2.5" SATA SSD
3SE-P 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	Modify ME dimension Update 16GB/32GB performance Add power consumption	Aug., 2013
Rev 1.1	Modify 8GB/256GB performance	Sep., 2013
Rev 1.2	Update LBA	Nov., 2013
Rev 1.3	Modify Part Number rule Add CE/FCC	Jan., 2014
Rev 1.4	Update all capacity performance Update power consumption	Apr., 2014
Rev 1.5	Modify TBW based on NAND Flash specifications	Jan., 2015
Rev 1.6	Update ME drawing	Jul., 2015
Rev 1.7	Update part number rule Add icell function (optional)	Dec., 2015

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1. Product Overview

1.1 Introduction of InnoDisk 2.5″ SATA SSD 3SE-P

Innodisk 2.5″ SATA SSD 3SE-P 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 3SE-P delivers sustain read speeds of up to 470MB/s and sustain write speeds of up to 340 MB/s. Except sequential read/ write performance, Innodisk 2.5″ SATA SSD 3SE-P also enhances random data access for small files. Furthermore, Innodisk 2.5″ SATA SSD 3SE-P supports TRIM for windows 7, it can improves performance when deleting files. It designed with standard 2.5-inch form factor, which can be used in laptop. Innodisk 2.5″ SATA SSD 3SE-P is designed for industrial field. 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). Innodisk 2.5″ SATA SSD 3SE-P can work in harsh environment. The SSD is vibration resistance, and can work in lower or higher temperature than HDD. Innodisk 2.5″ SATA SSD 3SE-P complies with ATA protocol, no additional drives are required, and the SSD can be configured as a boot device or data storage device.

1.2 Product View and Models

Innodisk 2.5″ SATA SSD 3SE-P is available in follow capacities within SLC flash ICs.

2.5″ SATA SSD 3SE-P 8GB   2.5″ SATA SSD 3SE-P 64GB
2.5″ SATA SSD 3SE-P 16GB   2.5″ SATA SSD 3SE-P 128GB
2.5″ SATA SSD 3SE-P 32GB   2.5″ SATA SSD 3SE-P 256GB

Figure 1: Innodisk 2.5″ SATA SSD 3SE-P

1.3 SATA Interface

Innodisk 2.5" SATA SSD 3SE-P 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 3SE-P 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 3SE-P can easy install in laptop. Innodisk 2.5" SATA SSD 3SE-P has a compact design 69.85mm (W) x99.85mm (L) x 9.20mm (H).

2. Product Specifications

2.1 Capacity and Device Parameters

2.5" SATA SSD 3SE-P device parameters are shown in Table 1.

Table 1: Device parameters

Capacity	LBA	Cylinders	Heads	Sectors	User Capacity(MB)
8GB	13695696	13587	16	63	6,687
16GB	29323728	16383	16	63	14,318
32GB	60579792	16383	16	63	29,580
64GB	121138416	16383	16	63	59,150
128GB	242255664	16383	16	63	118,289
256GB	484490160	16383	16	63	236,568

2.2 Performance

Burst Transfer Rate: 6.0Gbps

Table 2: Performance

Capacity	8GB	16GB	32GB	64GB	128GB	256GB
Sequential Read (max.)	400 MB/sec	490 MB/sec	470 MB/sec	470 MB/sec	470 MB/sec	470 MB/sec
Sequential Write (max.)	120 MB/sec	210 MB/sec	240 MB/sec	300 MB/sec	340 MB/sec	340 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 3SE-P 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	415 (max.)
Write	630 (max.)
Idle	193 (max.)

* Target: 2.5: SATA SSD 3SE-P 256GB

2.4 Environmental Specifications

2.4.1 Temperature Ranges

Table 5: Temperature range for 2.5″ SATA SSD 3SE-P

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 3SE-P

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 3SE-P 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 3SE-P MTBF

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

2.5 CE and FCC Compatibility

2.5" SATA SSD 3SE-P conforms to CE and FCC requirements.

2.6 RoHS Compliance

2.5" SATA SSD 3SE-P 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
TBW (Unit: TB)	
8GB	432 (Sequential Write)
16GB	864 (Sequential Write)
32GB	1728 (Sequential Write)
64GB	3456 (Sequential Write)
128GB	6912 (Sequential Write)
256GB	13824 (Sequential Write)

2.8 Transfer Mode

2.5" SATA SSD 3SE-P 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 3SE-P uses a standard SATA pin-out. See Table 8 for 2.5" SATA SSD 3SE-P pin assignment.

Table 8: InnoDisk 2.5" SATA SSD 3SE-P 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
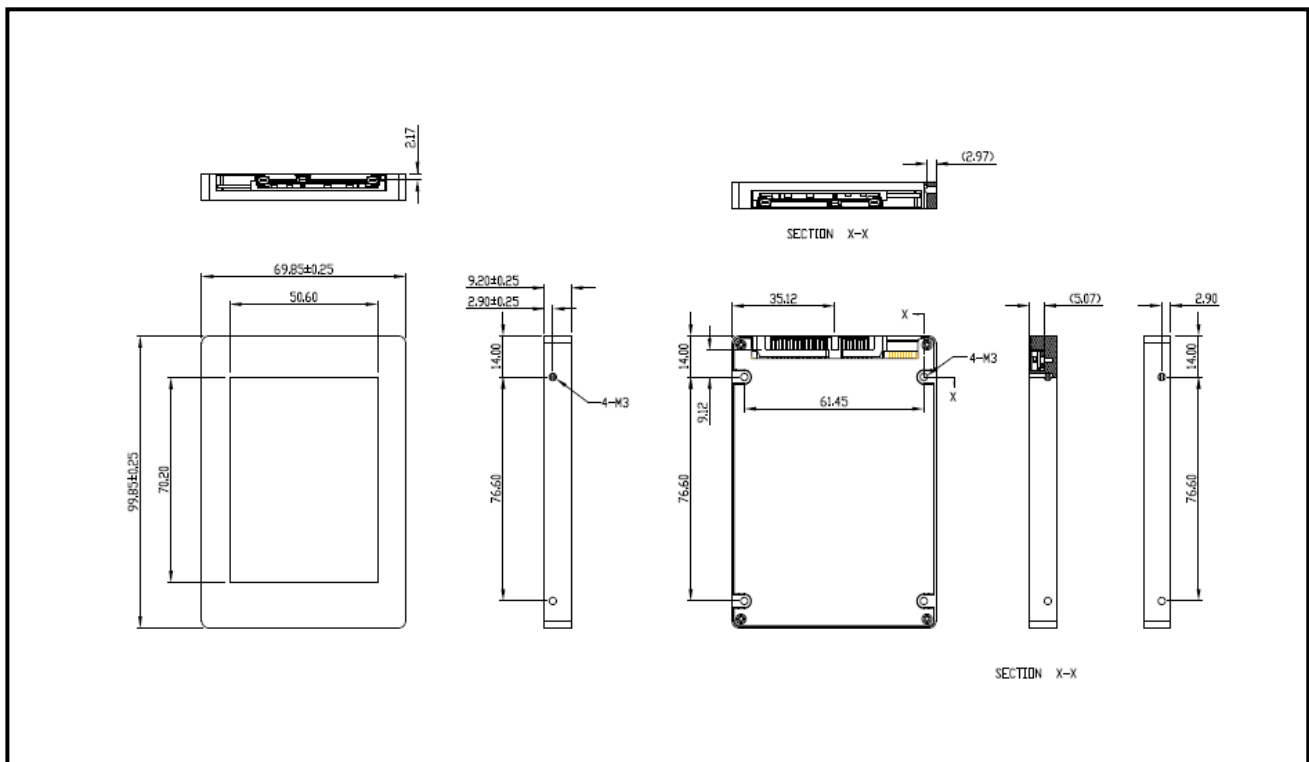
2.11 Assembly Weight

An Innodisk 2.5" SATA SSD 3SE-P within SLC 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 3SE-P 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 3SE-P uses Single Level Cell (SLC) NAND flash memory, which is non-volatility, high reliability and high speed memory storage. There are only two statuses 0 or 1 of one cell. Read or Write data to flash memory for SSD is control by microprocessor.

3. Theory of Operation

3.1 Overview

Figure 2 shows the operation of Innodisk 2.5″ SATA SSD 3SE-P from the system level, including the major hardware blocks.
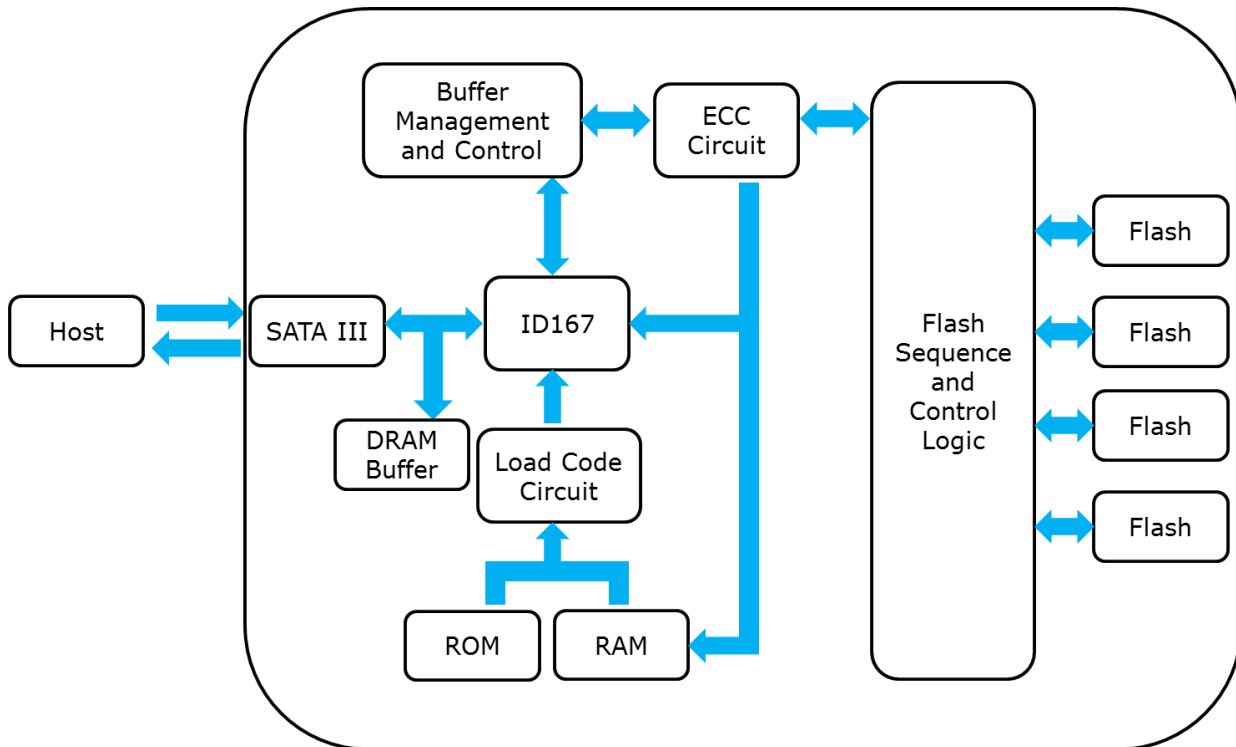

Figure 2: Innodisk FiD 2.5″ SATA SSD 3SE-P Block Diagram

Innodisk 2.5″ SATA SSD 3SE-P 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 3SE-P is designed with ID 167, 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 3SE-P 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/TRIM

Garbage collection and TRIM 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.

3.8 iCell Technology (Optional)

iCell circuit is designed with several capacitors to be able to provide power after host power off. The SSD controller can write all DRAM buffer data to flash, so that is why 2.5″ SATA SSD 3SE-P can ensure all data can be written to disk without any data loss.

4. Installation Requirements

4.1 2.5″ SATA SSD 3SE-P Pin Directions

Figure 3: Signal Segment and Power Segment
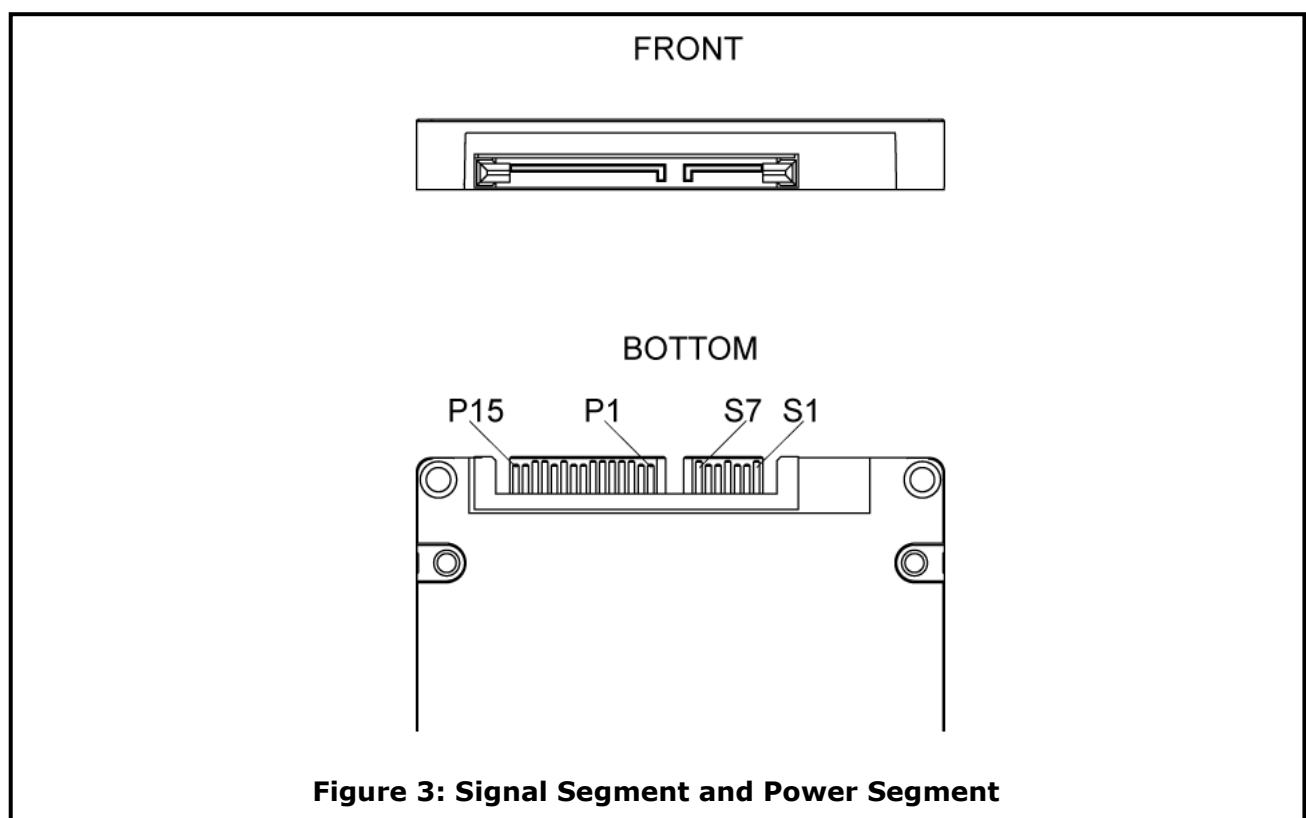
4.2 Electrical Connections for 2.5″ SATA SSD 3SE-P

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.
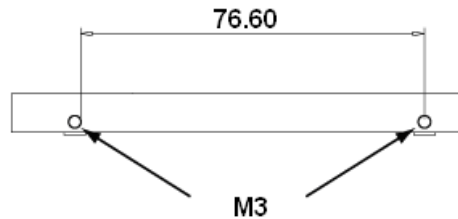

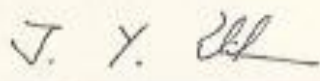**Figure 4: 2.5″ SATA SSD 3SE-P Mechanical Screw Hole**

4.4 Device Drive

No additional device drives are required. Innodisk 2.5″ SATA SSD 3SE-P 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	21
CODE	D	E	S	2	5	-	3	2	G	D	6	7	S	C	B	Q	B	(P)	-	X	X
Description	Disk	2.5″ SATA SSD 3SE-P					Capacity			Category			Flash Mode	Operation Temp.	Internal Control	CH.	Flash	iCell	-	Customized Code	

Definition	
Code 1st (Disk)	**Code 13th (Flash Mode)**
D : Disk	S: Synchronous Flash
Code 2nd ~ 5th (Form Factor)	**Code 14th (Operation Temperature)**
ES25: 2.5″ SATA SSD 3SE-P	C: Standard Grade (0℃~ +70℃)
Code 7th ~9th (Capacity)	W: Industrial Grade (-40℃~ +85℃)
08G: 8GB	**Code 15th (Internal control)**
16G: 16GB	**Code 16th (Channel of data transfer)**
32G: 32GB	Q: Quad Channels
64G: 64GB	**Code 17th (Flash Type)**
A28: 128GB	B: Toshiba SLC
B56: 256GB	**Code 18th (Flash Type)**
Code 10th ~12th (Series)	P: iCell (Optional)
D67: ID167	**Code 20th~21th (Customized Code)**

Appendix

Verification of Compliance

Product Name : 2.5" SATA SSD 3SE/3SE-P
Model Number : DES25-XXXD06*#%※&/DES25-XXXD67*#%※&
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,
　　M : Samsung MLC, N : Micron MLC, B : Toshiba SLC,
　　C: Toshiba MLC)
Applicant : Innodisk Corporation
Address : 9F, No.100, Sec. 1, Xintai 5th Rd., Xizhi Dist., New Taipei City 221, Taiwan
Report Number : O22-U070-1309-208
Issue Date : October 3, 2013
Applicable Standards : EN 55022:2010+AC:2011 Class B ITE
AS/NZS CISPR22:2009+A1:2010 Class B ITE
EN 55024:2010
EN 61000-4-2:2009
EN 61000-4-3:2006+A1:2008+A2:2010
EN 61000-4-4:2012

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 4699A
VCCI Accep. No. R-1527, C-1609, T-1441, G-10, C-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 : 886-2-25984568
Fax: 886-2-25984546

(Tsun-Yu Shih/ General Manager)
Date: October 3, 2013

Verification of Compliance

Product Name : **2.5" SATA SSD 3SE/3SE-P**
Model Number : **DES25-XXXD06*＃%※&/DES25-XXXD67*＃%※&**
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,
　　M：Samsung MLC,N：Micron MLC, B：Toshiba SLC,
　　C: Toshiba MLC）
Applicant : **Innodisk Corporation**
Address : **9F, No.100, Sec. 1, Xintai 5th Rd., Xizhi Dist., New Taipei City 221, Taiwan**
Report Number : **F-U070-1309-208**
Issue Date : **October 3, 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-10,
C-4400, T-1334, G-614

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Taipei, Taiwan, 104, R.O.C.
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Fax: 886-2-25984546

(Tsun-Yu Shih/ General Manager)

Date: October 3, 2013

innodisk

宜鼎國際股份有限公司
Innodisk Corporation

Tel:(02)7703-3000 Fax:(02) 7703-3555 Internet: http://www.innodisk.com/

RoHS 自我宣告書(RoHS Declaration of Conformity)

Manufacturer Product: All Innodisk EM Flash and Dram products

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，達成協議。

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 （Guarantor）

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 李鐘亮

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

Date 日期： 2014 / 07 / 29

(Company Stamp/公司大小章)

Innodisk

宜鼎國際股份有限公司
Innodisk Corporation

Tel:(02)7703-3000 Fax:(02) 7703-3555 Internet: http://www.innodisk.com/

REACH Declaration of Conformity

Manufacturer Product: All Innodisk EM Flash and Dram products

1.宜鼎國際股份有限公司（以下稱本公司）特此保證此售予貴公司之產品，皆符合歐盟化學品

法案(Registration , Evaluation and Authorization of Chemicals；REACH)之規定

(http://www.echa.europa.eu/de/candidate-list-table   last updated: 16/06/2014)。所提供

之產品包含：(1) 產品或產品所使用到的所有原物料；(2)包裝材料；(3)設計、生產及重工過程

中所使用到的所有原物料。

We Innodisk Corporation hereby declare that our products are in compliance with the
requirements according to the REACH Regulation
(http://www.echa.europa.eu/de/candidate-list-table **last updated: 16/06/2014**).
Products include： 1) Product and raw material used by the product； 2) Packaging
material ；3) Raw material used in the process of design, production and rework

2.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，達成協議。

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

立 保 證 書 人 (Guarantor)

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 李鐘亮

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

Date 日期： 2014 / 07 / 29

(Company Stamp/公司大小章)