 2	15nm, TSOP	890	875	350
	16GB x 1	15nm, TSOP	830	850	350
32GB	16GB x 2	15nm, TSOP	890	875	350
	32GB x 1	15nm, BGA	1220	1210	445
64GB	32GB x 2	15nm, BGA	1710	1650	455
	64GB x 1	15nm, BGA	1385	1380	445
128GB	64GB x 2	15nm, BGA	2260	2265	460
256GB	128GB x 2	15nm, BGA	3800	3790	470
512GB	256GB x 2	15nm, BGA	3800	3870	510

Unit: mW

■ pSLC

Capacity	Flash Structure	Flash Type	Read	Write	Idle
32GB	32GB x 2	15nm, BGA	1820	1790	470
	64GB x 1	15nm, BGA	1560	1560	460
64GB	64GB x 2	15nm, BGA	2330	2370	470
128GB	128GB x 2	15nm, BGA	2410	2510	470
256GB	256GB x 2	15nm, BGA	2315	2315	470

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. Sequential R/W is measured while testing 1000MB sequential R/W by CrystalDiskMark.
4. Power Consumption may differ according to flash configuration and platform.

## 5. INTERFACE



### 5.1. Pin Assignment and Descriptions

Pin #	mSATA Pin	Description
1	NC	No Connect
2	+3.3V	3.3V Source
3	NC	No Connect
4	DGND	Digital GND
5	NC	No Connect
6	NC	No Connect
7	NC	No Connect
8	NC	No Connect
9	DGND	Digital GND
10	NC	No Connect
11	NC	No Connect
12	NC	No Connect
13	NC	No Connect
14	NC	No Connect
15	DGND	Digital GND
16	NC	No Connect
17	NC	No Connect
18	DGND	Digital GND
19	NC	No Connect
20	NC	No Connect
21	SATA GND	SATA Ground Return Pin
22	NC	No Connect
23	TXP (out)	Host Receiver Differential Signal Pair
24	+3.3V	3.3V Source
25	TXN (out)	Host Receiver Differential Signal Pair
26	SATA GND	SATA Ground Return Pin
27	SATA GND	SATA Ground Return Pin
28	NC	No Connect
29	SATA GND	SATA Ground Return Pin
30	NC	No Connect
31	RXN (in)	Host Transmitter Differential Signal Pair

Pin #	mSATA Pin	Description
32	NC	No Connect
33	RXP (in)	Host Transmitter Differential Signal Pair
34	DGND	Digital GND
35	SATA GND	SATA Ground Return Pin
36	NC	No Connect
37	SATA GND	SATA Ground Return Pin
38	NC	No Connect
39	+3.3V	3.3V Source
40	DGND	Digital GND
41	+3.3V	3.3V Source
42	NC	No Connect
43	NC	No Connect
44	DEVSLP	Enter/Exit DevSleep
45	NC	Reserved pin
46	NC	No Connect
47	NC	Reserved pin
48	NC	No Connect
49	DAS	Device Activity Signal
50	DGND	Digital GND
51	GND	Default connect to GND
52	+3.3V	3.3V Source



## 6. SUPPORTED COMMANDS



### 6.1. ATA Command List

Code	Command Description	Protocol
<b>General Feature Set</b>		
90h	Execute Device Diagnostic	Execute device diagnostic
92h	Download Microcode	PIO data-out
93h	Download Microcode DMA	DMA
E7h	Flush Cache	Non-data
ECh	Identify Device	PIO data-in
91h	Initialize Drive Parameters	Non-data
00h	NOP	Non-data
E4h	Read Buffer	PIO data-in
E9h	Read Buffer DMA	DMA
C8h or C9h	Read DMA	DMA
2Fh	Read Log Ext	PIO data-in
47h	Read Log DMA Ext	DMA
C4h	Read Multiple	PIO data-in
20h or 21h	Read Sector(s)	PIO data-in
40h or 41h	Read Verify Sector(s)	Non-data
EFh	Set Feature	Non-data
C6h	Set Multiple Mode	Non-data
E8h	Write Buffer	PIO data-out
EBh	Write Buffer DMA	DMA
CAh or CBh	Write DMA	DMA
3Fh	Write Log Ext	PIO data-out
57h	Write Log DMA Ext	DMA
C5h	Write Multiple	PIO data-out
30h	Write Sector(s)	PIO data-out
<b>Power Management Feature Set</b>		
E5h or 98h	Check Power Mode	Non-data
E3h or 97h	Idle	Non-data
E1h or 95h	Idle Immediate	Non-data
E6h or 99h	Sleep	Non-data
E2h or 96h	Standby	Non-data
E0h or 94h	Standby Immediate	Non-data

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Code	Command Description	Command Description
<b>Security Mode Feature Set</b>		
F1h	Security Set Password	PIO data-out
F2h	Security Unlock	PIO data-out
F3h	Security Erase Prepare	Non-data
F4h	Security Erase Unit	PIO data-out
F5h	Security Freeze Lock	Non-data
F6h	Security Disable Password	PIO data-out
<b>SMART Feature Set</b>		
B0h	SMART Disable Operations	Non-data
B0h	SMART Enable/Disable Autosave	Non-data
B0h	SMART Enable Operations	Non-data
B0h	SMART Execute OFF-LINE Immediate	Non-data
B0h	SMART Read Log	PIO data-in
B0h	SMART Read Data	PIO data-in
B0h	SMART Read Threshold	PIO data-in
B0h	SMART Return Status	Non-data
B0h	SMART Save Attribute Values	Non-data
B0h	SMART Write Log	PIO data-out
<b>Host Protected Area Feature Set</b>		
F8h	Read Native Max Address	Non-data
F9h	Set Max Address	Non-data
F9h	Set Max Set Password	PIO data-out
F9h	Set Max Lock	Non-data
F9h	Set Max Freeze Lock	Non-data
F9h	Set Max Unlock	PIO data-out
<b>48-bit Address Feature Set</b>		
EAh	Flush Cache Ext	Non-data
24h	Read Sector(s) Ext	PIO data-in
25h	Read DMA Ext	DMA
29h	Read Multiple Ext	PIO data-in
27h	Read Native Max Address Ext	Non-data
42h	Read Verify Sector(s) Ext	Non-data
37h	Set Max Address Ext	Non-data
35h	Write DMA Ext	DMA
3Dh	Write DMA FUA Ext	DMA

Code	Command Description	Command Description
39h	Write Multiple Ext	PIO data-out
CEh	Write Multiple FUA Ext	PIO data-out
34h	Write Sector(s) Ext	PIO data-out
<b>NCQ Feature Set</b>		
60h	Read FPDMA Queued	DMA Queued
61h	Write FPDMA Queued	DMA Queued
<b>Trusted Computing Feature Set<sup>1</sup></b>		
5Ch	Trusted Receive	PIO data-in
5Dh	Trusted Receive DMA	DMA
5Eh	Trusted Send	DMA
5Fh	Trusted Send DMA	DMA
<b>DCO Feature Set</b>		
B1h	Device Configuration	/
<b>Sanitize Device Feature Set</b>		
B4h	Sanitize Device	/
<b>Miscellaneous and Historical Commands</b>		
06h	Data Set Management	DMA
70h	Seek	Non-data
10h	Recalibrate	Non-data
3Ch	Write Verify	PIO data-out
45h	Write Uncorrectable Ext	Non-data

## 6.2. Identify Device Data

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

Word	F / V	Default Value	Description
0	F	0040h	General configuration
1	X	XXXXh	Default number of cylinders
2	V	0000h	Reserved
3	X	00XXh	Default number of heads
4	X	0000h	Obsolete
5	X	0240h	Obsolete
6	F	XXXXh	Default number of sectors per track
7 - 8	V	XXXXh	Number of sectors per card (Word 7 = MSW, Word 8 = LSW)
9	X	0000h	Obsolete
10 - 19	F	XXXXh	Serial number in ASCII (Right justified)
20	X	0002h	Obsolete
21	X	0002h	Obsolete
22	X	0000h	Obsolete
23 - 26	F	XXXXh	Firmware revision in ASCII Big Endian Byte Order in Word
27 - 46	F	XXXXh	Model number in ASCII (Left justified) Big Endian Byte Order in Word
47	F	8001h	Maximum number of sectors on Read/Write Multiple command
48	F	0000h	Reserved
49	F	0F00h	Capabilities
50	F	4000h	Capabilities
51	F	0200h	PIO data transfer cycle timing mode
52	X	0000h	Obsolete
53	F	0007h	Field validity
54	X	XXXXh	Current numbers of cylinders
55	X	XXXXh	Current numbers of heads
56	X	XXXXh	Current sectors per track
57 - 58	X	XXXXh	Current capacity in sectors (LBAs) (Word 57 = LSW , Word 58 = MSW)
59	F	0101h	Multiple sector setting
60 - 61	F	XXXXh	Total number of user addressable logical sectors for 28-bit

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Word	F / V	Default Value	commands (DWord) Description
62	X	0000h	Reserved
63	F	0207h	Multiword DMA transfer Supports MDMA mode 0, 1 and 2
64	F	0003h	Advanced PIO modes supported
65	F	0078h	Minimum Multiword DMA transfer cycle time per word
66	F	0078h	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	4000h	Additional supported
70 - 74	F	0000h	Reserved
75	F	001Fh	Queue depth
76	F	070Eh	Serial ATA capabilities <ul style="list-style-type: none"> <li>• Supports Serial ATA Gen3</li> <li>• Supports Serial ATA Gen2</li> <li>• Supports Serial ATA Gen1</li> <li>• Supports Phy event counters log</li> <li>• Supports receipt of host initiated power management requests</li> <li>• Supports Native Command Queuing</li> </ul>
77	F	0080h	Serial ATA additional capability <ul style="list-style-type: none"> <li>• DevSleep_to_ReducedPwerState</li> </ul>
78	F	0148h	Serial ATA features supported <ul style="list-style-type: none"> <li>• Supports Device Sleep</li> <li>• Supports software settings preservation</li> <li>• Device supports initiating power management</li> </ul>
79	V	0040h	Reserved
80	F	03F0h	Major version number (ACS-2)
81	F	0000h	Minor version number
82	F	742Bh	Command sets supported 0
83	F	7500h	Command sets supported 1
84	F	4023h	Command sets supported 2
85 - 87	V	XXXXh	Command set/feature enabled
88	V	007Fh	Ultra DMA mode supported and selected
89	F	0003h	Time required for a Normal Erase mode Security Erase Unit command

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Word	F / V	Default Value	Description
90	F	0001h	Time required for an Enhanced Erase mode Security Erase Unit command
91	V	0000h	Current advanced power management value
92	V	FFFEh	Master password identifier
93 - 99	V	0000h	Reserved
100 - 103	V	XXXXh	Maximum user LBA for 48-bit address feature set
104	V	0000h	Reserved
105	F	0100h	Maximum number of 512-byte blocks per Data Set Management command
106 - 127	V	0000h	Reserved
128	V	0001h	Security status
129 - 159	X	XXXXh	Vendor specific
160	F	0000h	Power requirement description
161	X	0000h	Reserved
162	F	0000h	Key management schemes supported
163	F	0000h	CF Advanced True IDE Timing mode capability and setting
164 - 168	V	0000h	Reserved
169	F	0001h	Data Set Management supported
170 - 216	V	XXXXh	Reserved
217	F	0001h	Non-rotating media (SSD)
218 - 221	X	0000h	Reserved
222	F	107Fh	Transport major revision (SATA Rev 3.1)
223 - 254	X	0000h	Reserved
255	X	XXXXh	Integrity word

**Notes:**

1. F = content (byte) is fixed and does not change.
2. V = content (byte) is variable and may change depending on the state of the device or the commands executed by the device.
3. X = content (byte) is vendor specific and may be fixed or variable.

## 7. POWER LOSS PROTECTION (PLP)



### 7.1. General Description

The Power-Loss Protection (PLP) is a scheme to protect data from lost during a sudden power off when SSD drive is under programming or writing. It will ensure the system is stable and the data in the DRAM will be flushed to NAND. It needs to have controller firmware support first with additional power source from PCBA as backup power.

### 7.2. How to Protect Data?

The SSD drive includes controller, DRAM for temporary data and NAND for non-volatile memory. The PLP needs to have controller firmware support first. When the controller detects the power is dropping to certain level, the controller needs to inform the host and to stop the host from sending more data.

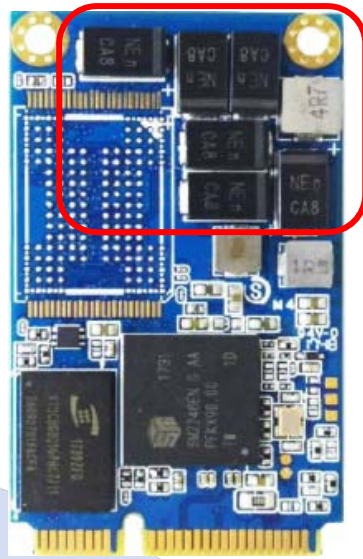
The 2nd step is to flush the data in the DRAM into the NAND flash, since DRAM cannot work when power is off. Therefore it needs enough extra power generated from Polymer Tantalum capacitors add-on PCBA to hold up several mini-seconds to ensure the data is flushed out to NAND completely.

The PLP system of UD Info is to offer about 45ms to ensure the data is flush out. Since the controller is featured with 4-ch process, if it is full 4-ch operation, the flush time will be short. However, if the flush speed is slower for small capacity, it takes longer time. UD Info PLP system will make sure all the capacity combinations will have last data stored in NAND flash safely with additional margin.

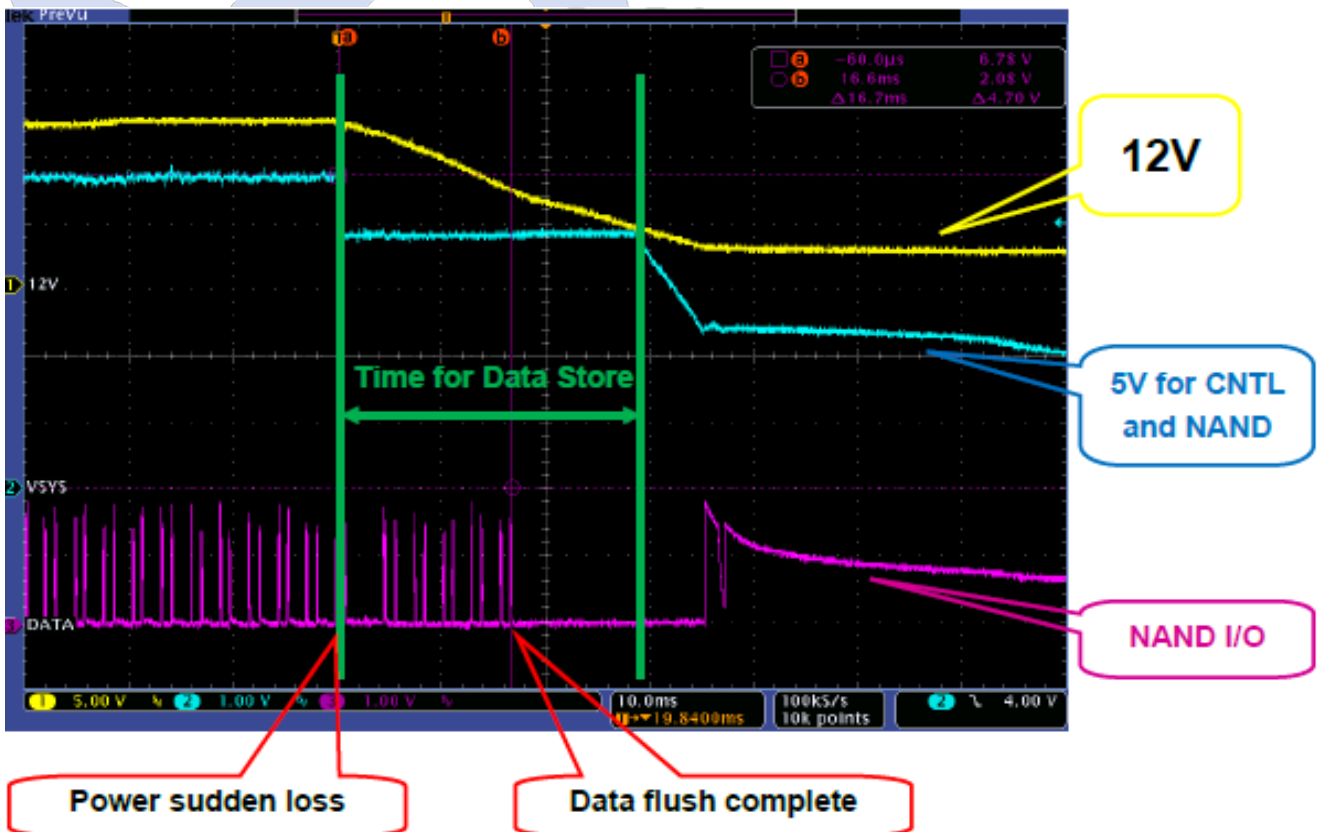
The following figure shows the PCBA of UD Info SATA SSD with PLP feature by adding Polymer Tantalum capacitors.

Additional figure shows when power is suddenly lost, a trigger to host stops sending data and the data are stored into NAND safely and completely with some margin.





Polymer Tantalum Capacitors



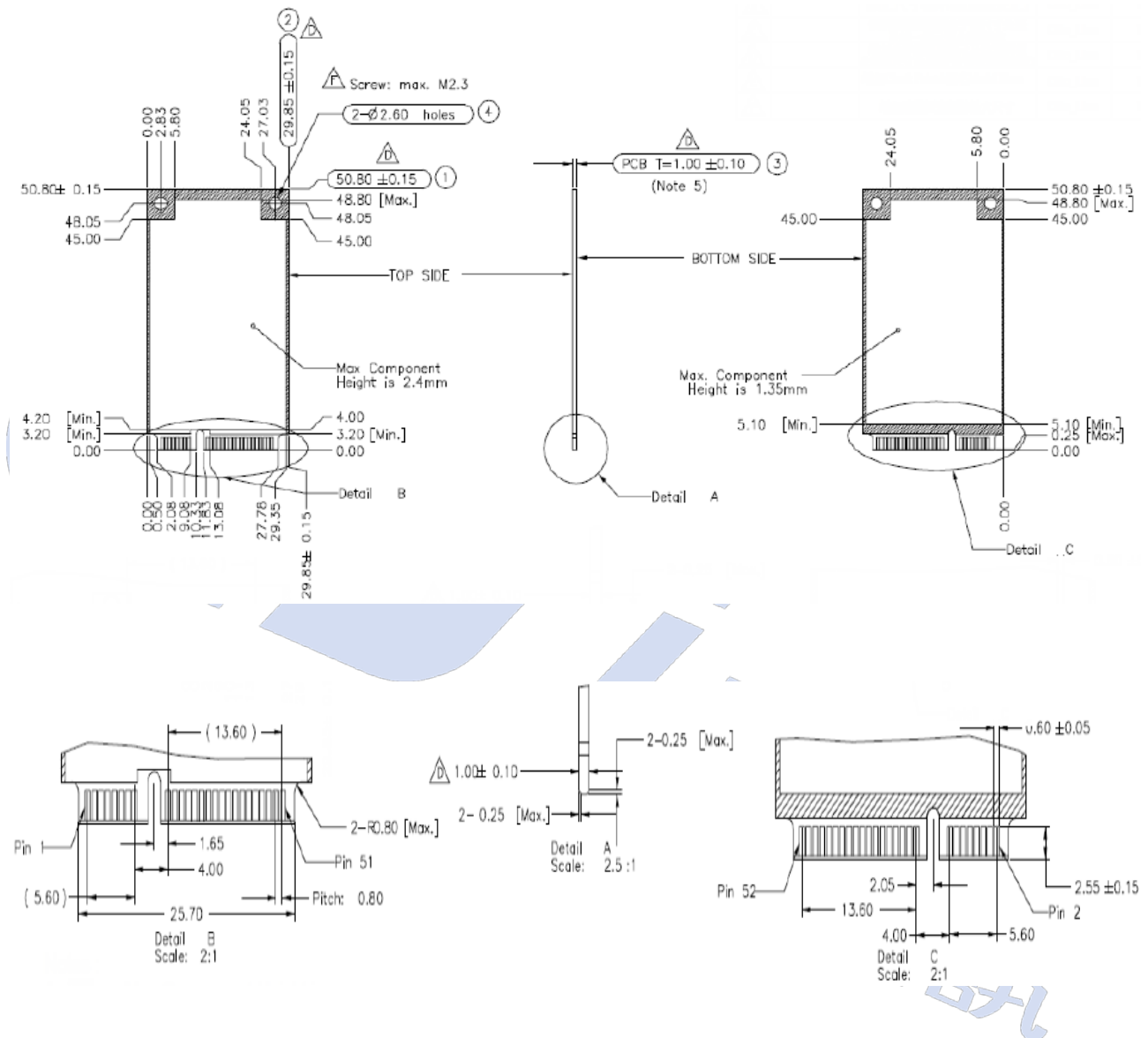
Power sudden loss

Data flush complete



## 8. PHYSICAL DIMENSION

Dimension: 50.8mm(L) x 29.85mm(W) x 4mm(H)



**Notes :**

1. = Max Component Height is
2. = No Component
3. = No Component / Signal Vias / Signal Copper/Print
4. General Tolerance : ±0.1mm
- △ 5. Card Thickness applies across tab and includes plating and/or metalization
- △ 6. Check Point: ① ~ ④
- △ 7. Screw Max. Size M2.3

DIM	CLASS	COMMON TOLERANCE			Finish	
		A	(B)	C	Material	Angles
L ≤ 3		±0.05	±0.10	±0.20	Scale : 1 / 1	Unit : mm
3 < L ≤ 6		±0.05	±0.10	±0.20	Drawing by	Otto_Lian
6 < L ≤ 16		±0.10	±0.15	±0.30	Approval	Tom
16 < L ≤ 30		±0.10	±0.15	±0.30	Date	2014/11/03
30 < L ≤ 120		±0.15	±0.20	±0.50	Size : A4	Rev:F
120 < L ≤ 315		±0.20	±0.50	±0.80		Page 1/1

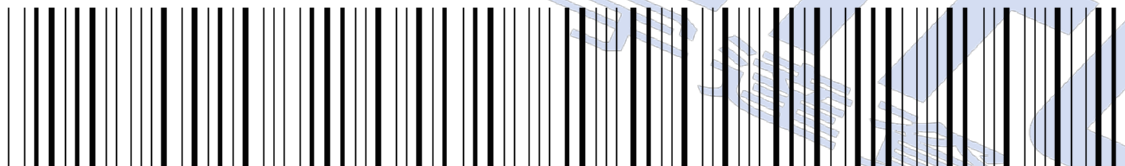
## 9. TERMINOLOGY



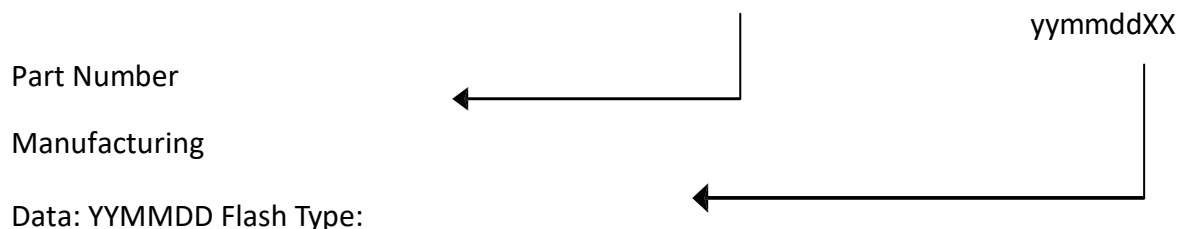
The following table is to list out the acronyms that have been applied throughout the document.

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

## 10. BARCODE DESCRIPTION



M H D 5 2 U S 5 1 2 G B K 4 U



## 11. PARTNUMBER DECODER



MHD-52USX<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>
MHD	52	US	004GB 008GB 016GB 032GB	064GB 128GB 256GB 512GB	C: SLC Standard (0°C ~ +70°C) I: SLC Industrial (-40°C ~ +85°C) K: MLC Standard (0°C ~ +70°C) M: MLC Industrial (-40°C ~ +85°C) P: pSLC Standard (0°C ~ +70°C) F: pSLC Industrial (-40°C ~ +85°C)	4	U	
<p>X<sup>16</sup>X<sup>17</sup></p> <p>Blank: standard</p> <p>20: Power Loss Protection (PLP) Function</p>								