

1.8" SATA SSD

3MR-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	Jan, 2014
Rev. 1.0	Update 512GB information	May, 2014
Rev. 1.1	Add specification of Quick Erase function	Nov, 2014
Rev. 1.2	Remove flash endurance SPEC	Jan, 2015

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1. Product Overview

1.1 Introduction of Innodisk 1.8" SATA SSD 3MR-P

Innodisk 1.8" SATA SSD 3MR-P is a SATA III 6.0Gb/s flash based disk, which delivers excellent performance and reliability. Especially, it comes with several data security functions, including QEraser/ SEraser (optional)/ Destroy(optional) and also Write Protect(optional). All the security functions can be triggered both by hardware and software approaches. 1.8" SATA SSD 3MR-P is compliant with MIL-STD-810F/G standards. The SSD is equipped ruggedized hardware design and thus it can perform well in the harsh environment.

Innodisk 1.8" SATA SSD 3MR-P products provide high capacity flash memory Solid State Drive (SSD) that electrically complies with Serial ATA (SATA) standard. Innodisk 1.8" SATA SSD 3MR-P delivers sustain read speeds of up to 460MB/s and sustain write speeds of up to 240MB/s. Beside sequential read/ write performance, Innodisk 1.8" SATA SSD 3MR-P also enhances random data access for small files. Furthermore, Innodisk 1.8" SATA SSD 3MR-P supports TRIM for windows 7, which can improve performance when deleting files. 1.8" SATA SSD 3MR-P is developed with Innodisk owned technical knowhow to ensure the data integrity and highest levels of reliability.

1.2 Product View and Models

Innodisk 1.8" SATA SSD 3MR-P is available in follow capacities within MLC flash ICs.

[1.8" SATA SSD 3MR-P 32GB](#)

[1.8" SATA SSD 3MR-P 64GB](#)

[1.8" SATA SSD 3MR-P 128GB](#)

[1.8" SATA SSD 3MR-P 256GB](#)

[1.8" SATA SSD 3MR-P 512GB](#)



Figure 1: Innodisk 1.8" SATA SSD 3MR-P

1.1 SATA Interface

Innodisk 1.8" SATA SSD 3MR-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 1.8" SATA SSD 3MR-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 9-pin power segment.

1.1 **1.8-inch Form Factor**

The Industry-standard 1.8-inch form factor design with metal material case is easy for installation because 1.8-inch is a popular form factor in industrial field. 1.8-inch is most laptop's hard disk's form factor. Innodisk 1.8" SATA SSD 3MR-P can easy install in laptop. Innodisk 1.8" SATA SSD 3MR-P has a compact design 54.0mm (W) x78.5mm (L) x 5.0mm (H).

2. Product Specifications

2.1 Capacity and Device Parameters

1.8" SATA SSD 3MR-P device parameters are shown in Table 1.

Table 1: Device parameters

Capacity	LBA	Cylinders	Heads	Sectors	User Capacity(MB)
32GB	60579792	16383	16	63	29580
64GB	121138416	16383	16	63	59150
128GB	242255664	16383	16	63	118289
256GB	484490160	16383	16	63	236568
512GB	968959152	16383	16	63	473125

2.2 Performance

Burst Transfer Rate: 6.0Gbps

Table 2: Performance

Capacity	32GB	64GB	128GB	256GB	512GB
Sequential Read (max.)	450 MB/sec	460 MB/sec	460 MB/sec	460 MB/sec	290 MB/sec
Sequential Write (max.)	85 MB/sec	150 MB/sec	240 MB/sec	240 MB/sec	250 MB/sec

Note: Base on CrystalDiskMark 3.01 with file size 1000MB

2.3 Electrical Specifications

2.3.1 Power Requirement

Table 3: Innodisk 1.8" SATA SSD 3MR-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	600 (max.)
Write	1080 (max.)
Idle	230 (max.)

* Target: 1.8" SATA SSD 3MR-P 256GB

2.4 Environmental Specifications

2.4.1 Temperature Ranges

Table 5: Temperature range for 1.8" SATA SSD 3MR-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 1.8" SATA SSD 3MR-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 1.8" SATA SSD 3MR-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: 1.8" SATA SSD 3MR-P MTBF

Product	Condition	MTBF (Hours)
Innodisk 1.8" SATA SSD 3MR-P	Telcordia SR-332 GB, 25°C	>3,000,000

2.5 CE and FCC Compatibility

1.8" SATA SSD 3MR-P conforms to CE and FCC requirements.

2.6 RoHS Compliance

1.8" SATA SSD 3MR-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)	
32GB	86.4 (Sequential Write)
64GB	172.8 (Sequential Write)
128GB	345.6 (Sequential Write)
256GB	691.2 (Sequential Write)
512GB	1382.4 (Sequential Write)

2.8 Transfer Mode

1.8" SATA SSD 3MR-P support the following transfer modes,

Serial ATA III 6.0Gbps

Serial ATA II 3.0Gbps

Serial ATA I 1.5Gbps

2.9 Pin Assignment

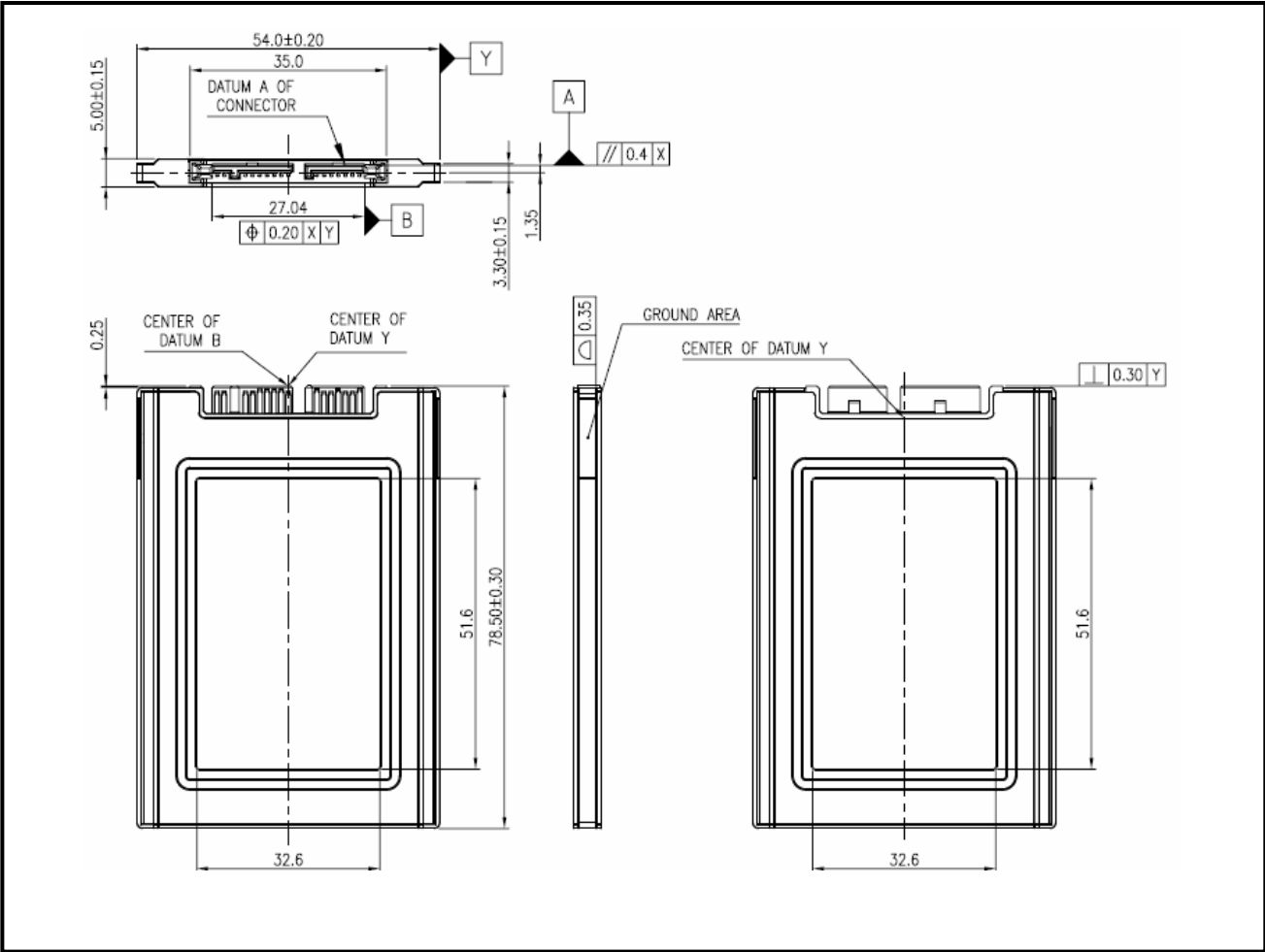
Innodisk 1.8" SATA SSD 3MR-P uses a standard SATA pin-out. See Table 8 for 1.8" SATA SSD 3MR-P pin assignment.

Table 8: Innodisk 1.8" SATA SSD 3MR-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	V33	3.3V Power
P2	V33	3.3V Power, Pre-charge
P3	GND	NA
P4	GND	NA
P5	V5	5V Power, Pre-charge
P6	V5	5V Power
P7	R	Reserved
Key	Key	Key
P8	Optional	Vendor Specific
P9	QE	*Quick Erase
<p>Note:</p> <p>* Active low "Quick Erase", the SSD will be triggered the QEraser function</p>		

2.10 Mechanical Dimensions



2.11 Assembly Weight

An Innodisk 1.8" SATA SSD 3MR-P within MLC flash ICs, 32GB's weight is 55 grams approx. The total weight of SSD will be less than 60 grams.

2.12 Seek Time

Innodisk 1.8" SATA SSD 3MR-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 1.8" SATA SSD 3MR-P uses Multi Level Cell (MLC) NAND flash memory, which is non-volatility, high reliability and high speed memory storage. There are only four statuses 00, 01, 10 or 11 of two cells. 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 1.8" SATA SSD 3MR-P from the system level, including the major hardware blocks.

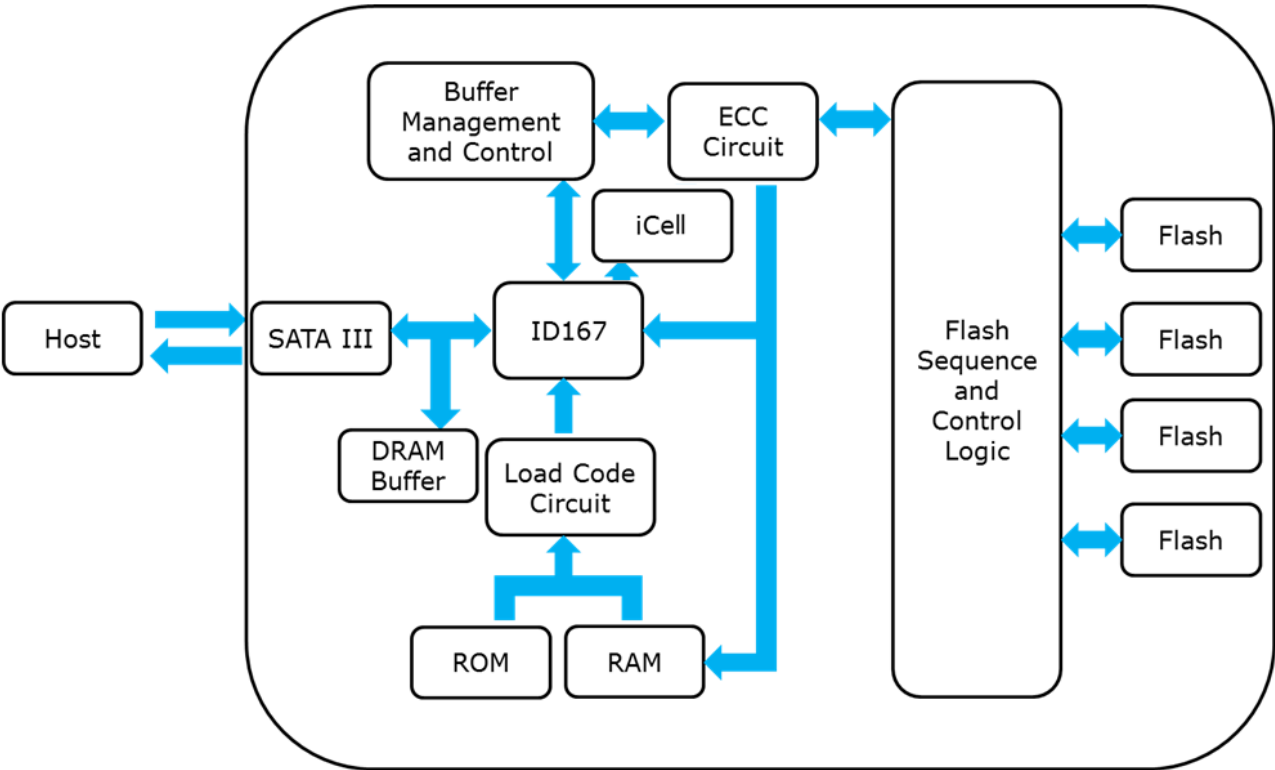


Figure 2: Innodisk 1.8" SATA SSD 3MR-P Block Diagram

Innodisk 1.8" SATA SSD 3MR-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 1.8" SATA SSD 3MR-P is designed with ID 167, a SATA III 6.0Gbps (Gen. 3) controller, which supports external DDR3 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 1.8" SATA SSD 3MR-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.

4. Installation Requirements

4.1 1.8" SATA SSD 3MR-P Pin Directions

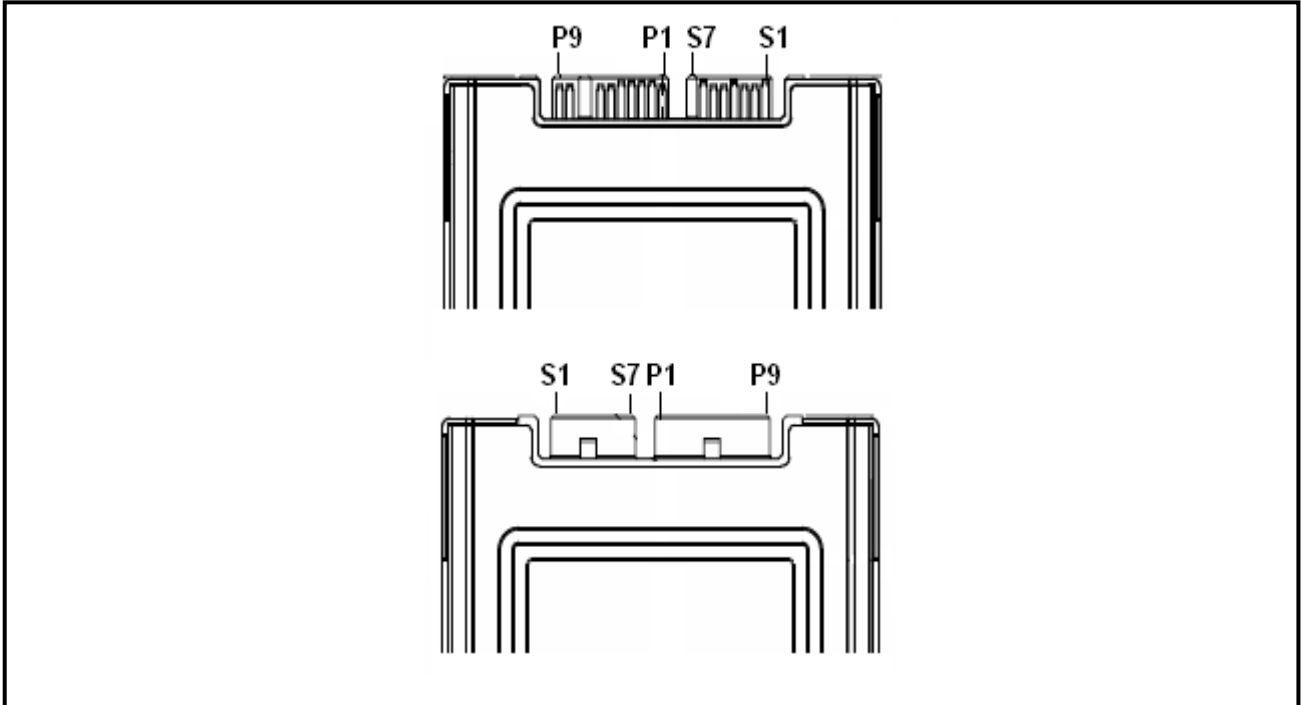


Figure 3: Signal Segment and Power Segment

4.2 Electrical Connections for 1.8" SATA SSD 3MR-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 Device Drive

No additional device drives are required. Innodisk 1.8" SATA SSD 3MR-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
	D	R	S	1	8	-	3	2	G	D	6	7	S	C	1	Q	C	-	X	X
Definition																				
Code 1st (Disk)											Code 13th (Flash Mode)									
D : Disk											S: Sync. Flash									
Code 2nd (Feature Set)											Code 14th (Operation Temperature)									
R: InnoRobust											C: Standard Grade (0°C ~ +70°C)									
Code 3rd ~5th (Form Factor)											Code 15th (Internal Control)									
S18: 1.8" SATA SSD																				
Code 7th ~9th (Capacity)											Code 16th (Channel of Data Transfer)									
32G: 32GB																				
64G: 64GB											Code 17th (Flash Type)									
A28: 128GB											Q: Quad Channels									
B56: 256GB											Code 19th ~20th (Customized Code)									
C12: 512GB											C: Toshiba MLC									
Code 10th ~12th (Controller)																				
D67: ID167																				

Appendix



宜鼎國際股份有限公司 Innodisk Corporation

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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



innodisk

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Innodisk Corporation

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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



International Standards Laboratory http://www.isl.com.tw

Certificate

Issue Date: November 12, 2013

Ref. Report No. ISL-13LE406CE

Product Name : 1.8" SATA SSD 3SR-P/3MR-P/3ME/3SE/3SE-P
 Model(s) : DRS18-XXXX67*#%&; DES18-XXXX06*#%&;
 DES18-XXXX67*#%&
 Brand : Innodisk
 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 :



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
- EN 61000-4-5: 2006 and IEC 61000-4-5: 2005
- EN 61000-4-6: 2009 and IEC 61000-4-6: 2008
- EN 61000-4-8: 2010 and IEC 61000-4-8: 2009
- EN 61000-4-11: 2004 and IEC 61000-4-11: 2004

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
Jim Chu / Director

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International Standards Laboratory http://www.isl.com.tw ISL International Standards Laboratory http://www.isl.com.tw

Certificate

Issue Date: November 12, 2013
 Ref. Report No. ISL-13LE406FB

Product Name : 1.8" SATA SSD 3SR-P/3MR-P /3ME /3SE/3SE-P
 Model(s) : DRS18-XXXXD67*#%*&; DES18-XXXXD06*#%*&;
 DES18-XXXXD67*#%*&
 Brand : Innodisk
 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
Jim Chu / Director

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