innodisk

Total Solution For
Industrial Flash Storage

2.5" PATA SSD

1SR-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	JAN., 2014
Rev. 1.0	1. Update block diagram 2. Update shock/vibration reliability test conditions/reference standards 3. Update part number decoder code 13th for flash type	APR., 2014
Rev. 1.1	Add K/T in 14th in part number rule	JUL., 2015
Rev 1.2	Add Quick Erase definition in Pin Assignment	JAN., 2016

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1. Product Overview

1.1 Introduction of Innodisk 2.5” PATA SSD 1SR-P

Innodisk 2.5” PATA SSD 1SR-P products provide high capacity 2.5” solid-state flash disk that electrically complies with ATA 7 standard, and supports Ultra DMA (0-5) and PIO (0-4) transfer modes.

2.5” PATA SSD 1SR-P is designed for industrial field, which has good performance, no latency time and small seek time. Especially, it comes with several data security functions, including QEraser/ SEraser/ Destroy and also Write Protect. All the security functions can be triggered both by hardware and software approaches. 2.5” PATA SSD 1SR-P is compliant with MIL-STD-810F/G standards. It effectively reduces the booting time of operation system and the power consumption is less than hard disk drive (HDD). 2.5” PATA SSD 1SR-P can work in harsh environment. It is vibration resistance, and can work in lower or higher temperature than HDD. 2.5” PATA SSD 1SR-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” PATA SSD 1SR-P is available in follow capacities:

2.5” PATA SSD 1SR-P 8GB
2.5” PATA SSD 1SR-P 16GB
2.5” PATA SSD 1SR-P 32GB
2.5” PATA SSD 1SR-P 64GB
2.5” PATA SSD 1SR-P 128GB
2.5” PATA SSD 1SR-P 256GB

Figure 1: Innodisk 2.5” PATA SSD 1SR-P

2. Product Specifications

2.1 Capacity and Device Parameters

2.5" PATA SSD 1SR-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	6687
16GB	29323728	16383	16	63	14318
32GB	60579792	16383	16	63	29579
64GB	125045424	16383	16	63	59149
128GB	242255664	16383	16	63	118288
256GB	484490160	16383	16	63	236567

2.2 Performance

Table 2: Performance

Capacity	8GB	16GB	32GB	64GB	128GB	256GB
Sequential Read (max.)	90 MB/sec	90 MB/sec	90 MB/sec	90 MB/sec	90 MB/sec	90 MB/sec
Sequential Write (max.)	70 MB/sec	70 MB/sec	70 MB/sec	90 MB/sec	90 MB/sec	90 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" PATA SSD 1SR-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	470 (max.)
Write	500 (max.)
Idle	280 (max.)

* Target: 2.5" PATA SSD 1SR-P 256GB

2.4 Environmental Specifications

2.4.1 Temperature Ranges

Table 5: Temperature range for 2.5" PATA SSD 1SR-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" PATA SSD 1SR-P

Reliability	Test Conditions	Reference Standards
Vibration	7 Hz to 2K Hz, 20G, 3 axes	IEC 68-2-6
	MIL-STD-810F Method 514.5	
Mechanical Shock	Duration: 0.5ms, 1500 G, 3 axes	IEC 68-2-27
	MIL-STD-810F, Method 516.5	

2.4.4 Mean Time between Failures (MTBF)

Table 7 summarizes the MTBF prediction results for various 2.5" PATA SSD 1SR-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" PATA SSD 1SR-P MTBF

Product	Condition	MTBF (Hours)
Innodisk 2.5" PATA SSD 1SR-P	Telcordia SR-332 GB, 25°C	>3,000,000

2.5 CE and FCC Compatibility

2.5” PATA SSD 1SR-P conforms to CE and FCC requirements.

2.6 RoHS Compliance

2.5” PATA SSD 1SR-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
Flash endurance	100,00 P/E cycles
TBW(Sequential Write)	
8GB	703
16GB	1,440
32GB	2,880
64GB	5,760
128GB	11,520
256GB	23,040

2.8 Transfer Mode

2.5” PATA SSD 1SR-P support following transfer mode:

- PIO Mode 0~4
- Ultra DMA 0~5

2.9 Pin Assignment

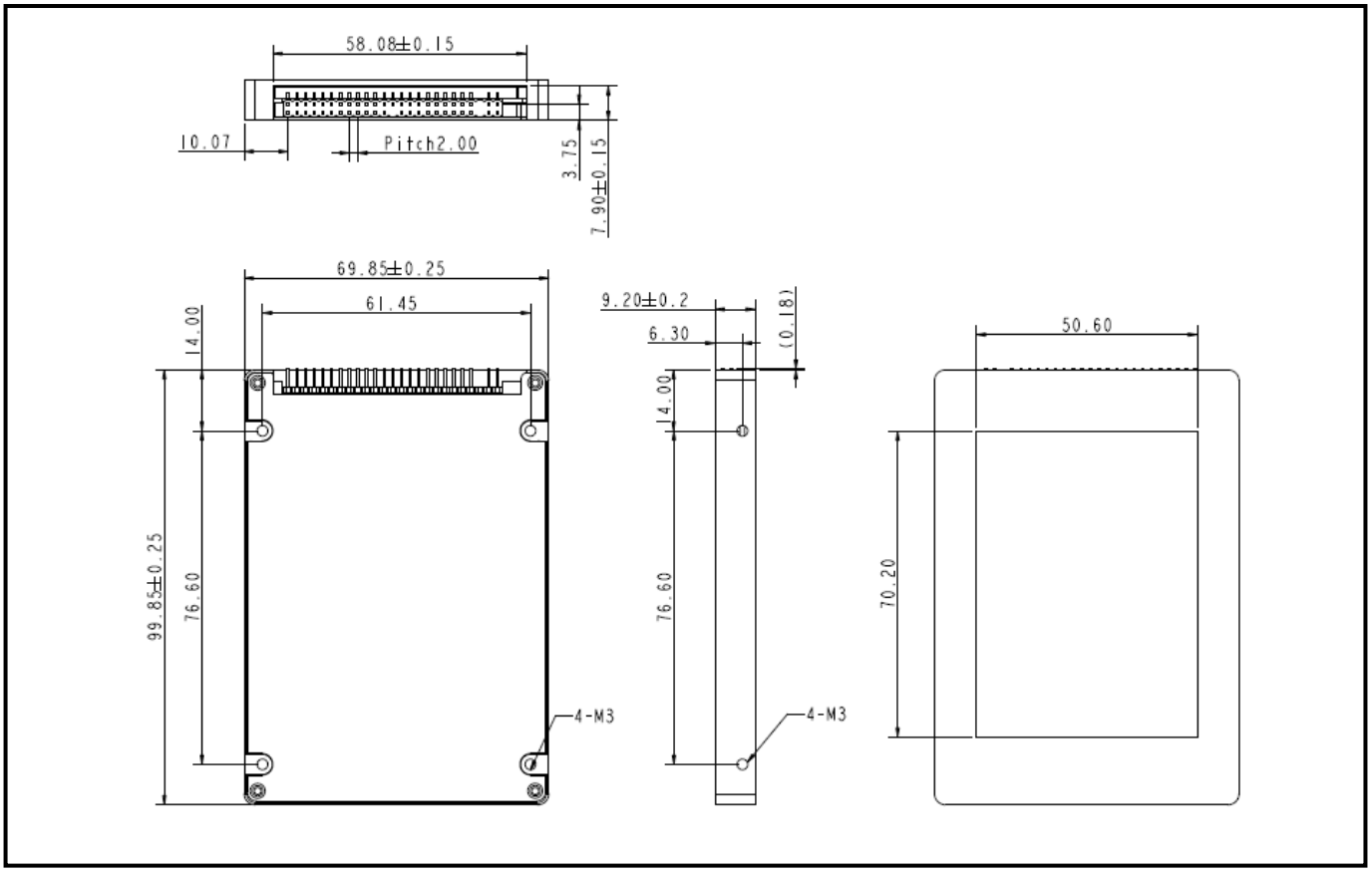
Innodisk 2.5” PATA SSD 1SR-P uses a standard ATA pin-out. See Table 8 for 2.5” PATA SSD 1SR-P pin assignment.

Table 8: Innodisk 2.5” PATA SSD 1SR-P Pin Assignment

Pin No.	Name	Function	Pin No.	Name	Function
1	HRESET	Host Reset	2	GND	Ground
3	HDB[7]	Host Data Bit 7	4	HDB[8]	Host Data Bit 8
5	HDB[6]	Host Data Bit 6	6	HDB[9]	Host Data Bit 9
7	HDB[5]	Host Data Bit 5	8	HDB[10]	Host Data Bit 10
9	HDB[4]	Host Data Bit 4	10	HDB[11]	Host Data Bit 11
11	HDB[3]	Host Data Bit 3	12	HDB[12]	Host Data Bit 12

13	HDB[2]	Host Data Bit 2	14	HDB[13]	Host Data Bit 13
15	HDB[1]	Host Data Bit 1	16	HDB[14]	Host Data Bit 14
17	HDB[0]	Host Data Bit 0	18	HDB[15]	Host Data Bit 15
19	GND	Ground	20	KEY	Key-pin
21	DMARQ	DMA Request	22	GND	Ground
23	HIOW[1] STOP[2]	Host I/O Write Stop Ultra DMA burst	24	GND	Ground
25	HIOR[1] HDMARDY[2] HSTROBE[2]	Host I/O Read Ultra DMA ready Ultra DMA data strobe	26	GND	Ground
27	IORDY[1] DDMARDY[2] DSTROBE[2]	I/O Ready Ultra DMA ready Ultra DMA data strobe	28	CSEL	Master/Slave Select
29	DMACK	DMA Acknowledge	30	GND	Ground
31	INTRQ	Interrupt Request	32	IOCS16	CS I/O 16-Bit
33	HAB[1]	Host Address Bit 1	34	PDIAG	Passed Diagnostic
35	HAB[0]	Host Address Bit 0	36	HAB[2]	Host Address Bit 2
37	CS0	Chip Select 0	38	CS1	Chip Select 1
39	DASP	Drive Active	40	GND	Ground
41	VCC	Supply Voltage	42	VCC	Supply Voltage
43	GND	Ground	44	NC	Not Connected
A	N/A	Master/Slave	B	N/A	Master/Slave
C	Security (GND)	Ground	D	Security	Quick Erase

2.10 Mechanical Dimensions



2.11 Assembly Weight

An Innodisk2.5” PATA SSD 1SR-P within SLC flash ICs, 8GB’s weight is 100 grams approx. The total weight of SSD will be less than 105 grams.

2.12 Seek Time

Innodisk 2.5” PATA SSD 1SR-P is not a magnetic rotating design. There is no seek or rotational latency required.

2.13 NAND Flash Memory

Innodisk 2.5” PATA SSD 1SR-P uses Single Level Cell (SLC) 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” PATA SSD 1SR-P from the system level, including the major hardware blocks.

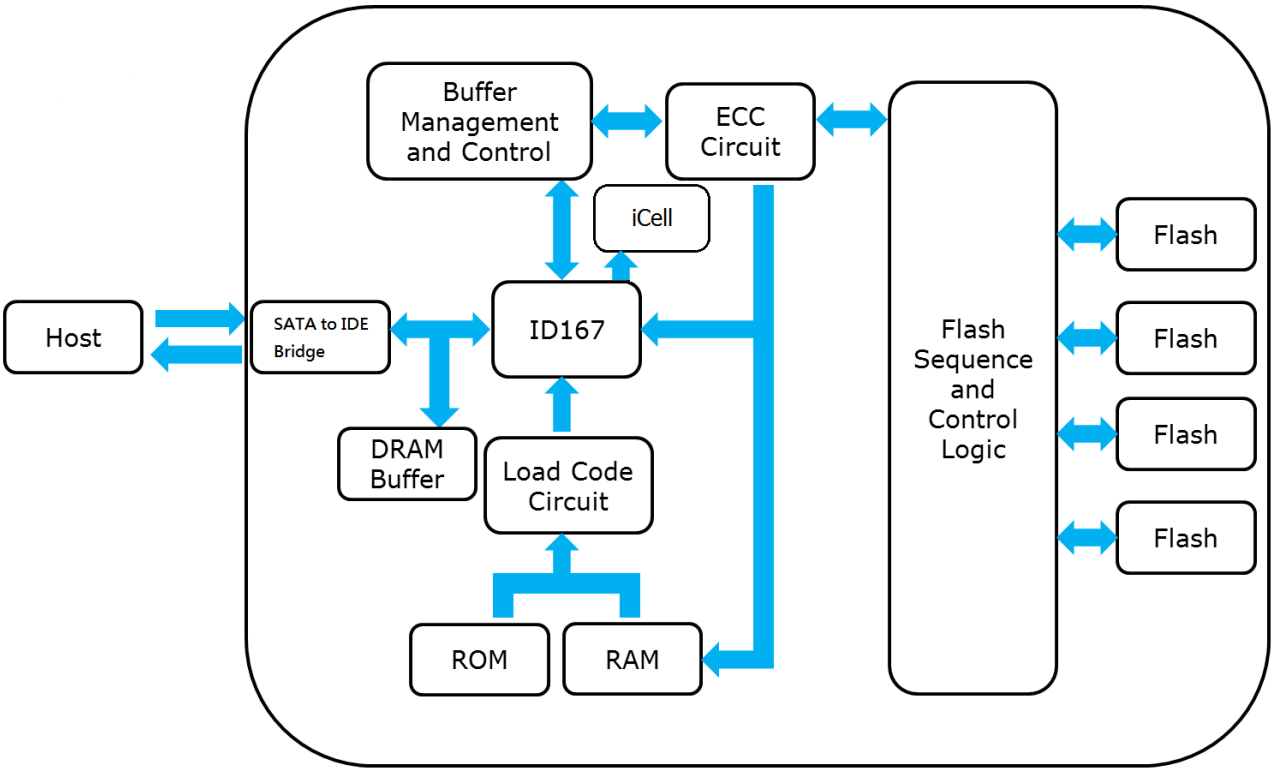


Figure 2: Innodisk FiD 2.5” PATA SSD 1SR-P Block Diagram

Innodisk 2.5” PATA SSD 1SR-P integrates a SATA to IDE Bridge, 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 NAND Flash Controller

Innodisk 2.5” PATA SSD 1SR-P is designed with ID 106 as major NAND Flash controller, which is a SATA III 6.0Gbps (Gen. 3) controller with 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" PATA SSD 1SR-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

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.

3.8 iCell Technology

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” PATA SSD 1SR-P can ensure all data can be written to disk without any data loss.

4. Installation Requirements

4.1 2.5” PATA SSD 1SR-P Pin Directions

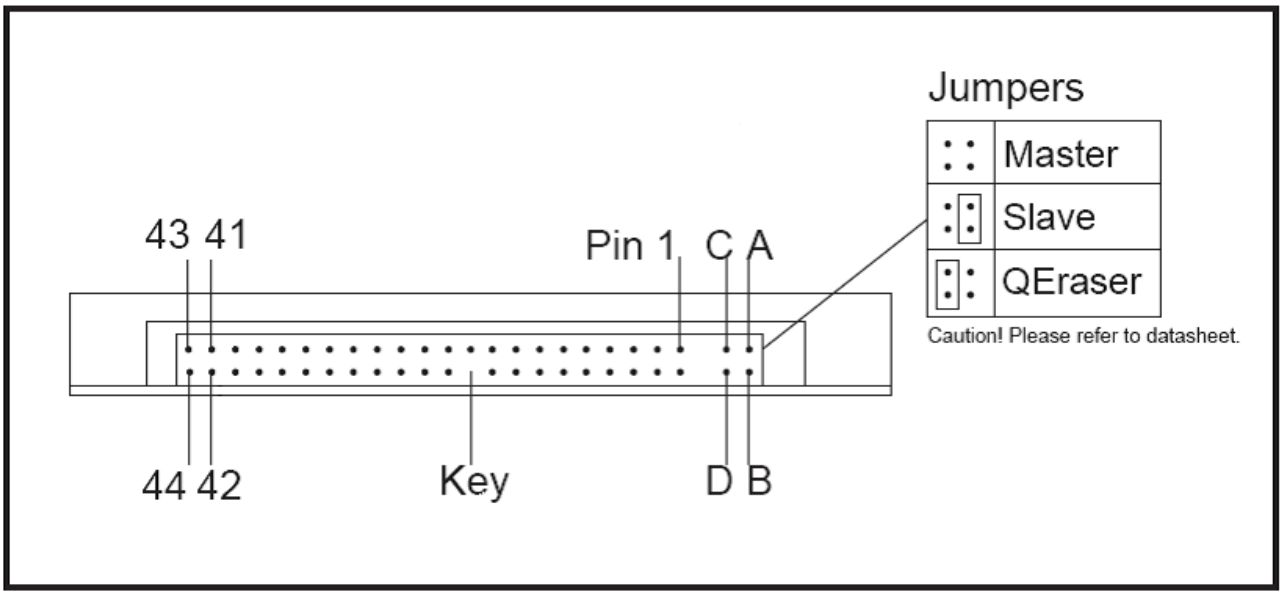


Figure 3: Signal Segment and Power Segment

4.2 Electrical Connections for 2.5” PATA SSD 1SR-P

2.5” PATA SSD is design with an IDE 2.00mm pin pitch interface connector and thus which can be directly connected to an IDE host or to a female 44pin connector and then to a host. For the connection through a cable, it is suggested that the cable should be no longer than 1meter.

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	**R**	**P**	**2**	**5**	**-**	**3**	**2**	**G**	**D**	**6**	**7**	**A**	**T**	**1**	**Q**	**B**	**-**	**X**	**X**
Description	Disk	2.5" PATA SSD 1SR-P					Capacity			Category			Flash Mode	Operation Temp.	Internal Control	CH.	Flash	-	Customized Code	

Definition	
Code 1st (Disk)	**Code 13th (Flash Type)**
D : Disk	A: Asynchronous Flash
Code 2nd	**Code 14th (Operation Temperature)**
R: InnoRobust	C: Standard Grade (0℃~ +70℃)
	W: Industrial Grade (-40℃~ +85℃)
Code 3rd ~ 5th (Form Factor)	K: Standard Grade with coating(0℃~ +70℃)
P25:2.5" PATA SSD	T: Industrial Grade with coating (-40℃~ +85℃)
	Code 15t:h (Internal control)
	Code 16th (Channel of data transfer)
Code 7th ~9th (Capacity)	Q: Quad Channels
08G: 8GB	
16G: 16GB	
32G: 32GB	
64G: 64GB	**Code 17th (Flash Type)**
A28: 128GB	B Toshiba SLC
B56: 256GB	
	Code 19th~20th (Customized Code)
Code 10th ~12th (Series)	
D67: 2.5" PATA SSD 1SR-P	

6. Appendix

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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)

Manufacturer Product: All Innodisk EM Flash and Dram products

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

一、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

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：2013 / 09 / 25

(Company Stamp/公司大小章)

Certificate

Issue Date: January 6, 2014
Ref. Report No. ISL-14HE004CE

Product Name	:	2.5 PATA SSD 1SE/1ME, 2.5 PATA SSD 1SR-P
Model	:	DEP25-XXXD06*#%※&
Responsible Party	:	Innodisk Corporation
Address	:	9F, No. 100, Sec. 1 Xintai 5th Rd., Xizhi City, Taipei 221, Taiwan

We, **International Standards Laboratory**, hereby certify that:

The device bearing the trade name and model specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in European Council Directive- EMC Directive 2004/108/EC. The device was passed the test performed according to :

CE

Standards:

EN 55022: 2010 and CISPR 22: 2008 (modified)
EN 61000-3-2: 2006+A1:2009 +A2:2009 and IEC 61000-3-2: 2005+A1:2008 +A2:2009
EN 61000-3-3: 2008 and IEC 61000-3-3: 2008
EN 55024: 2010 and CISPR 24: 2010
EN 61000-4-2: 2009 and IEC 61000-4-2: 2008
EN 61000-4-3: 2006+A1: 2008 +A2: 2010 and
IEC 61000-4-3:2006+A1: 2007+A2: 2010
EN 61000-4-4: 2004 +A1:2010 and IEC 61000-4-4: 2004 +A1:2010

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

International Standards Laboratory

Jim Chu / Director

☒ **Hsi-Chih LAB**:
No. 65, Gu Dai Keng St., Hsichih District,
New Taipei City 22179, Taiwan
Tel: 886-2-2646-2550; Fax: 886-2-2646-4641

Nemko
ELA113A

Certificate

Issue Date: January 6, 2014
Ref. Report No. ISL-14HE004FB

Product Name	:	2.5 PATA SSD 1SE/1ME, 2.5 PATA SSD 1SR-P
Model	:	DEP25-XXXD06*#%※&
Applicant	:	Innodisk Corporation
Address	:	9F, No. 100, Sec. 1 Xintai 5th Rd., Xizhi City, Taipei 221, Taiwan

We, **International Standards Laboratory**, hereby certify that:

The device bearing the trade name and model specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified. (refer to Test Report if any modifications were made for compliance).

Standards:

FCC CFR Title 47 Part 15 Subpart B: 2010- Section 15.107 and 15.109
ANSI C63.4-2009
Industry Canada Interference-Causing Equipment Standard ICES-003 Issue 5: 2012

Class B

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

International Standards Laboratory

Jim Chu / Director

☒ **Hsi-Chih LAB**:
No. 65, Gu Dai Keng St., Hsichih District,
New Taipei City 22179, Taiwan
Tel: 886-2-2646-2550; Fax: 886-2-2646-4641