

Industrial Micro SD Card

SD 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. 2012
Rev. 1.0	Add 8GB in available capacities.	Sep. 2012
Rev. 1.1	1. Update product picture 2. Add features 3. Add description of enhanced power cycling 4. Add chapter of i-S.M.A.R.T Utility	Nov. 2012
Rev. 1.2	Add device parameters Add mechanical drawing	April, 2014
Rev.1.3	Update ECC bits	March, 2016
Rev 1.4	Update performance	April, 2016
Rev 1.5	Modified power consumption, remove 16GB & 3.0 interface description.	Oct., 2017
Rev 1.6	Updated to new part number (2 version for 1GB/ 3 version for 2 GB and 4GB), Removed 8GB	Aug., 2018

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1. Product Overview

1.1 Introduction of Innodisk Industrial Micro SD card

While micro SD card has been a popular embedded storage device for mobile market, Innodisk has been developing a more reliable micro SD card that will support ruggedized applications in the embedded fields. Therefore, Innodisk would like to introduce you the industrial-grade micro SD card built with SLC (Single Level Cell) flash, delivering the most reliable micro SD card with outstanding performance and excellent endurance.

1.2 Product View and Models

Innodisk Industrial Micro SD card is available in follow capacities.

1GB 2GB 4GB



Figure 1: Innodisk Industrial Micro SD card

1.3 Product Features

- Interface: SD 2.0/1.1/1.0
- SLC NAND Flash
- Support SD/SPI mode
- Built-in ECC corrects up to 24 bits per 1 KB
- Resistance to Shock and Vibration
- Enhanced endurance by Global Wear-Leveling algorithm

2. Product Specifications

2.1 Capacity and Device Parameters

Innodisk Industrial Micro SD card device parameters are shown in Table 1.

Table 1: Device parameters

SLC		
Capacity	LBA	User Capacity(MB)
1GB	2000888	976
2GB	3956096	1931
4GB	7905272	3859

2.2 Performance

Burst Transfer Rate: up to 25 MB/s in SD 2.0

Table 2: Performance

Capacity	1GB	2GB	4GB
Sequential Read (max.)	21 MB/sec	23 MB/sec	23 MB/sec
Sequential Write (max.)	18 MB/sec	17 MB/sec	19 MB/sec

Note: Base on CrystalDiskMark 5.1.2 with file size 1000MB

2.3 Electrical Specifications

2.3.1 Power Requirement

Table 3: Innodisk Industrial Micro SD card Power Requirement

Item	Symbol	Rating	Unit
Input voltage	V _{IN}	2.7V~3.6V	V

2.3.2 Power Consumption

Table 4: Power Consumption

Mode	Power Consumption (mA)
Read	40 (max.)
Write	49 (max.)
Idle	0.06(max.)

* Target: Industrial Micro SD card 4GB

2.4 Environmental Specifications

2.4.1 Temperature Ranges

Table 5: Temperature range for Industrial Micro SD card

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 Industrial Micro SD card

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 Industrial Micro SD card 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: Industrial Micro SD card MTBF

Product	Condition	MTBF (Hours)
Innodisk Industrial Micro SD card	Telcordia SR-332 GB, 25°C	>3,000,000

2.5 CE and FCC Compatibility

Industrial Micro SD card conforms to CE and FCC requirements.

2.6 RoHS Compliance

Industrial Micro SD card 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	SLC: 100,000 P/E cycles
TBW(Sequential Write)	
1GB	90
2GB	180
4GB	360

2.8 Transfer Mode

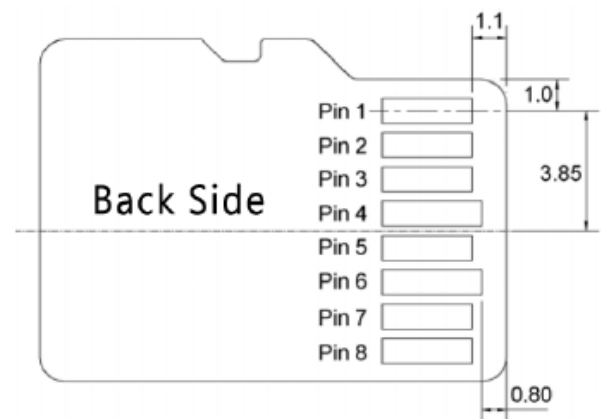
Industrial Micro SD card support following transfer mode:

SD 2.0

SD 1.1

2.9 Pin Assignment

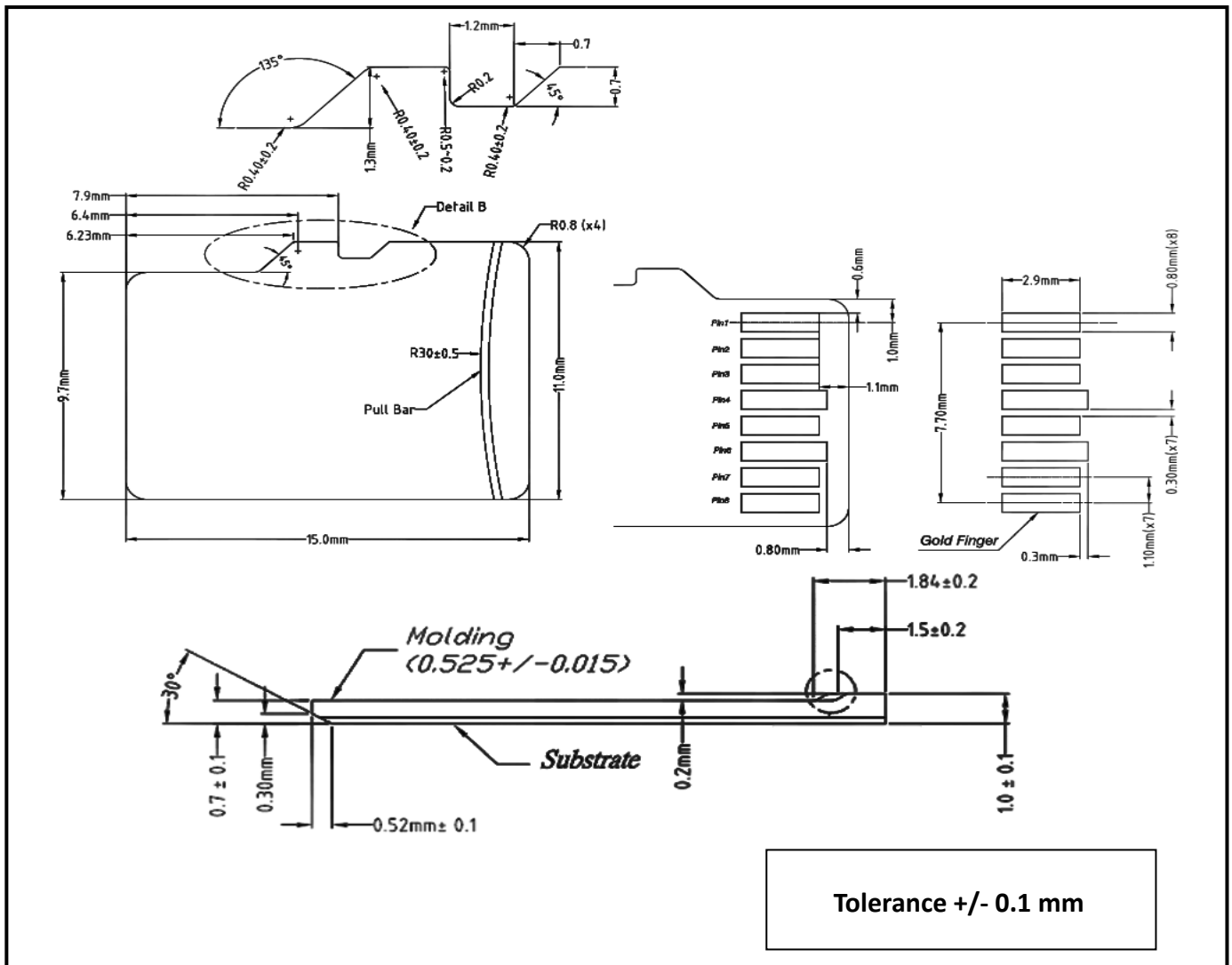
Innodisk Industrial Micro SD card compliant with standard SD SPEC., please refer to Table 8 for pin assignment.



Pin #	SD Mode		SPI Mode	
	Name	Description	Name	Description
1	DAT2	Data line bit 2.	-	
2	CD,DAT3	Card Detect	CS	Chip select
3	CMD	Command/Response	DI	Data in
4	V _{DD}	Supply voltage	VDD	Supply voltage
5	CLK	Clock	CLK	Clock
6	VSS	Supply voltage ground	VSS	Supply voltage ground
7	DAT0	Data Line [Bit 0]	DO	Data Out
8	DAT1	Data Line [Bit 1]	-	

Table 8: Innodisk Industrial Micro SD card Pin Assignment

2.10 Mechanical Dimensions



2.11 Assembly Weight

An Innodisk Industrial Micro SD card 2.0 within SLC flash ICs, 4GB's weight is 5.7 grams approx.

2.12 Seek Time

Innodisk Industrial Micro SD card is not a magnetic rotating design. There is no seek or rotational latency required.

2.13 Hot Plug

The Micro SD card support hot plug function and can be removed or plugged-in during operation.

2.14 NAND Flash Memory

Innodisk Industrial Micro SD card uses SLC (Single Level Cell) 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 Industrial Micro SD card from the system level, including the major hardware blocks.

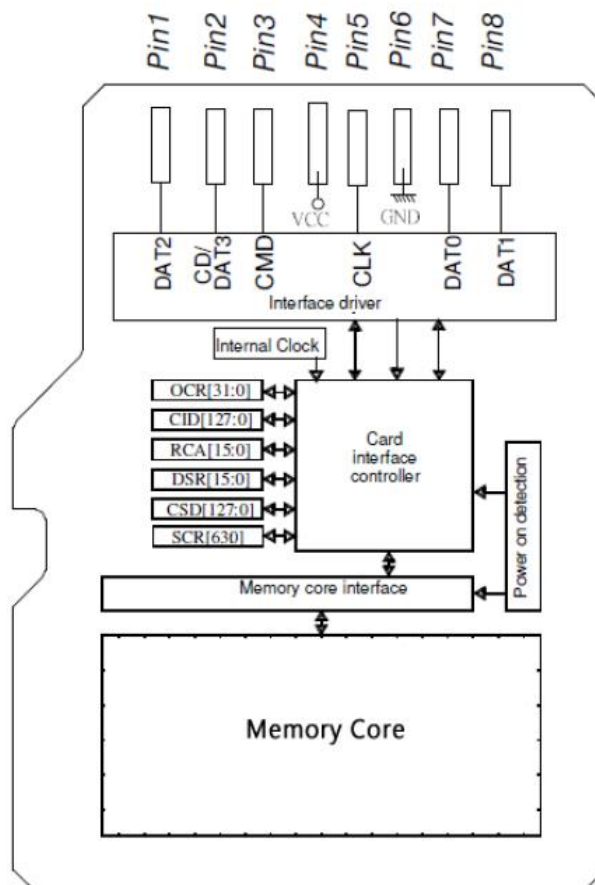


Figure 2: Innodisk Industrial Micro SD card Block Diagram

3.2 SD 2.0 Controller

Innodisk Industrial Micro SD card is designed with a SD 2.0 controller, which has single channel 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 up to 24 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 Industrial Micro SD card uses a global 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

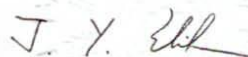
Bad Blocks are blocks that contain one or more invalid bits whose reliability are not guaranteed. The Bad Blocks may be presented while the product is shipped, or may develop during the life time of the Micro SD card. When the Bad Blocks is detected, it will be flagged, and not be used anymore. The Micro SD card 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.

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	S	2	M	-	0	4	G	I	8	1	A	C	3	S	T				
Description	Disk	Micro SD card				Capacity			Category			Flash Mode	Operation Temp.	Internal Control	CH	Flash.				
Definition																				
Code 1 st (Disk)												Code 12 th (Flash Mode)								
D : Disk												A: Async. Flash								
Code 2 nd ~ 4 th (Form Factor)																				
S2M: micro SD card																				
Code 6 th ~8 th (Capacity)												Code 13 th (Operation Temperature)								
01G: 1GB												C: Standard Grade (0°C ~ +70°C)								
02G: 2GB												W: Industrial Grade (-40°C ~ +85°C)								
04G: 4GB												Code 14 th (Internal control)								
												Code 15 th (Channel of data transfer)								
												S: Single Channel								
Code 9 th ~11 th (Series)																				
I81: SD series												Code 16 th (Flash Type)								
												B: Toshiba SLC								
												Code 19 th ~20 th (Customized Code)								

Appendix

CE

Verification of Compliance	
Product Name	: Industrial micro SD card
Model Number	: DS2M-XXGI81A#1S% XX: capacity (01,02,04) : #: temperature (C, W) : %: flash (B, T)
Applicant	: InnoDisk Corporation
Address	: 9F, No. 100, Sec. 1 Xintai 5th Rd., Xizhi City, Taipei 221, Taiwan
Report Number	: O22-U070-1205-077
Issue Date	: May 10, 2012
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	 Central Research Technology Co. EMC Test Laboratory 11, Lane 41, Fushuen St., Jungshan Chiu, Taipei, Taiwan, 104, R.O.C. Tel : 886-2-25984568 Fax: 886-2-25984546
 (Tsun-Yu Shih/ General Manager) Date: <u>May 10, 2012</u>	

Verification of Compliance

Product Name : Industrial micro SD card
Model Number : DS2M-XXGI81A#1S%
XX: capacity (01,02 ,04) ;
#: temperature (C, W) ;
%: flash (B, T)
Applicant : InnoDisk Corporation
Address : 9F, No. 100, Sec. 1 Xintai 5th Rd., Xizhi City, Taipei 221, Taiwan
Report Number : F-U070-1205-077
Issue Date : May 10, 2012

Applicable Standards : FCC Part 15, Subpart B Class B ITE
ANSI C63.4:2009
Industry Canada ICES-003 Issue 4
CSA-IEC CISPR22: 02 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



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Tel : 886-2-25984568

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A handwritten signature in black ink, appearing to read 'J. Y. Shih'.

(Tsun-Yu Shih/ General Manager)

Date: May 10, 2012

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 及 (EU) 2015/863 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) and (EU) 2015/863 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
鄰苯二甲酸二(2-乙基己基)酯 (DEHP)	< 1000 ppm
鄰苯二甲酸丁酯苯甲酯 (BBP)	< 1000 ppm
鄰苯二甲酸二丁酯 (DBP)	< 1000 ppm
鄰苯二甲酸二異丁酯 (DIBP)	< 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： 2017 / 01 / 18



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



