

UD info Corp.

Industrial SATA Solid State Drive HF3-25MD Series Product DataSheet



UD info CORP.

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Revision History

Revision	Draft Date	History	Author
1.0	2019/8/29	New release	Golden Lee
1.1	2020/1/10	Add Power Loss Protection Lite (PLP Lite) function	Golden Lee
1.2	2020/4/7	Add Bics4 support	Golden Lee

Product Overview

- **Capacity**
 - 60GB up to 960GB
- **SATA Interface**
 - SATA Revision 3.1
 - SATA 1.5Gbps, 3Gbps, and 6Gbps interface
- **Flash Interface**
 - Flash Type: 3D TLC
- **Performance**
 - Read up to 550MB/s
 - Write up to 500MB/s
- **Power Consumption^{Note1}**
 - Active mode: < 2000mW
 - Idle mode: < 420mW
- **TBW (Terabyte Written)**
 - 492 TBW for 960GB
- **Advanced Flash Management**
 - Static and Dynamic Wear Leveling
 - Bad Block Management
 - TRIM
 - SMART
 - Over-Provision
- **Performance**
 - DIPM/HIPM Mode
 - DEVSLP mode (Optional)
- **Temperature Range**
 - Operation (Standard): 0°C ~ 70°C
 - Storage: -40°C ~ 85°C
- **Compliant**
 - RoHS
 - CE & FCC
- **Hardware Power Loss Protection Lite (PLP Lite) support**

Notes:

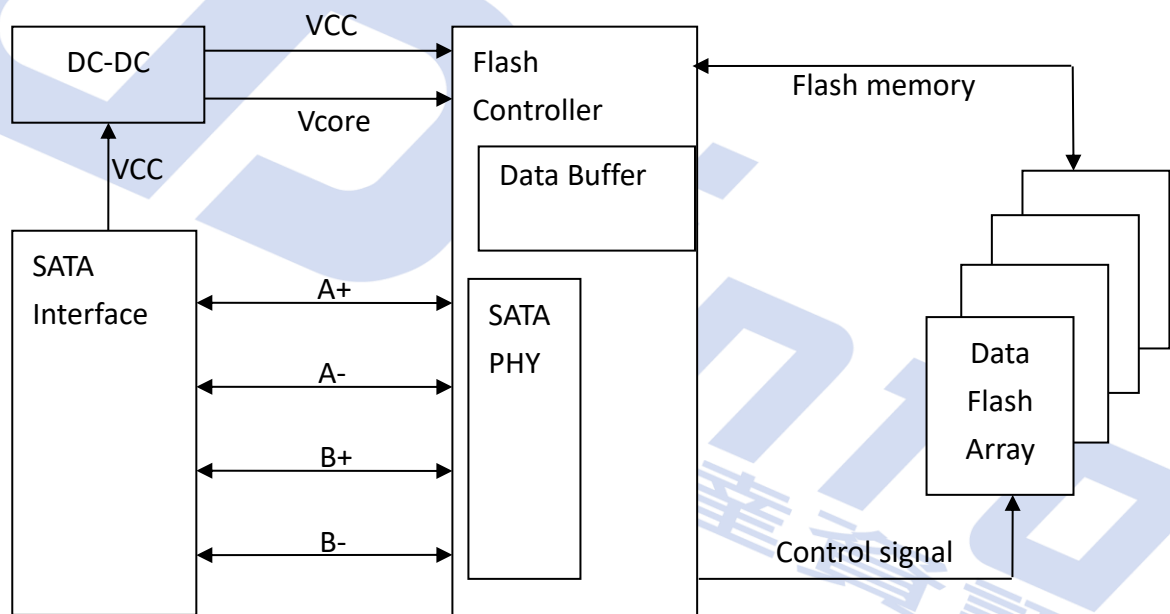
1. Please see "Power Consumption" for details.

1. INTRODUCTION

1.1. General Description

UDinfo 2.5" SATA SSD delivers all the advantages of flash disk technology with Serial ATA I/II/III interface, including being fully compliant with standard 2.5-inch form factor, providing low power consumption compared to traditional hard drive and hot-swapping when removing/replacing/upgrading flash disks. The device is designed based on the standard 7-pin interface for data segment and 15-pin for power segment, as well as operating at a maximum operating frequency of 300MHz with 50MHz external crystal. Its capacity could provide a wide range up to 960GB. Moreover, it can reach up to 550MB/s read as well as 500MB/s write high performance based on Toshiba's NAND flash. Meanwhile, the power consumption of the 2.5" SSD is much lower than traditional hard drives.

1.2. Block Diagram



2.5" SATA SSD Block Diagram

2. PRODUCT SPECIFICATIONS



- **Capacity**
 - From 60GB up to 960GB (support 48-bit addressing mode)
- **Electrical/Physical 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
 - Supports 28-bit and 48-bit LBA (Logical Block Addressing) mode commands
- **Supported NAND Flash**
 - Supports ONFI 3.0, Toggle 2.0, and Asynchronous interface
 - Supports SDR, NV-DDR and NV-DDR2, Toggle DDR/DDR2 flash
 - Supports 8KB and 16KB page size
 - Supports 1-plane, 2-plane, and 4-plane operation
- **Data Protection and Reliability**
 - Supports ATA8 security feature set
 - Hardware LDPC ECC engine with hard-decision and soft-decision decoding
 - RAID engine offers additional level of data protection
 - Global wear leveling algorithm evens program/erase count and extends SSD lifespan
- **Support SMART and TRIM commands**
- **Support Hardware Quick Erase Function (Optional)**
- **Support Hardware Write Protect Function (Optional)**
- **Support Hardware Power Loss Protection Lite (PLP Lite)**
- **Capacity Information**

Capacity	Cylinders	Heads	Sectors	Total Sectors	User Data Size
60GB	16,383	15	63	117,231,408	Depended on file management
120GB	16,383	15	63	234,441,648	
240GB	16,383	15	63	468,862,128	
480GB	16,383	15	63	937,703,088	
960GB	16,383	15	63	1,875,385,008	

- Performance

Capacity	Flash Structure	Flash Type	Sequential	
			Read (MB/s)	Write (MB/s)
60GB	64GB x 1	Bics3, BGA	550	250
120GB	64GB x 2	Bics3, BGA	550	450
240GB	128GB x 2	Bics3, BGA	550	490
480GB	128GB x 4	Bics3, BGA	550	500
	256GB x 2	Bics3, BGA	550	500
960GB	256GB x 4	Bics3, BGA	550	500
120GB	64GB x 2	Bics4, BGA	550	220
240GB	64GB x 4	Bics4, BGA	550	450
480GB	128GB x 4	Bics4, BGA	550	500
960GB	256GB x 4	Bics4, BGA	550	500

- TBW (Terabytes Written)

Capacity	TBW
60GB	30
120GB	62
240GB	123
480GB	261
960GB	492

Notes:

1. Samples were built using Toshiba Bics3 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

■ High Temperature Test Condition

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

■ Low Temperature Test Condition

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

■ High Humidity Test Condition

	Temperature	Humidity
Operation (Standard)	40°C	90% RH
Storage (Standard)	40°C	93% RH

■ Temperature Cycle Test

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

Notes:

1. Operation temperature is measured by device temperature sensor. Airflow is suggested and it will allow device to be operated at appropriate temperature for each component during heavy workloads environment.
2. Operation temperature shows in case temperature not ambient temperature.

3.1.2. Shock

■ Shock Specification

	Acceleration Force
Non-operational	1500G

3.1.3. Vibration

■ Vibration Specification

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

3.1.4. Drop

■ Drop Specification

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

3.1.5. Bending

■ Bending Specification

	Force	Action
Non-operational	≥ 50N	Hold 1min/5times

3.1.6. Durability

■ Durability Specification

	Condition
Non-operational	1000 mating cycles

3.1.7. Electrostatic Discharge (ESD)

■ Contact ESD Specification

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

3.1.8. EMI Compliance

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

3.2. MTBF

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

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

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	5V

4.2. Power Consumption

Capacity	Flash Structure	Flash Type	Read	Write	Idle
60GB	64GB x 1	TSB Bics3, BGA	1,300	1,220	405
120GB	64GB x 2	TSB Bics3, BGA	1,600	1,600	410
240GB	128GB x 2	TSB Bics3, BGA	1,750	1,750	410
480GB	128GB x 4	TSB Bics3, BGA	1,950	1,950	415
	256GB x 2	TSB Bics3, BGA	1,950	1,950	415
960GB	256GB x 4	TSB Bics3, BGA	2,000	2,000	415
120GB	64GB x 2	TSB Bics4, BGA	1,500	1,300	415
240GB	64GB x 4	TSB Bics4, BGA	1,700	1,600	415
480GB	128GB x 4	TSB Bics4, BGA	1,800	1,800	420
960GB	256GB x 4	TSB Bics4, BGA	1,800	1,800	420

Unit: mW

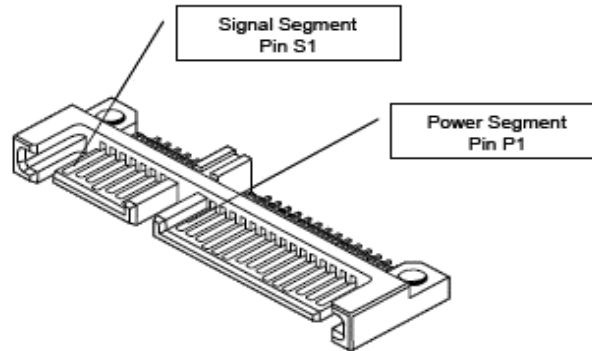
Notes:

1. The average value of power consumption is achieved based on 100% conversion efficiency.
2. The measured power voltage is 5V.
3. Samples were built using Toshiba Bics3 TLC NAND flash and measured under normal temperature.
4. Sequential R/W is measured while testing 1GB sequential R/W 5 times by CrystalDiskMark.
5. Power Consumption may differ according to flash configuration and platform.

5. INTERFACE



5.1. Pin Assignment and Descriptions



Signal Segment Pin Assignment	Pin Number	Function
	S1	GND
	S2	A+ (Differential Signal Pair A)
	S3	A – (Differential Signal Pair A)
	S4	GND
	S5	B – (Differential Signal Pair B)
	S6	B+ (Differential Signal Pair B)
Power Segment Pin Assignment	Pin Number	Function
	P1	Not Used (3.3V)
	P2	Not Used (3.3V)
	P3	DEVSLP
	P4	GND
	P5	GND
	P6	GND
	P7	5V pre-charge
	P8	5V
	P9	5V
	P10	GND
	P11	Reserved
	P12	GND
	P13	Not Used (12V pre-charge)
	P14	Not Used (12V)
P15	Not Used (12V)	

6. SUPPORTED COMMANDS



6.1. ATA Command List

Code	Command Description	Protocol
General Feature Set		
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
Power Management Feature Set		
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
Security Mode Feature Set		
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
SMART Feature Set		
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
Host Protected Area Feature Set		
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
48-bit Address Feature Set		
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
NCQ Feature Set		
60h	Read FPDMA Queued	DMA Queued
61h	Write FPDMA Queued	DMA Queued
Trusted Computing Feature Set¹		
5Ch	Trusted Receive	PIO data-in
5Dh	Trusted Receive DMA	DMA
5Eh	Trusted Send	DMA
5Fh	Trusted Send DMA	DMA
DCO Feature Set		
B1h	Device Configuration	/
Sanitize Device Feature Set		
B4h	Sanitize Device	/
Miscellaneous and Historical Commands		
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"> • Supports Serial ATA Gen3 • Supports Serial ATA Gen2 • Supports Serial ATA Gen1 • Supports Phy event counters log • Supports receipt of host initiated power management requests • Supports Native Command Queuing
77	F	0080h	Serial ATA additional capability <ul style="list-style-type: none"> • DevSleep_to_ReducedPwerState
78	F	0148h	Serial ATA features supported <ul style="list-style-type: none"> • Supports Device Sleep • Supports software settings preservation • Device supports initiating power management
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:

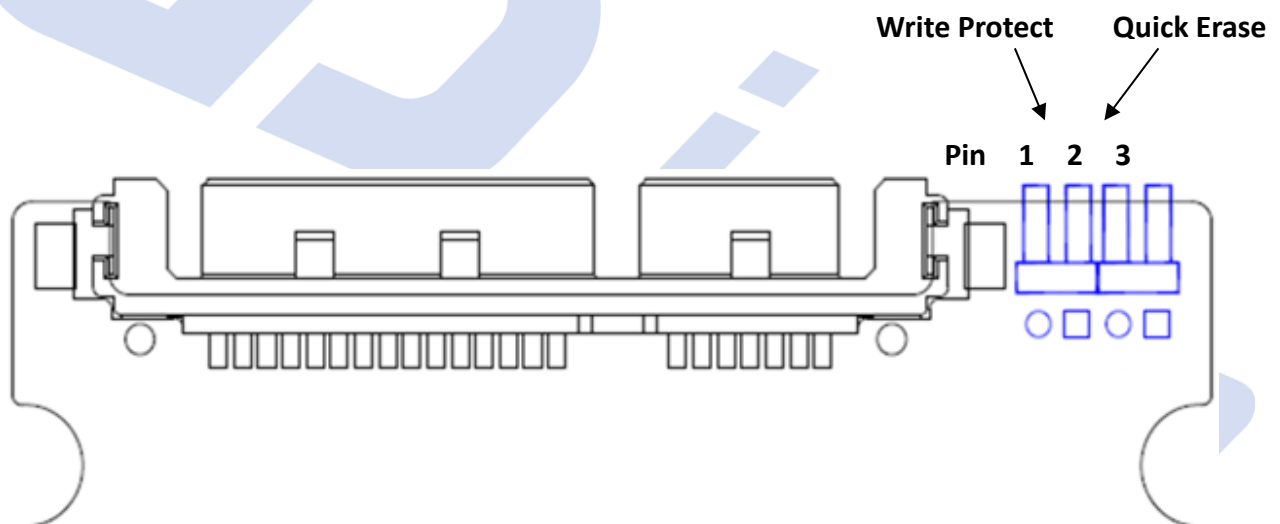
1. F = content (byte) is fixed and does not change.
2. V = content (byte) is variable and may change depending on the state of the device or the commands executed by the device.
3. X = content (byte) is vendor specific and may be fixed or variable.

6.3. Write Protect Function (Optional)

The write protect function is triggered by pin1 and pin2 short of pin header. This used to set the device as a write protection device after power up. When the function is triggered, the data can't be written to the device. The device is then set as read only.

6.4. Quick Erase Function (Optional)

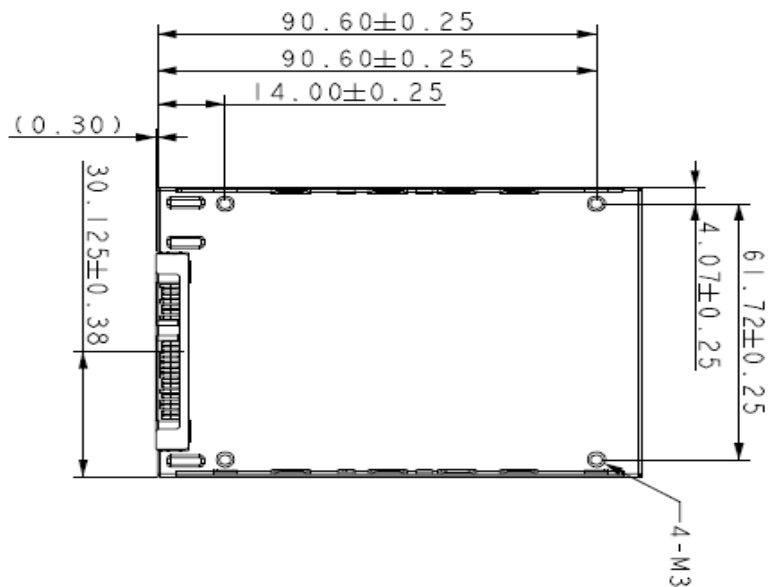
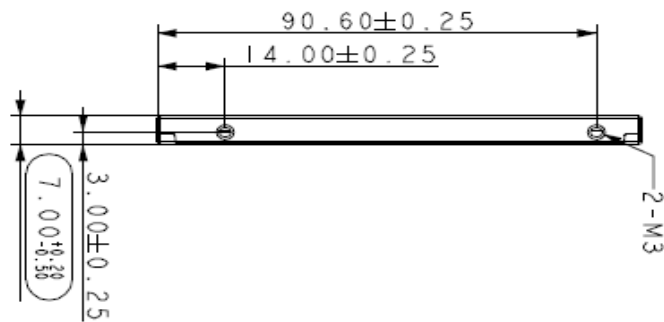
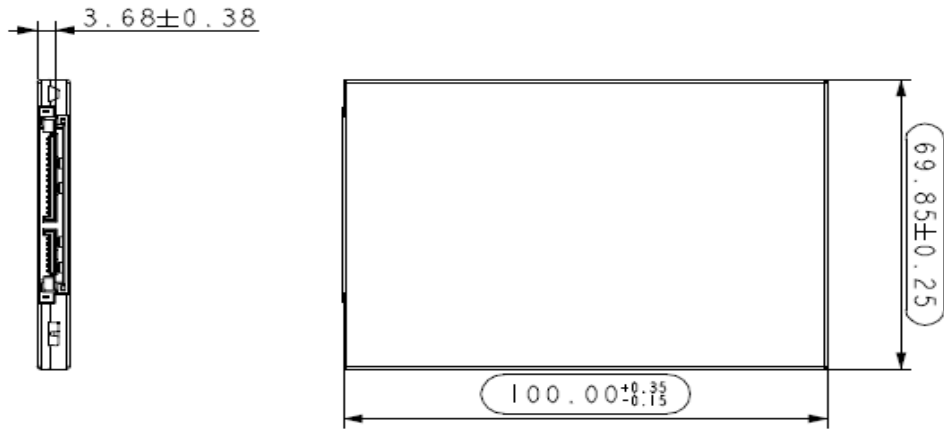
The Quick Erase is a special feature to allow users to erase user data of SSD by hardware trigger. When this feature is triggered by pin2 and pin3 short of pin header, the SSD controller will write all "0x00" to wipe all the data except firmware area, and the SSD will return to its factory default setting. This feature is particularly useful for emergent circumstances to quickly erase user data.



7. PHYSICAL DIMENSION



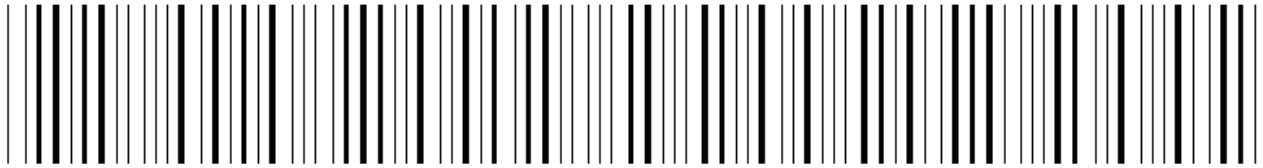
Dimension: 100.10mm(L) x 69.85mm(W) x 7.00mm(H)



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8. BARCODE DESCRIPTION



H F 3 2 5 M D 9 6 0 G B A 4 U



9. PARTNUMBER DECODER

HF3-25MDX⁸X⁹X¹⁰X¹¹X¹²X¹³X¹⁴X¹⁵X¹⁶X¹⁷

X ¹ X ² X ³	X ⁴ X ⁵	X ⁶ X ⁷	X ⁸ X ⁹ X ¹⁰ X ¹¹ X ¹²	X ¹³	X ¹⁴	X ¹⁵	X ¹⁶ X ¹⁷
HF3	25	MD	060GB 120GB 240GB 480GB 960GB	A: 3D TLC Standard (0°C ~ +70°C)	4	U	

X¹⁶X¹⁷

Blank: standard

01: Write Protection (WP)

03: Quick Erase Jumper (QEJ)

06: Conformal Coating (CC)

07: CC + WP

09: CC + QEJ

33: Power Loss Protection Lite (PLP Lite)