

mSATA

3SE-P Series

Customer: _____

Customer

Part

Number: _____

Innodisk

Part

Number: _____

Innodisk

Model Name: _____

Date: _____

Innodisk Approver	Customer Approver

**Total Solution For
Industrial Flash Storage**

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REVISION HISTORY

Revision	Description	Date
Preliminary	First Released	May, 2013
1.0	Official release	July, 2013
1.1	Modify pin assignment	APR, 2014
1.2	Modify TBW based on NAND Flash specifications	FEB, 2015
1.3	Update mechanical drawing and capacity	AUG, 2015
1.4	Delete 128GB	July, 2016

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1. Product Overview

1.1 Introduction of Innodisk mSATA 3SE-P

Innodisk mSATA 3SE-P is designed as the standard Mini PCIe form factor with SATA interface, and supports SATA III standard (6.0Gb/s) with excellent performance. The form factor refers to the MO-300/MO-300B specification which established by JEDEC. Regarding of mechanical interference, Innodisk mSATA 3SE-P absolutely replaces the traditional hard disk and makes personal computer, in any field, smaller and easier.

Innodisk mSATA 3SE-P effectively reduces the booting time of operation system and the power consumption is less than hard disk drive (HDD), and complies with ATA protocol, no additional drives are required, and can be configured as a boot device or data storage device

1.2 Product View and Models

Innodisk mSATA 3SE-P is available in follow capacities within SLC flash ICs.

[mSATA 3SE-P 4GB](#) [mSATA 3SE-P 8GB](#) [mSATA 3SE-P 16GB](#)
[mSATA 3SE-P 32GB](#) [mSATA 3SE-P 64GB](#)



Figure 1: Innodisk mSATA 3SE-P

1.3 SATA Interface

Innodisk mSATA 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 mSATA 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).

2. Product Specifications

2.1 Capacity and Device Parameters

mSATA 3SE-P device parameters are shown in Table 1.

Table 1: Device parameters

Capacity	Cylinders	Heads	Sectors	LBA	User Space
4GB	7773	16	63	7835184	3,826
8GB	15525	16	63	15649200	7,641
16GB	16383	16	63	31277232	15,272
32GB	16383	16	63	62533296	30,533
64GB	16383	16	63	125045424	61,057

2.2 Performance

Burst Transfer Rate: 6.0Gbps

Table 2: Performance

Capacity	4GB	8GB	16GB	32GB	64GB
Sequential Read (max.)	250 MB/sec	400 MB/sec	400 MB/sec	460 MB/sec	460 MB/sec
Sequential Write (max.)	50 MB/sec	110 MB/sec	130 MB/sec	230 MB/sec	230 MB/sec

Note: the information is based on CrystalDiskMark 3.01 with file size 1000MB test patent

2.3 Electrical Specifications

2.3.1 Power Requirement

Table 3: Innodisk mSATA 3SE-P Power Requirement

Item	Symbol	Rating	Unit
Input voltage	V _{IN}	+3.3 DC +- 5%	V

2.3.2 Power Consumption

Table 4: Power Consumption

Mode	Power Consumption (mA)
Read	320 (max.)
Write	390 (max.)
Idle	95 (max.)

* Target: 32GB mSATA 3SE-P

2.4 Environmental Specifications

2.4.1 Temperature Ranges

Table 5: Temperature range for mSATA3SE-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 mSATA3SE-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 mSATA 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: mSATA 3SE-P MTBF

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

2.5 CE and FCC Compatibility

mSATA 3SE-P conforms to CE and FCC requirements.

2.6 RoHS Compliance

mSATA 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	
4GB	216(Sequential write)
8GB	432 (Sequential write)
16GB	864 (Sequential write)
32GB	1728 (Sequential write)
64GB	3456 (Sequential write)

2.8 Transfer Mode

mSATA 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

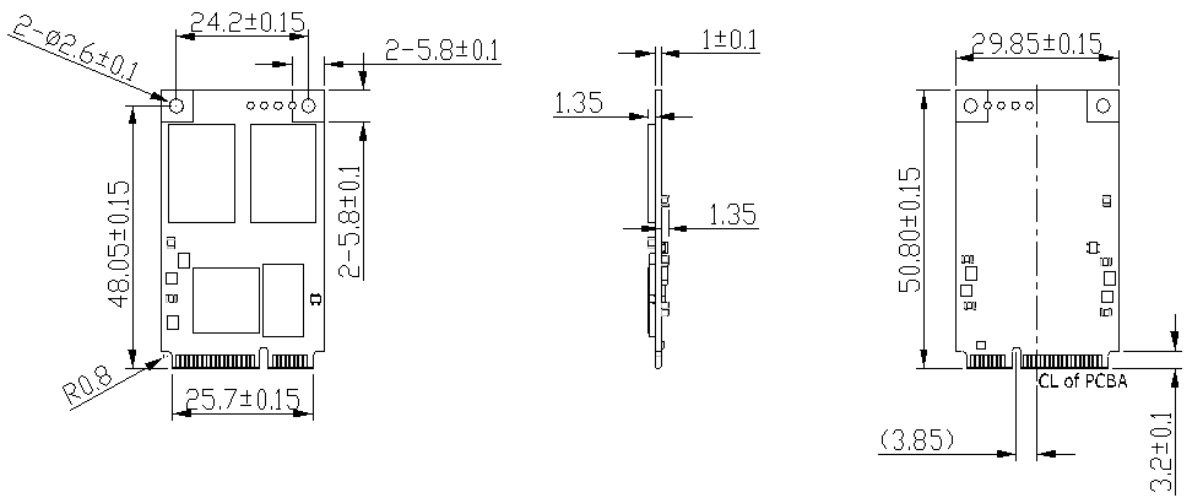
Innodisk mSATA 3SE-P uses a standard SATA pin-out. See Table 8 for mSATA 3SE-P pin assignment.

Table 8: Innodisk mSATA 3SE-P Pin Assignment

Signal Name	Pin #	Pin #	Signal Name
GND	51	52	+3.3V
DAS	49	50	GND
NC	47	48	NC
NC	45	46	NC
NC	43	44	NC
+3.3V	41	42	NC
+3.3V	39	40	GND
GND	37	38	NC
GND	35	36	NC

RX+	33	34	GND
RX-	31	32	NC
GND	29	30	NC
GND	27	28	NC
TX-	25	26	GND
TX+	23	24	+3.3V
GND	21	22	NC
NC	19	20	NC
NC	17	18	GND
GND	15	16	NC
NC	13	14	NC
NC	11	12	NC
GND	9	10	NC
NC	7	8	NC
NC	5	6	NC
NC	3	4	GND
NC	1	2	+3.3V

2.10 Mechanical Dimensions



TOLERANCE: ± 0.20 mm
UNIT: mm

2.11 Assembly Weight

An Innodisk mSATA 3SE-P within flash ICs, 32GB's weight is 8 grams approximately.

2.12 Seek Time

Innodisk mSATA 3SE-P is not a magnetic rotating design. There is no seek or rotational latency required.

2.13 NAND Flash Memory

Innodisk mSATA 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 mSATA 3SE-P from the system level, including the major hardware blocks.

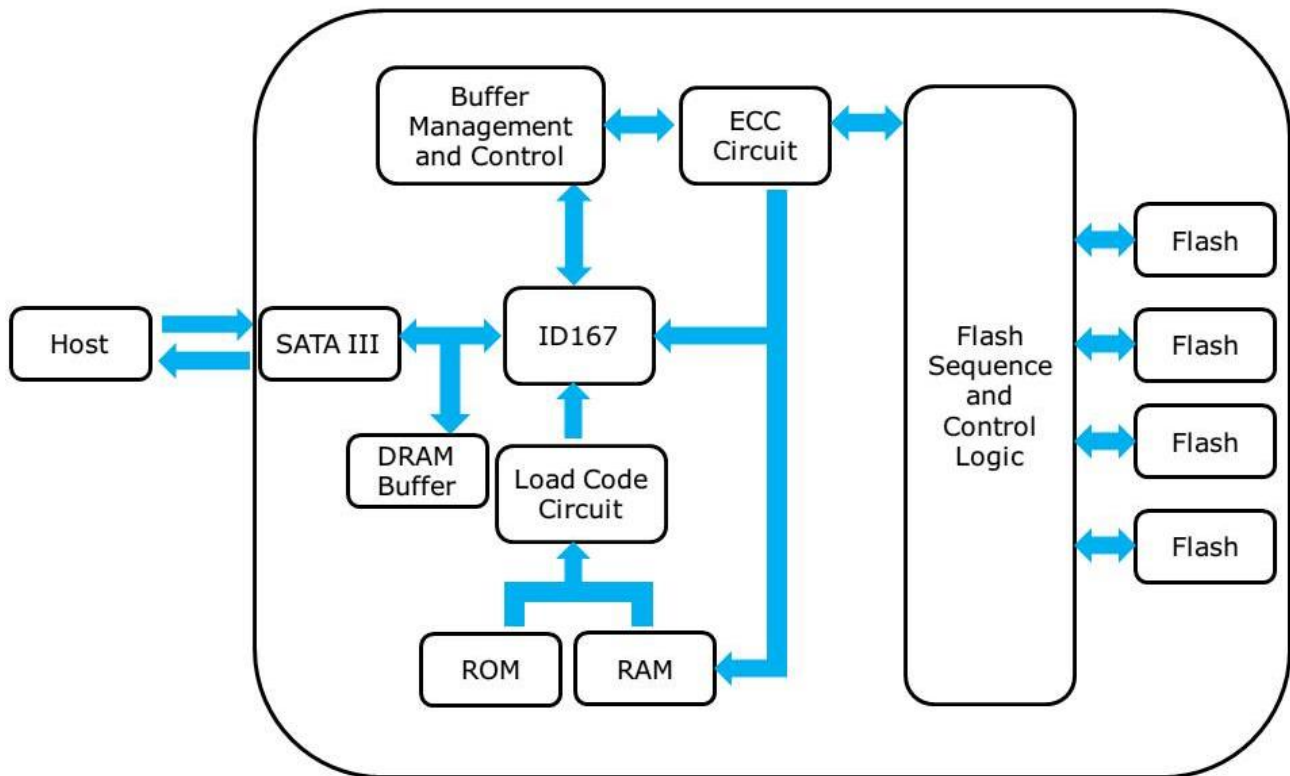


Figure 2: Innodisk mSATA 3SE-P Block Diagram

Innodisk mSATA 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 mSATA 3SE-P is designed with ID167, a SATA III 6.0Gbps (Gen. 3) controller. 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 2 / 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 mSATA 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 Secure erase function

Secure Erase is the name given to a set of commands available from the firmware on SATA based hard drives. Using Secure Erase to erase the data from a hard drive is often considered the best way to do so because the action is accomplished from the drive itself, the same hardware that wrote the data in the first place.

4. Installation Requirements

4.1 mSATA 3SE-P Pin Directions

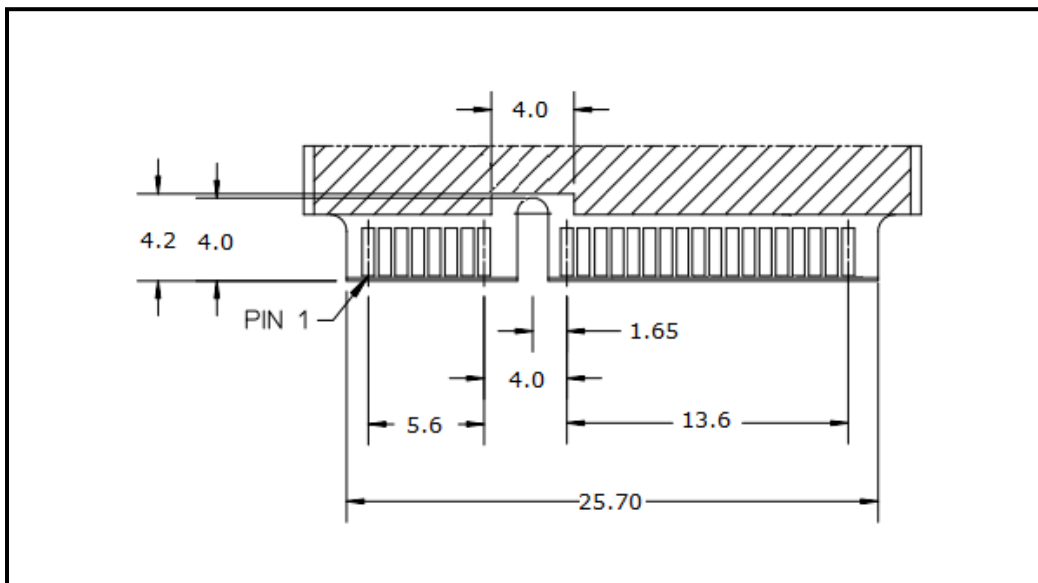


Figure 3: Signal Segment and Power Segment

4.2 Electrical Connections for mSATA 3SE-P

A Serial ATA device may be either directly connected to a host or connected to a host through an adaptor card. The SATA interface has a separate connector for the power supply. Please refer to the pin description for further details.

4.3 Device Drive

No additional device drives are required. The Innodisk mSATA 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
	D	E	M	S	R	-	3	2	G	D	6	7	S	C	X	Q	B	-	X	X	X
Definition																					
Code 1st (Disk)											Code 14th (Operation Temperature)										
D : Disk											C: Standard Grade (0°C ~ +70°C)										
Code 2nd (Feature set)											W: Industrial Grade (-40°C ~ +85°C)										
E : Embedded series											Code 15th (Internal control)										
A~Z: BGA PCB version.											Code 16th (Channel of data transfer)										
Code 3rd ~5th (Form factor)											D: Dual Channels										
MSR: mSATA Regular											Q: Quad channels										
Code 7th ~9th (Capacity)											Code 17th (Flash Type)										
04G: 4GB											B: Toshiba SLC										
08G: 8GB											T: Micron SLC										
16G: 16GB.											Code 18th										
32G: 32GB											Code 19th~21st (Customize code)										
64G: 64GB																					
Code 10th ~12th (Controller)																					
D67: ID167																					
Code 13th (Flash mode)																					
S: Synchronous NAND.																					

Verification of Compliance

Product Name : mSATA 3SE-P
 Model Number : D@MSR-XXXD67* #%※&
 @: Feature set (G: EverGreen, H: iSLC, R:InnoRobust,
 E: Embedded)
 XXX: 4GB~64GB
 * : Flash Mode
 #: Temperature (C : Commercial Temp W : Industrial Temp)
 % : PCB Version (A, B, C... or 1, 2, 3...)
 ※ : Channel (S : Single, D:Dual, T: Three, 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-U070-1306-277
 Issue Date : July 22, 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.



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



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(Tsun-Yu Shih/ General Manager)

Date: July 22, 2013

Verification of Compliance

Product Name : mSATA 3SE-P
 Model Number : D@MSR-XXXD67* # % ※ &
 @: Feature set (G: EverGreen, H: iSLC, R:InnoRobust,
 E: Embedded)
 XXX: 4GB~64GB
 * : Flash Mode
 #: Temperature (C : Commercial Temp W : Industrial Temp)
 % : PCB Version (A, B, C... or 1, 2, 3...)
 ※ : Channel (S : Single, D: Dual, T: Three, 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 : F-U070-1306-277
 Issue Date : July 22, 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.
 Tel : 886-2-25984568
 Fax: 886-2-25984546

(Tsun-Yu Shih/ General Manager)

Date: July 22, 2013

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: 16/05/2014)。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





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 李鍾亮

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

Date 日期: 2014 / 07 / 29

