

mSATA

3MV2-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
1.0	Officially Released	June, 2017
1.1	Update Steady Sequential Write Performance	Sep., 2017

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1. Product Overview

1.1 Introduction of Innodisk mSATA 3MV2-P

InnoREC is innodisk's proprietary flash feature set designed specifically for surveillance applications. Through the smart integration of firmware and hardware, the speed and performance required by modern surveillance solutions is fully met. mSATA 3MV2-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 and supports several features, including REC line, iData Guard, iCell, Quick Erase, Thermal sensor, passive cooling and S.M.A.R.T.

1.2 Product View and Models

Innodisk MSATA 3MV2-P is available in follow capacities within MLC flash ICs.

mSATA 3MV2-P 8GB

mSATA 3MV2-P 64GB

mSATA 3MV2-P 512GB

mSATA 3MV2-P 16GB

mSATA 3MV2-P 128GB

mSATA 3MV2-P 32GB

mSATA 3MV2-P 256GB



Figure 1: Innodisk mSATA 3MV2-P

1.3 SATA Interface

mSATA 3MV2-P supports SATA III interface, and backward compliant with Serial ATA Gen 1, Gen 2 and Gen 3 specification (Gen 3 supports 1.5Gbps /3.0Gbps/6.0Gbps data rate)..

1.4 Capacity

Innodisk MSATA 3MV2-P provides unformatted 8GB, 16GB, 32GB, 64GB, 128GB, 256GB and

512GB capacities within MLC Flash IC.

1.5 MO-300 Form Factor

mSATA 300 has a compact design 29.85 mm (W) x 50.8 mm (L) x 4.85 mm (H) without metal material case, and is easy for installation.

2. Product Specifications

2.1 Capacity and Device Parameters

mSATA 3MV2-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	236,567
512GB	968959152	16383	16	63	473,124

2.2 Performance

Burst Transfer Rate: 6.0 Gbps

Table 2: Performance

Sequential Read and Write Performance

Specification (max.)	Sequential Read (SATA 6Gb/s)	Sequential Write (SATA 6Gb/s)
Unit	MB/s	MB/s
8GB (1CH)	140	25
16GB(1CH)	135	22
16GB (2CH)	280	50
32GB(2CH)	275	45
32GB (4CH)	550	100
64GB (4CH)	550	90
128GB (4CH)	560	180
256GB (4CH)	560	360
512GB (4CH)	560	450

Note:

1. Sequential performance measured using out-of-box SSD.
2. Performance measured using CrystalDiskMark 5.1.2 with file size 1000M of Queue Depth 32

Steady Sequential Write Performance

Specification	Sequential Write (SATA 6Gb/s)
Unit	MB/s
8GB (1CH)	23
16GB (1CH)	18
16GB (2CH)	35
32GB (2CH)	40
32GB (4CH)	85
64GB (4CH)	86
128GB (4CH)	174
256GB (4CH)	343
512GB (4CH)	420

Note:

1. Steady performance measured using Vdbench 5.02.
2. SSD is separated by two areas, 50% is full of random data and 50% is full of sequential data.
3. Sequential performance measurements are performed on writing 50% random data and then 50% sequential data in SSD.
4. The testing loop is running 70 cycles to reach steady performance.

Random Read and Write Performance

Specification	Random Read (SATA 6Gb/s)	Random Write (SATA 6Gb/s)
Unit	IOPS	IOPS
8GB (1CH)	14,000	6,400
16GB(1CH)	13,000	5,600
16GB (2CH)	28,000	13,000
32GB (2CH)	26,000	11,000
32GB (4CH)	55,000	25,000
64GB (4CH)	52,000	23,000
128GB (4CH)	75,000	46,000
256GB (4CH)	76,000	82,000
512GB (4CH)	75,000	77,000

Note:

1. Sequential performance measured using out-of-box SSD.
2. Performance measured using CrystalDiskMark 5.1.2 with file size 1000M of Queue Depth 32

2.3 Electrical Specifications

2.3.1 Power Requirement

Table 3: Innodisk MSATA 3MV2-P Power Requirement

Item	Symbol	Rating	Unit
Input voltage	V _{IN}	+3.3 DC +- 5% 500mA (max.)	V

2.3.2 Power Consumption

Table 4: Power Consumption

Mode	Power Consumption
Read	466 mA (max.)
Write	865 mA (max.)
Idle	91 mA (max.)

* Target: mSATA 3MV2-P 256GB

2.4 Environmental Specifications

2.4.1 Temperature Ranges

Table 5: Temperature range for mSATA 3MV2-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 mSATA 3MV2-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 3MV2-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 3MV2-P MTBF

Product	Condition	MTBF (Hours)
Innodisk mSATA 3MV2-P	Telcordia SR-332 GB, 25°C	>3,000,000

2.5 CE and FCC Compatibility

mSATA 3MV2-P conforms to CE and FCC requirements.

2.6 RoHS Compliance

mSATA 3MV2-P is fully compliant with RoHS directive.

2.7 Reliability

Parameter		Value
Read Cycles		Unlimited Read Cycles
Flash Endurance		3,000 P/E cycles
Wear-Leveling Algorithm		Support
Bad Blocks Management		Support
Error Correct Code		Support
iData Guard		Support
Thermal Sensor		Support
TBW* (Total Bytes Written)		Unit: TB
Capacity	Sequential workload	Client workload
08GB	21.3	9.4
16GB	42.6	18.8
32GB	85.2	37.5
64GB	170.5	75
128GB	340.9	150
256GB	681.8	300
512GB	1364	600
* Note: 1. Sequential: Mainly sequential write, tested by Vdbench. 2. Client: Follow JESD218 Test method and JESD219A Workload, tested by ULINK. (The capacity lower than 64GB client workload is not specified in JEDEC219A, the values are estimated.) 3. Based on out-of-box performance.		

2.8 Transfer Mode

MSATA 3MV2-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 3MV2-P uses a standard SATA pin-out. See Table 8 for mSATA 3MV2-P pin assignment.

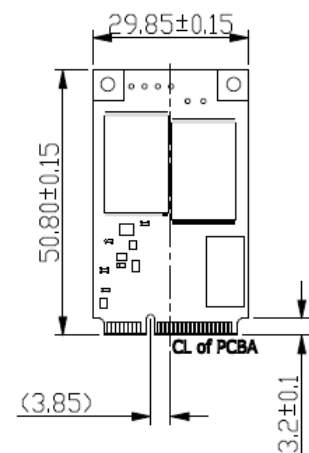
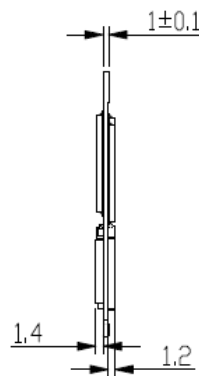
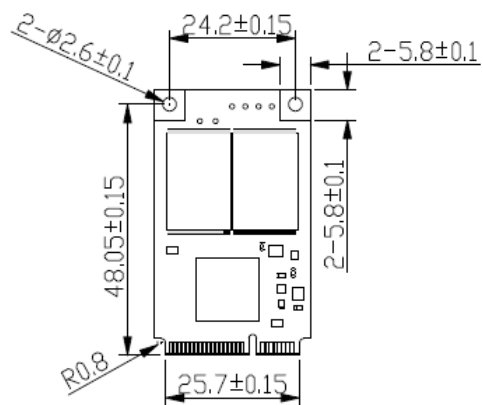
Table 8: Innodisk mSATA 3MV2-P Pin Assignment

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	DEVSLP
+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

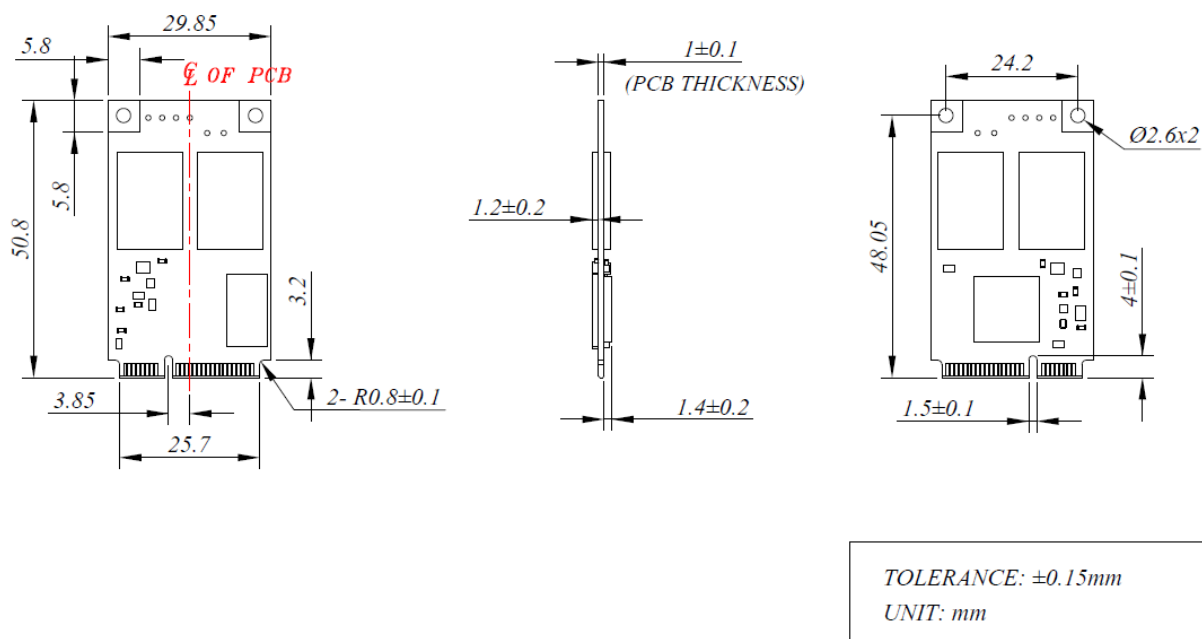
2.10 Mechanical Dimensions

Toshiba TSOP



TOLERANCE: ± 0.20 mm
UNIT: mm

Toshiba BGA 512GB



2.11 Assembly Weight

An Innodisk mSATA 3MV2-P within MLC flash ICs, 32GB's weight is 10 grams approx.

2.12 Seek Time

Innodisk mSATA 3MV2-P is not a magnetic rotating design. There is no seek or rotational latency required.

2.13 NAND Flash Memory

Innodisk mSATA 3MV2-P uses Multi Level Cell (MLC) NAND flash memory, which is non-volatility, high reliability which has 3,000 program/erase times and high speed memory storage. Each cell stores 2 bits or holds four states per 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 3MV2-P from the system level, including the major hardware blocks.

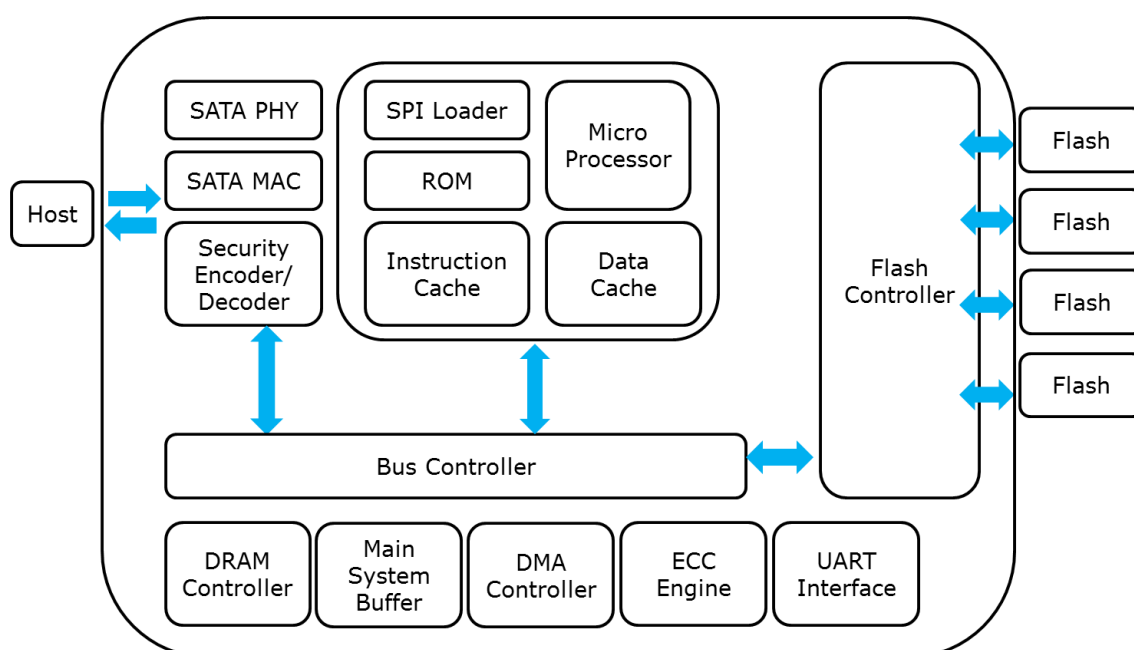


Figure 2: Innodisk mSATA 3MV2-P Block Diagram

Innodisk mSATA 3MV2-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 3MV2-P is designed with ID 201, 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 REC Line

REC Line is the exclusive firmware algorithm for video recording that ensures steady performance without any frame-loss.

3.4 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 66 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.

3.5 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 3MV2-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.

3.6 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.

3.7 iData Guard

Innodisk's iData Guard 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 iData Guard provides effective power cycling management, preventing data stored in flash from degrading with use.

3.8 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.

3.9 Thermal Sensor

When the surveillance system threatens to overheat, an immediate warning is issued. The SSD will automatically adjusting the transmission frequency to ensure continued performance and reliability.

4. Installation Requirements

4.1 mSATA 3MV2-P Pin Directions

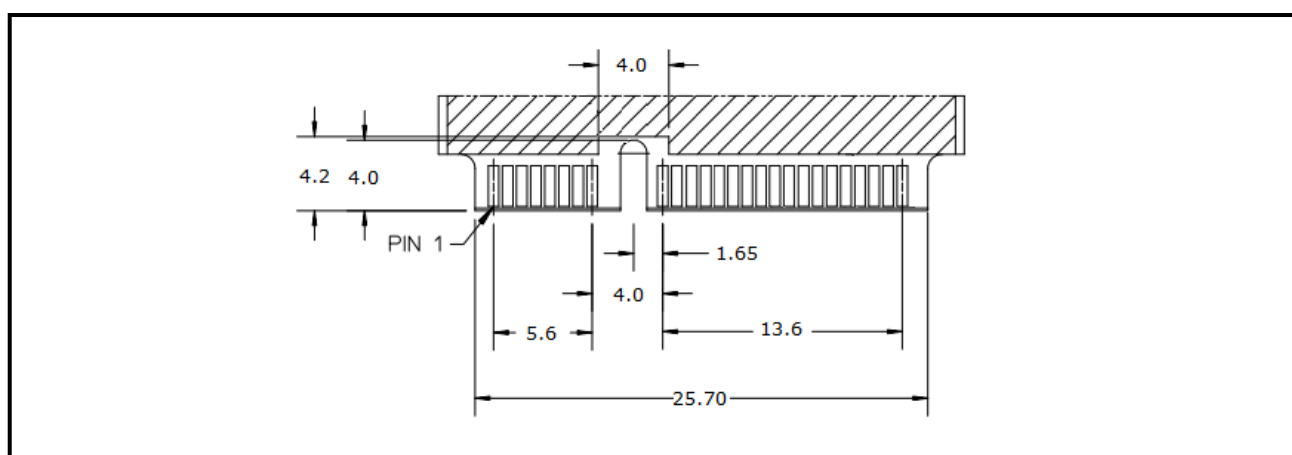


Figure 3: Signal Segment and Power Segment

4.2 Electrical Connections for mSATA 3MV2-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 mSATA 3MV2-P can be configured as a boot device.

5. SMART Feature Set

Innodisk 3MV2-P support the SMART command set and defines some vendor-specific data to report SMART attributes of SSD.

Value	Command
D0h	Read Data
D1h	Read Attribute Threshold
D2h	Enable/Disable Autosave
D3h	Save Attribute Values
D4h	Execute OFF-LINE Immediate
D5h	Read Log
D6h	Return Status
D8h	Enable SMART Operations
D9h	Disable SMART Operations
DAh	Return Status

5.1 SMART Attributes

Innodisk's 3MV2-P series SMART data attributes are listed in following table.

Attribute ID (hex)	Raw Attribute Value							Attribute Name
1 (01h)	MSB	00	00	00	00	00	00	Raw Read Error Rate
5 (05h)	LSB	MSB	00	00	00	00	00	Reallocated Sector Count
9 (09h)	LSB			MSB	00	00	00	Power-on Hours
12 (0Ch)	LSB			MSB	00	00	00	Power Cycle Count

160 (A0h)	LSB			MSB	00	00	00	Uncorrectable sector count when read/write
161 (A1h)	LSB	MSB	00	00	00	00	00	Number of valid spare block
163 (A3h)	LSB	MSB	00	00	00	00	00	Number of initial invalid block
164 (A4h)	LSB	MSB	00	00	00	00	00	Total erase count
165 (A5h)	LSB			MSB	00	00	00	Maxumum erase count
166 (A6h)	LSB			MSB	00	00	00	Minimum erase count
167 (A7h)	LSB			MSB	00	00	00	Average erase count
168 (A8h)	LSB			MSB	00	00	00	Max erase count of spec
169 (A9h)	LSB			MSB	00	00	00	Reman Life (percentage)
175 (AFh)	LSB			MSB	00	00	00	Program fail count in worst die
176 (B0h)	LSB			MSB	00	00	00	Erase fail count in worst die
177 (B1h)	LSB			MSB	00	00	00	Total wear level count
178 (B2h)	LSB	MSB	00	00	00	00	00	Runtime invalid block count
181 (B5h)	LSB			MSB	00	00	00	Total program fail count
182 (B6h)	LSB	MSB	00	00	00	00	00	Total erase fail count
187 (BBh)	LSB			MSB	00	00	00	Uncorrectable error count
192 (C0h)	LSB	MSB	00	00	00	00	00	Power-Off Retract Count
194 (C2h)	MSB	00	00	00	00	00	00	Controlled temperature
195 (C3h)	LSB			MSB	00	00	00	Hardware ECC recovered
196 (C4h)	LSB			MSB	00	00	00	Reallocation event count
198 (C6h)	LSB			MSB	00	00	00	Uncorrectable error count off-line
199 (C7h)	LSB	MSB	00	00	00	00	00	UltraDMA CRC error count
225 (E1h)	LSB						MSB	Total LBAs written (each write unit = 32MB)
232 (E8h)	LSB	MSB	00	00	00	00	00	Available reserved space
241 (F1h)	LSB						MSB	Total LBAs written (each write unit = 32MB)
242 (F2h)	LSB						MSB	Total LBAs read (each write unit = 32MB)

6. 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	V	M	S	R	-	3	2	G	D	8	1	B	C	X	D	C	-	X	X
Description	Disk	mSATA 3MV2-P				Capacity			Category			Flash Mode	Operation Temp.	Internal Control	CH.	Flash	-	Customized Code		
Definition																				
Code 1 st (Disk)												Code 13 th (Flash Mode)								
D : Disk												B:15nm Synchronous flash								
Code 2 nd ~ 5 th (Form Factor)												Code 14 th (Operation Temperature)								
VMSR: mSATA 3MV2-P												C: Standard Grade (0℃ ~ +70℃)								
Code 7 th ~9 th (Capacity)												W: Industrial Grade (-40℃ ~ +85℃)								
08G: 8GB												Code 15 th (Internal control)								
16G: 16GB												1~9 : TSOP PCB version								
32G: 32GB												A~Z: BGA PCB version								
64G: 64GB												Code 16 th (Channel of data transfer)								
A28: 128GB												S: Single Channel								
B56: 256GB												D: Dual Channels								
C12: 512GB												Q: Quad Channels								
Code 10 th ~12 th (Series)												Code 17 th (Flash Type)								
D81: ID201												C: Toshiba MLC								
												Code 19 th ~20 th (Customized Code)								

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)
鉛 (Pb)	< 1000 ppm
汞 (Hg)	< 1000 ppm
鎘 (Cd)	< 100 ppm
六價鉻 (Cr 6+)	< 1000 ppm
多溴聯苯 (PBBs)	< 1000 ppm
多溴二苯醚 (PBDEs)	< 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： Randy Chien 簡川勝

Company Representative Title 公司代表人職稱： Chairman 董事長

Date 日期： 2016 / 08 / 04





VERIFICATION OF COMPLIANCE

This Verification of Compliance is hereby issued to the below named company. The test results of this report relate only to the tested sample identified in this report.

**Technical Standard: FCC Part 15 Class B
IC ICES-003**

General Information

Applicant: Innodisk Corporation
5F., No. 237, Sec. 1, Datong Rd., Xizhi Dist.,
New Taipei City 22161, Taiwan (R.O.C)

Product Description

EUT Description: mSATA
Brand Name: Innodisk
Model Number: mSATA 3S*#-&
S:Flash type: (S:SLC, L:SLC, M:MLC, T:3D TLC, A~Z:Others)
*:Product line: (E:Embedded, G:EverGreen, R:InnoRobust, S:Server, V:InnoREC, A~Z:Others)
#:Product Generation: (empty, 0~9)
&:Product line: (empty, P:Plus)

Measurement Facilities

Xindian Lab.: Compliance Certification Services Inc.
No.163-1, Jhongsheng Rd., Xindian Dist., New Taipei City, 23151 Taiwan.
Tel: +886-2-22170894 / Fax: +886-2-22171029

This device has been shown to be in compliance with and was tested in accordance with the measurement procedures specified in the Standards & Specifications listed above and as indicated in the measurement report number: T170504D06-D

Sam Hu / Assistant Manager

Date: May 4, 2017



VERIFICATION OF COMPLIANCE

This Verification of Compliance is hereby issued to the below named company. The test results of this report relate only to the tested sample identified in this report.

**Technical Standard: EMC DIRECTIVE 2014/30/EU
(EN55032 / EN55024)**

General Information

Applicant: Innodisk Corporation
5F., No. 237, Sec. 1, Datong Rd., Xizhi Dist.,
New Taipei City 22161, Taiwan (R.O.C)

Product Description

EUT Description: mSATA
Brand Name: Innodisk
Model Number: mSATA 3S*#-&
\$:Flash type: (S:SLC, LiSLC, M:MLC, T:3D TLC, A~Z:Others)
*:Product line: (E:Embedded, G:EverGreen, R:InnoRobust, S:Server, V:InnoREC, A~Z:Others)
#:Product Generation: (empty, 0~9)
&:Product line: (empty, P:Plus)

Measurement Standard

EN 55032: 2012 / AC: 2013
CISPR 32: 2012
EN 61000-3-2: 2014
EN 61000-3-3: 2013
EN 55024: 2010 + A1: 2015
(IEC 61000-4-2: 2008; IEC 61000-4-3: 2006 + A1: 2007 + A2: 2010; IEC 61000-4-4: 2012;
IEC 61000-4-5: 2014; IEC 61000-4-6: 2013; IEC 61000-4-8: 2009; IEC 61000-4-11: 2004)

Measurement Facilities

Xindian Lab.: Compliance Certification Services Inc.
No.163-1, Zhongsheng Rd., Xindian Dist., New Taipei City, 23151 Taiwan.
Tel: +886-2-22170894 / Fax: +886-2-22171029

This device has been shown to be in compliance with and was tested in accordance with the measurement procedures specified in the Standards & Specifications listed above and as indicated in the measurement report number: T170504D06-E

Sam Hu / Assistant Manager

Date: May 4, 2017

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; (EC) No 1907/2006 REACH) 以及附錄 XIV 中的限用物質之規定 (<http://www.echa.europa.eu/de/candidate-list-table> last updated: 12/01/2017, SVHC's 173)。

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 (EC) No 1907/2006 REACH Regulation and restricted substances in Annex XIV (<http://www.echa.europa.eu/de/candidate-list-table> last updated: 12/01/2017, SVHC's 173).

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： Randy Chien 簡川勝

Company Representative Title 公司代表人職稱： Chairman 董事長

Date 日期： 2017 / 02 / 08

