

M.2 (S60)

3ME3 Series

Customer: _____

Customer

Part

Number: _____

Innodisk

Part

Number: _____

Innodisk

Model Name: _____

Date: _____

Innodisk Approver	Customer Approver

**Total Solution For
Industrial Flash Storage**

Table of contents

LIST OF FIGURES	6
1. PRODUCT OVERVIEW	7
1.1 INTRODUCTION OF INNODISK M.2 (S60) 3ME3	7
1.2 PRODUCT VIEW AND MODELS	7
1.3 SATA INTERFACE.....	7
2. PRODUCT SPECIFICATIONS	8
2.1 CAPACITY AND DEVICE PARAMETERS.....	8
2.2 PERFORMANCE	8
2.3 ELECTRICAL SPECIFICATIONS	8
2.3.1 Power Requirement	8
2.3.2 Power Consumption	9
2.4 ENVIRONMENTAL SPECIFICATIONS	9
2.4.1 Temperature Ranges	9
2.4.2 Humidity.....	9
2.4.3 Shock and Vibration	9
2.4.4 Mean Time between Failures (MTBF)	9
2.5 CE AND FCC COMPATIBILITY	10
2.6 RoHS COMPLIANCE	10
2.7 RELIABILITY	10
2.8 TRANSFER MODE	10
2.9 PIN ASSIGNMENT	10
2.10 MECHANICAL DIMENSIONS.....	12
2.11 ASSEMBLY WEIGHT	12
2.12 SEEK TIME	12
2.13 HOT PLUG.....	12
2.14 NAND FLASH MEMORY.....	12
3. THEORY OF OPERATION.....	13
3.1 OVERVIEW.....	13
3.2 SATA III CONTROLLER	13
3.3 ERROR DETECTION AND CORRECTION.....	14
3.4 WEAR-LEVELING	14
3.5 BAD BLOCKS MANAGEMENT	14
3.6 POWER CYCLING	14
3.7 GARBAGE COLLECTION.....	14
4. INSTALLATION REQUIREMENTS	15
4.1 M.2 (S60) 3ME3 PIN DIRECTIONS.....	15

4.2 ELECTRICAL CONNECTIONS FOR M.2 (S60) 3ME3 15

4.3 DEVICE DRIVE 15

5. PART NUMBER RULE16

6. APPENDIX.....17

REVISION HISTORY

Revision	Description	Date
Preliminary	First Released	MAR., 2016
Rev 1.0	Official Release	OCT., 2016

List of Tables

TABLE 1: DEVICE PARAMETERS	8
TABLE 2: PERFORMANCE	8
TABLE 3: INNODISK M.2 (S60) 3ME3 POWER REQUIREMENT	8
TABLE 4: POWER CONSUMPTION	9
TABLE 5: TEMPERATURE RANGE FOR M.2 (S60) 3ME3	9
TABLE 6: SHOCK/VIBRATION TESTING FOR M.2 (S60) 3ME3	9
TABLE 7: M.2 (S60) 3ME3 MTBF	9
TABLE 8: INNODISK M.2 (S60) 3ME3 PIN ASSIGNMENT	10

List of Figures

FIGURE 1: INNODISK M.2 (S60) 3ME3 (TYPE 2260)	7
FIGURE 2: INNODISK M.2 (S60) 3ME3 BLOCK DIAGRAM	13
FIGURE 3: SIGNAL SEGMENT AND POWER SEGMENT	15

1. Product Overview

1.1 Introduction of Innodisk M.2 (S60) 3ME3

Innodisk M.2 (S60) 3ME3 is designed as the standard M.2 form factor with SATA interface, and supports SATA III standard (6.0Gb/s) with excellent performance. The form factor refers to the M.2(NGFF) specification which established by JEDEC. Regarding of mechanical interference, Innodisk M.2 (S60) 3ME3 absolutely replaces the traditional hard disk and makes personal computer, in any field, smaller and easier.

Innodisk M.2 (S60) 3ME3 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 M.2 (S60) 3ME3 is available in follow capacities within MLC flash ICs.

M.2 (S60) 3ME3 32GB

M.2 (S60) 3ME3 64GB

M.2 (S60) 3ME3 128GB

M.2 (S60) 3ME3 256GB

M.2 (S60) 3ME3 512GB



Figure 1: Innodisk M.2 (S60) 3ME3 (type 2260)

1.3 SATA Interface

Innodisk M.2 (S60) 3ME3 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 M.2 (S60) 3ME3 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

M.2 (S60) 3ME3 device parameters are shown in Table 1.

Table 1: Device parameters

Capacity	Cylinders	Heads	Sectors	LBA	user space
32GB	16383	16	63	62533296	30,533
64GB	16383	16	63	125045424	61,057
128GB	16383	16	63	250069680	122,104
256GB	16383	16	63	500118192	244,198
512GB	16383	16	63	1000215216	488,386

2.2 Performance

Burst Transfer Rate: 6.0Gbps

Table 2: Performance

Capacity	32GB	64GB	128GB	256GB	512GB
Sequential* Read (max.)	200 MB/s	380 MB/s	415 MB/s	415 MB/s	415 MB/s
Sequential* Write (max.)	40 MB/s	80 MB/s	145 MB/s	200 MB/s	200 MB/s
4KB Random** Read (QD32)	6,100 IOPS	7,900 IOPS	10,700 IOPS	10,700 IOPS	10,700 IOPS
4KB Random** Write (QD32)	8,600 IOPS	14,000 IOPS	23,100 IOPS	28,700 IOPS	28,700 IOPS

Note: * Sequential performance is based on CrystalDiskMark 3.03 with file size 1000MB

** Random performance is based on IO meter with Queue Depth 32

2.3 Electrical Specifications

2.3.1 Power Requirement

Table 3: Innodisk M.2 (S60) 3ME3 Power Requirement

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

2.3.2 Power Consumption

Table 4: Power Consumption

Capacity	Seq. Read(mA)	Seq. Write(mA)	Idle(mA)
32GB	179.8	215.5	145.2
64GB	186.7	259.1	145.8
128GB	215.2	352.9	145.5
256GB	282.4	465.1	145.8
512GB	308.4	481.1	145.6

* Target: 64GB M.2 (S60) 3ME3

2.4 Environmental Specifications

2.4.1 Temperature Ranges

Table 5: Temperature range for M.2 (S60) 3ME3

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 M.2 (S60) 3ME3

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 M.2 (S60) 3ME3 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: M.2 (S60) 3ME3 MTBF

Product	Condition	MTBF (Hours)
Innodisk M.2 (S60) 3ME3	Telcordia SR-332 GB, 25°C	>3,000,000

2.5 CE and FCC Compatibility

M.2 (S60) 3ME3 conforms to CE and FCC requirements.

2.6 RoHS Compliance

M.2 (S60) 3ME3 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
iData Guard	Support
Thermal Sensor	WT only
TBW* (Total Bytes Written)	Unit: TB
	32GB 9.4
	64GB 18.8
	128GB 37.5
	256GB 75
	512GB 150
* Total bytes written is based on JEDEC 218 (Solid-State Drive Requirements and Endurance Test Method)	
** Lifespan is calculated by device written per day	

2.8 Transfer Mode

M.2 (S60) 3ME3 support following transfer mode:

Serial ATA III 6.0Gbps

Serial ATA II 3.0Gbps

Serial ATA I 1.5Gbps

2.9 Pin Assignment

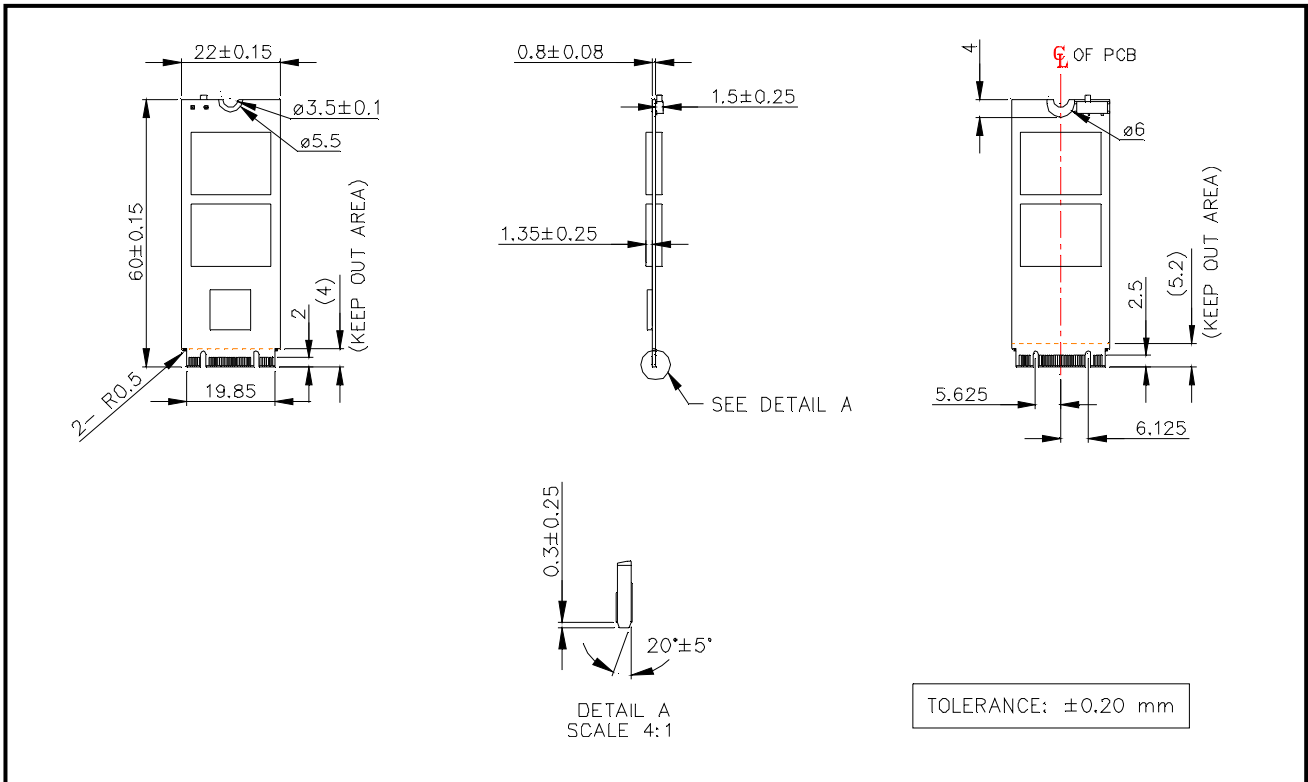
Innodisk M.2 (S60) 3ME3 uses a standard SATA pin-out. See Table 8 for M.2 (S60) 3ME3 pin assignment.

Table 8: Innodisk M.2 (S60) 3ME3 Pin Assignment

Signal Name	Pin #	Pin #	Signal Name
		75	GND
3.3V	74	73	GND
3.3V	72	71	GND
3.3V	70	69	GND

SUSCLK	68	67	NC
Notch	66	65	Notch
Notch	64	63	Notch
Notch	62	61	Notch
Notch	60	59	Notch
Reserved/MFG Clock	58		
Reserved/ MFG Data	56	57	GND
NC	54	55	NC
NC	52	53	NC
NC	50	51	GND
NC	48	49	RX+
NC	46	47	RX-
NC	44	45	GND
NC	42	43	TX-
NC	40	41	TX+
DEVSLP	38	39	GND
NC	36	37	NC
NC	34	35	NC
NC	32	33	GND
NC	30	31	NC
NC	28	29	NC
NC	26	27	GND
NC	24	25	NC
NC	22	23	NC
NC	20	21	GND
Notch	18	19	Notch
Notch	16	17	Notch
Notch	14	15	Notch
Notch	12	13	Notch
DAS/DSS	10	11	NC
NC	8	9	NC
NC	6	7	NC
3.3V	4	5	NC
3.3V	2	3	GND
		1	GND

2.10 Mechanical Dimensions



2.11 Assembly Weight

An Innodisk M.2 (S60) 3ME3 within flash ICs, 64GB's weight is 8 grams approximately.

2.12 Seek Time

Innodisk M.2 (S60) 3ME3 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 M.2 (S60) 3ME3 uses Multi Level Cell (MLC) 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 M.2 (S60) 3ME3 from the system level, including the major hardware blocks.

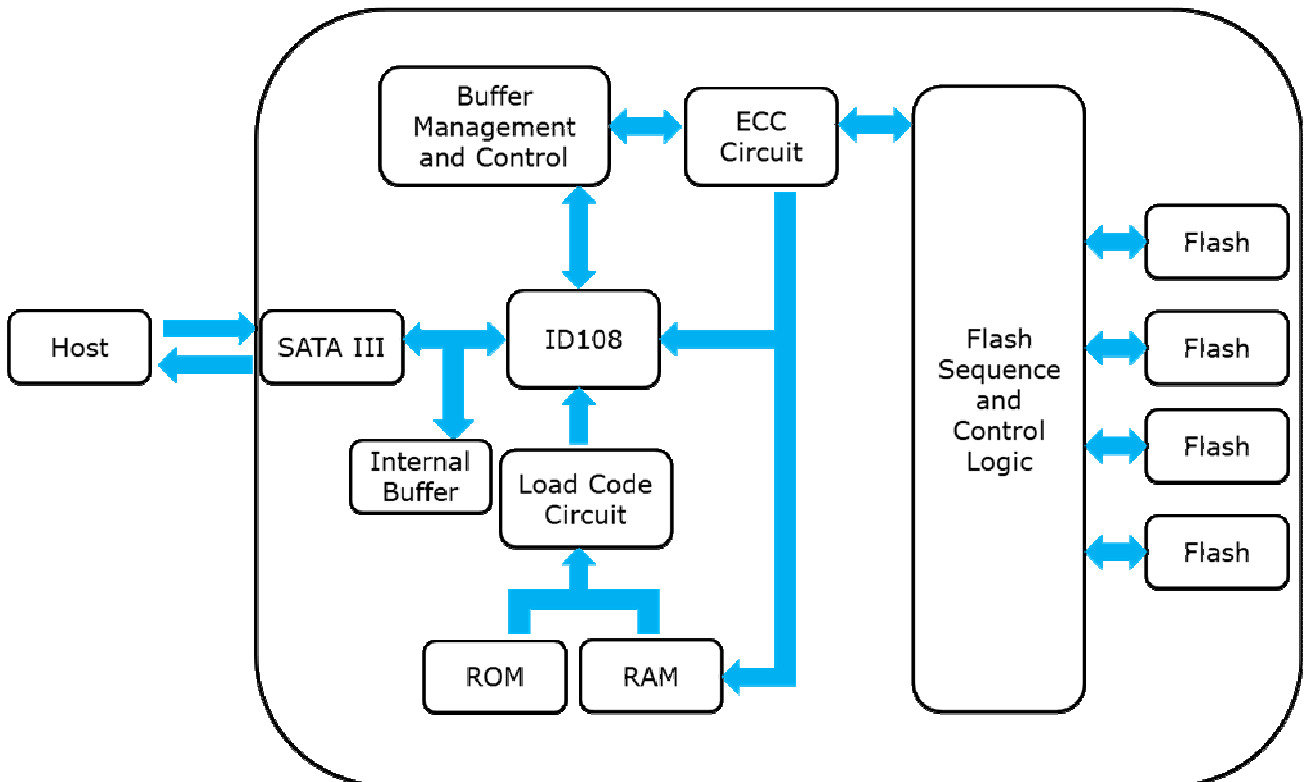


Figure 2: Innodisk M.2 (S60) 3ME3 Block Diagram

Innodisk M.2 (S60) 3ME3 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 M.2 (S60) 3ME3 is designed with ID 108, 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 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 M.2 (S60) 3ME3 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 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 M.2 (S60) 3ME3 Pin Directions

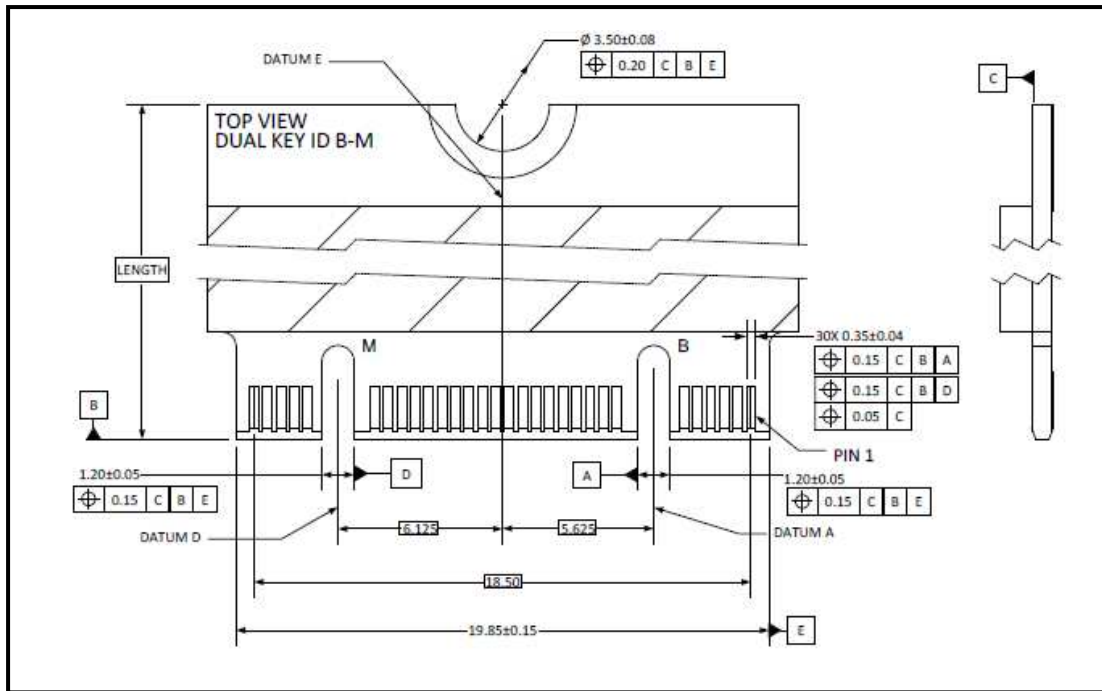


Figure 3: Signal Segment and Power Segment

4.2 Electrical Connections for M.2 (S60) 3ME3

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. The Innodisk M.2 (S60) 3ME3 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	2	6	-	A	2	8	D	0	8	B	C	A	D	C	-	X	X	X	
Definition																						
Code 1st (Disk)											Code 14th (Operation Temperature)											
D : Disk											C: Standard Grade (0°C ~ +70°C)											
Code 2nd (Feature set)											Code 15th (Internal control)											
E : Embedded series											W: Industrial Grade (-40°C ~ +85°C)											
Code 3rd ~5th (Form factor)											Code 16th (Channel of data transfer)											
M26: M.2-SATA Type 2260											A: BGA PCB version.											
Code 7th ~9th (Capacity)											Code 17th (Flash Type)											
32G: 32GB			64G: 64GB			A28: 128GB						D: Dual Channels										
B56: 256GB			C12: 512GB									Q: Quad Channels										
Code 10th ~12th (Controller)											Code 19th~21st (Customize code)											
D08:ID108											C: Toshiba MLC											
Code 13th (Flash mode)																						
B: Synchronous NAND for Toshiba 15nm																						

6. Appendix

REACH

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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: 20/06/2016)。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: 20/06/2016).

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： 2016 / 06 / 23



RoHS

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Innodisk Corporation

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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）特此保證售予新漢股份有限公司之所有產品，皆符合歐盟 2011/65/EU 關於 RoHS 之規範要求。

Innodisk Corporation declares that all products sold to Nexcom, 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



CE



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
(EN55022 / 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: M.2
 Brand Name: Innodisk
 Model Number: M.2 (S60) 3S*W-&
 (&-Flash type: (S-SLC, L-LSLC, M-MLC);
 *-Product line: (E-Embedded, G-EverGreen, R-InnoRobust);
 #-Controller: (empty:106/107/167, 2-201/ 202, 3-108/109/170, 4-9-Others);
 &-Product feature: (P-with DRAM, empty:without DRAM))

Measurement Standard
 EN 55022: 2010 / AC: 2011
 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: T160810D12-E



 Sam Hu / Assistant Manager
 Date: August 12, 2016



群創科技股份有限公司
 Compliance Certification Services Inc.

FCC



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. 217, Sec. 1, Datong Rd., Xizhi Dist.,
New Taipei City 22161, Taiwan (R.O.C)


Product Description

EUT Description: M.2
Brand Name: Innodisk
Model Number: M.2 (S60) 3S*0-&
(S:Flash type: (S:SLC,I:SLC,M:MLC);
*Product line: (E:Embedded, G:EverGreen, R:InnoRobust);
#Controller: (empty:106/107/167, 2:201/ 202, 3:108/109/170, 4-9:Others);
&:Product feature: (P:with DRAM, empty:without DRAM))

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: T160810D12-D


Sam Hu / Assistant Manager
Date: August 12, 2016

CCSRF
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Compliance Certification Services Inc.