innodisk

Total Solution For Industrial Flash Storage

2.5" SATA SSD

3ME Series

Customer: _____

Customer Part Number: _____

Innodisk Part Number: _____

Innodisk Model Name: _____

Date: _____

Innodisk Approver	Customer Approver

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REVISION HISTORY

Revision	Description	Date
Preliminary	First Released	May, 2013
Rev. 1.0	Add CE/FCC certifications	June, 2013
Rev. 1.1	1. Add RoHS declaration 2. Add power consumption	July, 2013

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1. Product Overview

1.1 Introduction of InnoDisk 2.5” SATA SSD 3ME

Innodisk 2.5” SATA SSD 3ME products provide high capacity flash memory Solid State Drive (SSD) that electrically complies with Serial ATA (SATA) standard. It supports SATA III standard (6.0GHz) with high performance. Innodisk 2.5” SATA SSD 3ME is designed for industrial field, and supports several standard features, including NCQ, and S.M.A.R.T. The SSD have good performance, no latency time and small seek time. It effectively reduces the booting time of operation system and the power consumption is less than hard disk drive (HDD).

1.2 Product View and Models

Innodisk 2.5” SATA SSD 3ME is available in follow capacities:

2.5” SATA SSD 3ME 8GB
2.5” SATA SSD 3ME 16GB
2.5” SATA SSD 3ME 32GB
2.5” SATA SSD 3ME 64GB
2.5” SATA SSD 3ME 128GB
2.5” SATA SSD 3ME 256GB

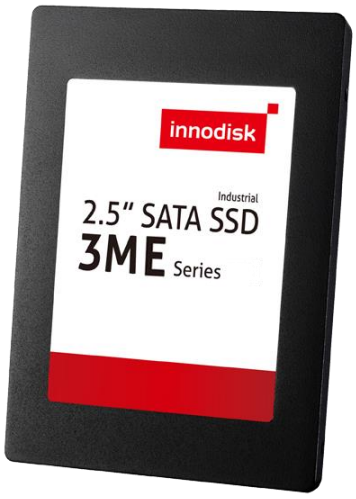


Figure 1: Innodisk 2.5” SATA SSD 3ME

1.3 SATA Interface

Innodisk 2.5” SATA SSD 3ME supports SATA III interface, and compliant with SATA I and SATA II. SATA III interface can work with Serial Attached SCSI (SAS) host system, which is used in server computer. Innodisk 2.5” SATA SSD 3ME is compliant with Serial ATA Gen 1, Gen 2 and Gen 3 specification (Gen 3 supports 1.5Gbps /3.0Gbps/6.0Gbps data rate). SATA connector uses a 7-pin signal segment and a 15-pin power segment.

1.4 2.5-inch Form Factor

The Industry-standard 2.5-inch form factor design with metal material case is easy for installation because 2.5-inch is a popular form factor in industrial field. 2.5-inch is most laptop’s hard disk’s form factor. Innodisk 2.5” SATA SSD 3ME can easy install in laptop. Innodisk 2.5” SATA SSD 3ME has a compact design 70mm (W) x100.0mm (L) x 6.8mm (H).

2. Product Specifications

2.1 Capacity and Device Parameters

2.5" SATA SSD 3ME device parameters are shown in Table 1.

Table 1: Device parameters

Capacity	LBA	Cylinders	Heads	Sectors	User Capacity(MB)
8GB	15649200	13587	16	63	7641
16GB	31277232	16383	16	63	15272
32GB	62533296	16383	16	63	30533
64GB	125045424	16383	16	63	61057
128GB	250069680	16383	16	63	122104
256GB	500118192	16383	16	63	244193

2.2 Performance

Burst Transfer Rate: 6.0Gbps

Table 2: Performance

Capacity	8GB	16GB	32GB	64GB	128GB	256GB
Sequential Read (max.)	120MB/sec	240 MB/sec	460MB/sec	460 MB/sec	460 MB/sec	460 MB/sec
Sequential Write (max.)	15 MB/sec	40 MB/sec	77 MB/sec	160 MB/sec	165 MB/sec	240 MB/sec

Note: Base on CrystalDiskMark 3.01 with file size 1000MB

2.3 Electrical Specifications

2.3.1 Power Requirement

Table 3: InnoDisk 2.5" SATA SSD 3ME Power Requirement

Item	Symbol	Rating	Unit
Input voltage	V_{IN}	+5 DC +- 5%	V

2.3.2 Power Consumption

Table 4: Power Consumption

Mode	Power Consumption (mA)
Read	160 (max.)
Write	428 (max.)
Idle	80 (max.)

* Target: 2.5" SATA SSD 3ME 256GB

2.4 Environmental Specifications

2.4.1 Temperature Ranges

Table 5: Temperature range for 2.5" SATA SSD 3ME

Temperature	Range
Operating	Standard Grade: 0°C to +70°C
	Industrial Grade:-40°C to +85°C
Storage	-55°C to +95°C

2.4.2 Humidity

Relative Humidity: 10-95%, non-condensing

2.4.3 Shock and Vibration

Table 6: Shock/Vibration Testing for 2.5" SATA SSD 3ME

Reliability	Test Conditions	Reference Standards
Vibration	7 Hz to 2K Hz, 20G, 3 axes	IEC 68-2-6
Mechanical Shock	Duration: 0.5ms, 1500 G, 3 axes	IEC 68-2-27

2.4.4 Mean Time between Failures (MTBF)

Table 7 summarizes the MTBF prediction results for various 2.5" SATA SSD 3ME configurations. The analysis was performed using a RAM Commander™ failure rate prediction.

- **Failure Rate**: The total number of failures within an item population, divided by the total number of life units expended by that population, during a particular measurement interval under stated condition.
- **Mean Time between Failures (MTBF)**: A basic measure of reliability for repairable items: The mean number of life units during which all parts of the item perform within their specified limits, during a particular measurement interval under stated conditions.

Table 7: 2.5" SATA SSD 3ME MTBF

Product	Condition	MTBF (Hours)
Innodisk 2.5" SATA SSD 3ME	Telcordia SR-332 GB, 25°C	>3,000,000

2.5 CE and FCC Compatibility

2.5” SATA SSD 3ME conforms to CE and FCC requirements.

2.6 RoHS Compliance

2.5” SATA SSD 3ME is fully compliant with RoHS directive.

2.7 Reliability

Parameter	Value
Read Cycles	Unlimited Read Cycles
Wear-Leveling Algorithm	Support
Bad Blocks Management	Support
Error Correct Code	Support
Flash endurance	3000 P/E cycles
TBW(Sequential Write)	
16GB	43.2
32GB	86.2
64GB	172.8
128GB	345.6
256GB	691.2

2.8 Transfer Mode

2.5” SATA SSD 3ME support following transfer mode:

Serial ATA III 6.0Gbps

Serial ATA II 3.0Gbps

Serial ATA I 1.5Gbps

2.9 Pin Assignment

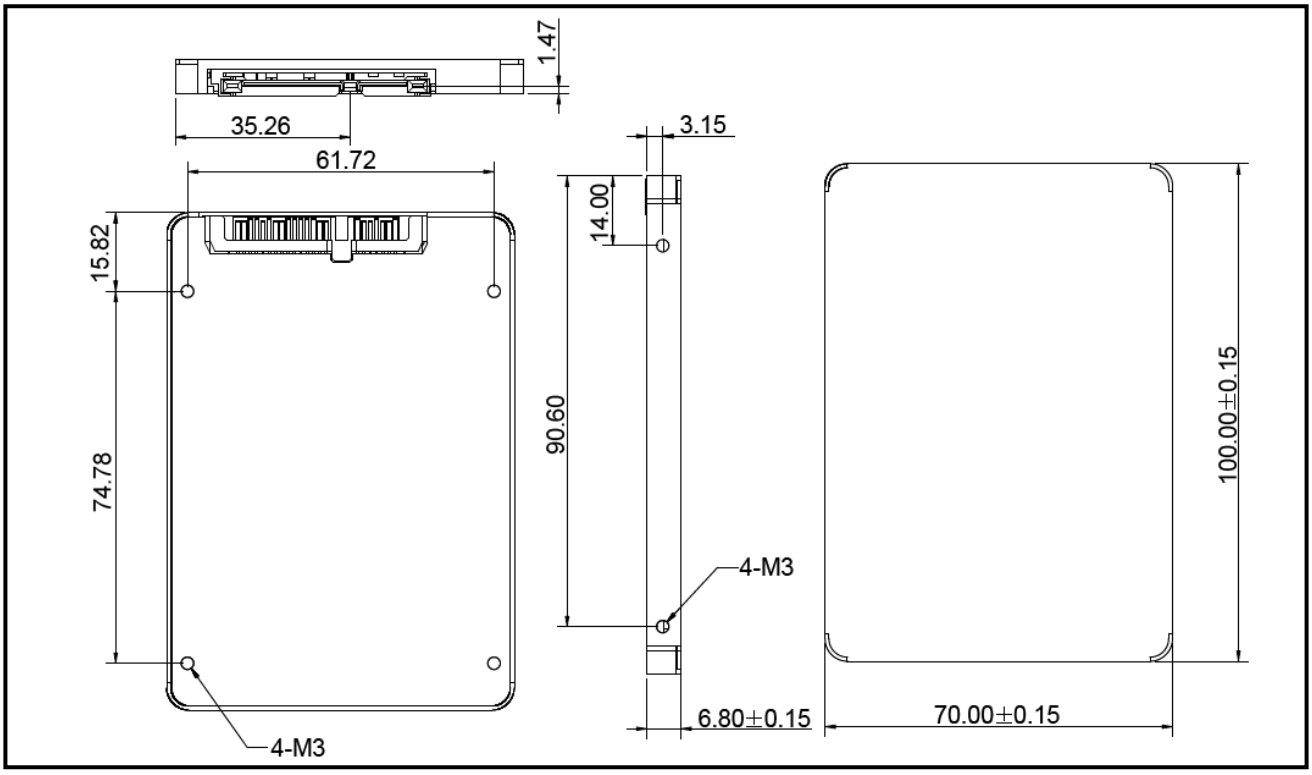
Innodisk 2.5” SATA SSD 3ME uses a standard SATA pin-out. See Table 8 for 2.5” SATA SSD 3ME pin assignment.

Table 8: InnoDisk 2.5” SATA SSD 3ME Pin Assignment

Name	Type	Description
S1	GND	NA
S2	A+	Differential Signal Pair A
S3	A-	
S4	GND	NA
S5	B-	Differential Signal Pair B
S6	B+	
S7	GND	NA
Key and Spacing separate signal and power segments		

P1	NC	NA
P2	NC	NA
P3	NC	NA
P4	GND	NA
P5	GND	NA
P6	GND	NA
P7	V5	5V Power, Pre-Charge
P8	V5	5V Power
P9	V5	5V Power
P10	GND	NA
P11	DAS/DSS	Device Activity Signal / Disable Staggered
P12	GND	NA
P13	NC	NA
P14	NC	NA
P15	NC	NA

2.10 Mechanical Dimensions



2.11 Assembly Weight

An Innodisk2.5” SATA SSD 3ME within MLC flash ICs, 16GB’s weight is 100 grams approx. The total weight of SSD will be less than 135 grams.

2.12 Seek Time

Innodisk 2.5” SATA SSD 3ME is not a magnetic rotating design. There is no seek or rotational latency required.

2.13 Hot Plug

The SSD support hot plug function and can be removed or plugged-in during operation. User has to avoid hot plugging the SSD which is configured as boot device and installed operation system.

Surprise hot plug : The insertion of a SATA device into a backplane (combine signal and power) that has power present. The device powers up and initiates an OOB sequence.

Surprise hot removal: The removal of a SATA device from a powered backplane, without first being placed in a quiescent state.

2.14 NAND Flash Memory

Innodisk 2.5” SATA SSD 3ME uses Multi Level Cell (MLC) NAND flash memory, which is non-volatility, high reliability and high speed memory storage.

3. Theory of Operation

3.1 Overview

Figure 2 shows the operation of Innodisk 2.5” SATA SSD 3ME from the system level, including the major hardware blocks.

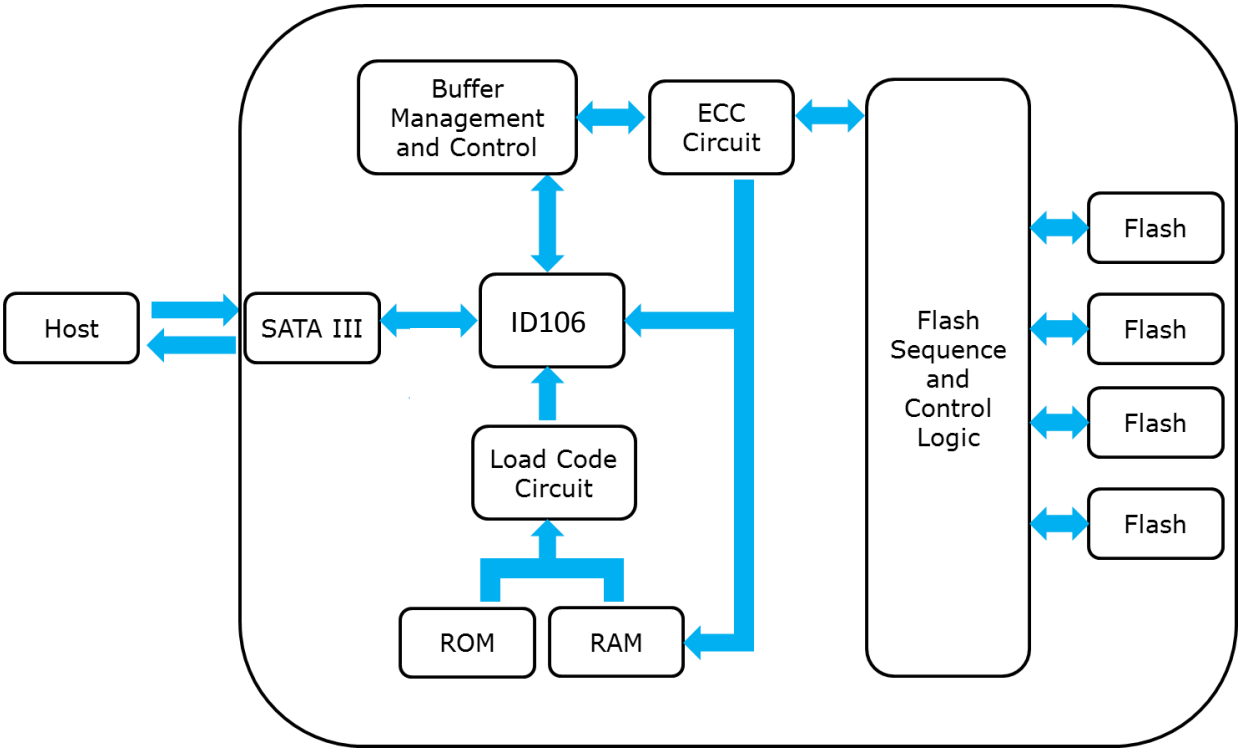


Figure 2: Innodisk FiD 2.5” SATA SSD 3ME Block Diagram

Innodisk 2.5” SATA SSD 3ME integrates a SATA III controller and NAND flash memories. Communication with the host occurs through the host interface, using the standard ATA protocol. Communication with the flash device(s) occurs through the flash interface.

3.2 SATA III Controller

Innodisk 2.5” SATA SSD 3ME is designed with ID 106, a SATA III 6.0Gbps (Gen. 3) controller, which supports external DDDR3 DRAM. The Serial ATA physical, link and transport layers are compliant with Serial ATA Gen 1, Gen 2 and Gen 3 specification (Gen 3 supports 1.5Gbps/3.0Gbps/6.0Gbps data rate). The controller has 4 channels for flash interface.

3.3 Error Detection and Correction

Highly sophisticated Error Correction Code algorithms are implemented. The ECC unit consists of the Parity Unit (parity-byte generation) and the Syndrome Unit (syndrome-byte computation). This unit implements an algorithm that can correct 40 bits per 1024 bytes in an ECC block. Code-byte generation during write operations, as well as error detection during read operation, is implemented on the fly without any speed penalties.

3.4 Wear-Leveling

Flash memory can be erased within a limited number of times. This number is called the ***erase cycle limit*** or ***write endurance limit*** and is defined by the flash array vendor. The erase cycle limit applies to each individual erase block in the flash device.

Innodisk 2.5” SATA SSD 3ME uses a static wear-leveling algorithm to ensure that consecutive writes of a specific sector are not written physically to the same page/block in the flash. This spreads flash media usage evenly across all pages, thereby extending flash lifetime.

3.5 Bad Blocks Management

Bad Blocks are blocks that contain one or more invalid bits whose reliability are not guaranteed. The Bad Blocks may be presented while the SSD is shipped, or may develop during the life time of the SSD. When the Bad Blocks is detected, it will be flagged, and not be used anymore. The SSD implement Bad Blocks management, Bad Blocks replacement, Error Correct Code to avoid data error occurred. The functions will be enabled automatically to transfer data from Bad Blocks to spare blocks, and correct error bit.

3.6 Power Cycling

Innodisk’s power cycling management is a comprehensive data protection mechanism that functions before and after a sudden power outage to SSD. Low-power detection terminates data writing before an abnormal power-off, while table-remapping after power-on deletes corrupt data and maintains data integrity. Innodisk’s power cycling provides effective power cycling management, preventing data stored in flash from degrading with use.

3.7 Garbage Collection

Garbage collection technology is used to maintain data consistency and perform continual data cleansing on SSDs. It runs as a background process, freeing up valuable controller resources while sorting good data into available blocks, and deleting bad blocks. It also significantly reduces write operations to the drive, thereby increasing the SSD’s speed and lifespan.

4. Installation Requirements

4.1 2.5” SATA SSD 3ME Pin Directions

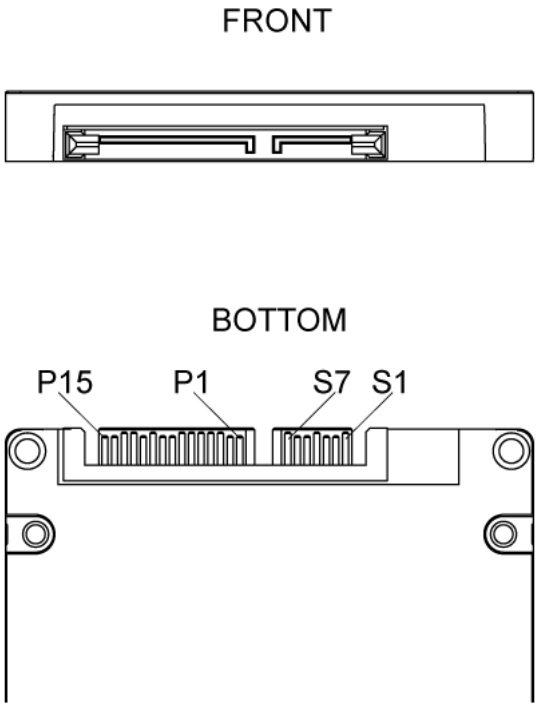


Figure 3: Signal Segment and Power Segment

4.2 Electrical Connections for 2.5” SATA SSD 3ME

A Serial ATA device may be either directly connected to a host or connected to a host through a cable. For connection via cable, the cable should be no longer than 1meter. The SATA interface has a separate connector for the power supply. Please refer to the pin description for further details.

4.3 Form Factor

Please prepare following things:

- Screw driver.
- Four M3 screws.
- SATA single cable (7-pin, Maximum length l meter).
- SATA power cable (15-pin).

Please turn off your computer, and open your computer’s case. Find one of available 2.5-inch slot, and plug the SSD in. To use the screws fix the SSD. Plug in the SATA single cable, and power cable. Please boot the installation Operation System from CD-ROM, and install Operation System into SSD.

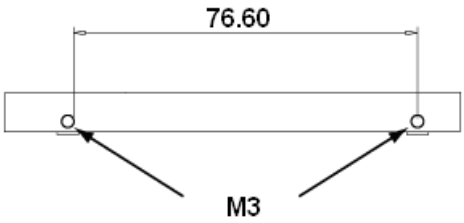


Figure 4: 2.5” SATA SSD 3ME Mechanical Screw Hole

4.4 Device Drive

No additional device drives are required. Innodisk 2.5” SATA SSD 3ME can be configured as a boot device.

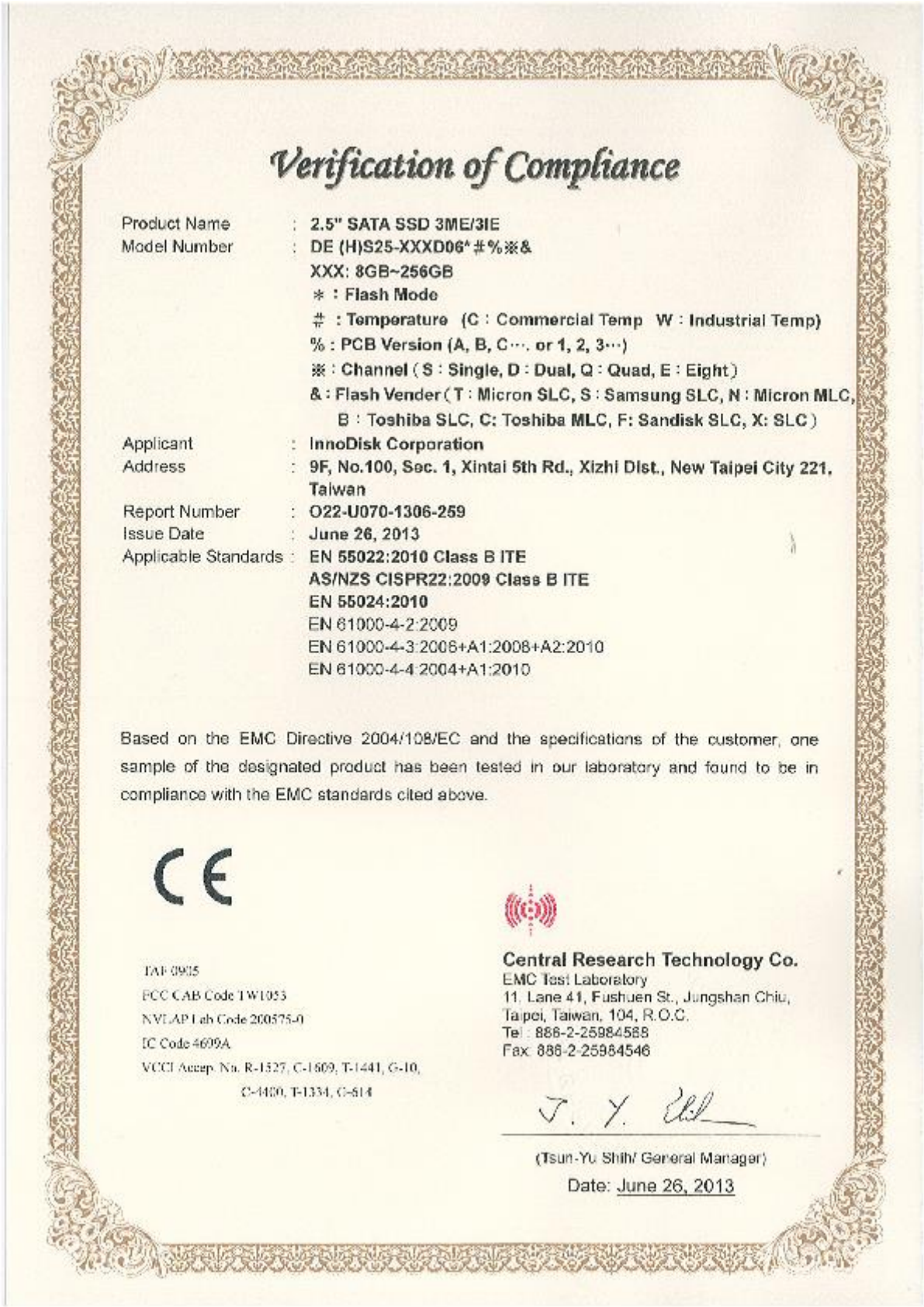
5. Part Number Rule

CODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	D	**E**	**S**	**2**	**5**	**-**	**3**	**2**	**G**	**D**	**0**	**6**	**S**	**C**	**1**	**Q**	**C**	**-**	**X**	**X**
Description	Disk	2.5” SATA SSD 3ME					Capacity			Category			Flash Mode	Operation Temp.	Internal Control	CH.	Flash	-	Customized Code	

Definition	
Code 1st (Disk)	**Code 13th (Firmware version)**
D : Disk	S: Synchronous Flash
Code 2nd	**Code 14th (Operation Temperature)**
E: Embedded	C: Standard Grade (0℃~ +70℃)
	W: Industrial Grade (-40℃~ +85℃)
Code 3rd ~ 5th (Form Factor)	
S25:2.5” SSD	**Code 15th (Internal control)**
	Code 16th (Channel of data transfer)
Code 7th ~9th (Capacity)	S: Single Channel
08G: 8GB	D: Dual Channels
16G: 16GB	Q: Quad Channels
32G: 32GB	
64G: 64GB	**Code 17th (Flash Type)**
A28: 128GB	C: Toshiba MLC
B56: 256GB	
	Code 19th~20th (Customized Code)
Code 10th ~12th (Series)	
D06: 2.5” SATA SSD 3ME	

6. Appendix

CE/FCC/RoHS (TBD)



Verification of Compliance

Product Name	:	2.5" SATA SSD 3ME/3IE
Model Number	:	DE (H)S25-XXXD06*#%※&
		XXX: 8GB~256GB
		* : Flash Mode
		# : Temperature (C : Commercial Temp W : Industrial Temp)
		% : PCB Version (A, B, C…. or 1, 2, 3…)
		※ : Channel (S : Single, D : Dual, Q : Quad, E : Eight)
		& : Flash Vender (T : Micron SLC, S : Samsung SLC, N : Micron MLC, B : Toshiba SLC, C: Toshiba MLC, F: Sandisk SLC, X: SLC)
Applicant	:	InnoDisk Corporation
Address	:	9F, No.100, Sec. 1, Xintai 5th Rd., Xizhi Dist., New Taipei City 221, Taiwan
Report Number	:	O22-U070-1306-259
Issue Date	:	June 26, 2013
Applicable Standards	:	EN 55022:2010 Class B ITE
		AS/NZS CISPR22:2009 Class B ITE
		EN 55024:2010
		EN 61000-4-2:2009
		EN 61000-4-3:2006+A1:2008+A2:2010
		EN 61000-4-4:2004+A1:2010

Based on the EMC Directive 2004/108/EC and the specifications of the customer, one sample of the designated product has been tested in our laboratory and found to be in compliance with the EMC standards cited above.

CE

TAF 0905
FCC CAB Code TW1053
NVLAP Lab Code 200575-0
IC Code 4609A
VCCI Accep. No. R-1527, C-1609, T-1441, G-10, G-4400, T-1334, G-614

Central Research Technology Co.
EMC Test Laboratory
11, Lane 41, Fushuen St., Jungshan Chiu, Taipei, Taiwan, 104, R.O.C.
Tel : 886-2-25984588
Fax: 886-2-25984546

(Tsun-Yu Shih/ General Manager)
Date: June 26, 2013

Verification of Compliance

Product Name	:	2.5" SATA SSD 3ME/3IE
Model Number	:	DE (H)S25-XXXD06*#%※&
		XXX: 8GB~256GB
		* : Flash Mode
		# : Temperature (C : Commercial Temp W : Industrial Temp)
		% : PCB Version (A, B, C…. or 1, 2, 3…)
		※ : Channel (S : Single, D : Dual, Q : Quad, E : Eight)
		& : Flash Vender (T : Micron SLC, S : Samsung SLC, N : Micron MLC, B : Toshiba SLC, C: Toshiba MLC, F: Sandisk SLC, X: SLC)
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Report Number	:	F-U070-1306-259
Issue Date	:	June 26, 2013
Applicable Standards	:	FCC Part 15, Subpart B Class B ITE ANSI C63.4:2009 Industry Canada ICES-003 Issue 5 CSA-IEC CISPR22-10 Class B ITE

One sample of the designated product has been tested in our laboratory and found to be in compliance with the FCC rules cited above.

NVLAP LAB CODE 200575-0

TAF 0905

FCC CAB Code TW1053

IC Code 4699A

VCCI Accep. No. R-1527, C-1609, T-1441, G-13, G-4408, T-1334, G-614

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(Tsun-Yu Shih/ General Manager)

Date: June 26, 2013

innodisk

宜鼎國際股份有限公司

Tel:(02)2696-3000 Fax:(02)2696-2000 Internet http://www.innodisk.com/

RoHS 自我宣告書(RoHS Declaration of Conformity)

Model Name : 2.5" SATA SSD 3ME / 3IE Series

P/N : DE(ID)S25-XXXD06＊＃%※&

XXX: 08G~B56(256G)

＊:Flash Mode

＃:Temperature(C:Commercial Temp W:Industrial Temp)

%:PCB Version (A B C...or 1 2 3...)

※:Channel (S:Single,D:Dual,Q:Quad,E:Eight)

&:Flash Vendor (T:Micron SLC,S:Samsung SLC,N:Micron MLC,R:Toshiba SLC,C:Toshiba MLC,F:Sandisk SLC,X:SLC)

一、 宜鼎國際股份有限公司（以下稱本公司）特此保證售予貴公司之所有產品，皆符合歐盟 2011/65/EU 關於 RoHS 之規範要求。

InnoDisk Corporation declares that all products sold to the company, are complied with European Union RoHS Directive (2011/65/EU) requirement

二、 本公司同意因本保證書或與本保證書相關事宜有所爭議時，雙方宜友好協商，達成圓滿。

InnoDisk Corporation agrees that both parties shall settle any dispute arising from or in connection with this Declaration of Conformity by friendly negotiations.

Name of hazardous substance	Limited of RoHS ppm (mg/kg)
Cd	< 100 ppm
Pb	< 1000 ppm
Hg	< 1000 ppm
Chromium VI (Cr+6)	< 1000 ppm
Polybromodiphenyl ether (PBDE)	< 1000 ppm
Polybrominated Biphenyls (PBB)	< 1000 ppm

立 保 證 書 人

Company name 公司名稱： **InnoDisk Corporation 宜鼎國際股份有限公司**

Company Representative 公司代表人： Richard Lee 李錫光

Company Representative Title 公司代表人職稱： CEO 執行長

Date 日期： 2013 / 07 / 01

(Company Stamp/公司大小章)