innodisk

Total Solution For Industrial Flash Storage

Industrial SD Card

SD 3.0 series (iSLC)

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	June, 2016
1.0	Officially release	Nov., 2016

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1. Product Overview

1.1 Introduction of Innodisk Industrial SD card 3.0 series

Innodisk industrial SD card 3.0 series are specifically designed for industrial PC and embedded applications. The 3.0 series SD card has latest firmware architecture and Flash algorithms, including superior wear leveling, read disturb management, and power fail management ensuring highest reliability and endurance.
Innodisk industrial SD card 3.0 series provide wide range capacities from 8GB to 64GB within MLC NAND Flash, and fully compliant to SD3.0, and SD2.0 specifications.
With its low power consumption and features above, Innodisk industrial SD card 3.0 series can be applied on industrial automation, SBC (single-board computer), medical equipment, infotainment, and mobile application.

1.2 Product View and Models

Innodisk Industrial SD card 3.0 iSLC series is available from 8GB up to 64GB capacities within MLC Flash IC.

Figure 1: Innodisk Industrial SD card

1.3 SD 3.0 Interface

Innodisk Industrial SD card 3.0 series support SD 3.0 interface, and backward compliant to SD 2.0 interface.

2. Product Specifications

2.1 Capacity and Device Parameters

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

Table 1: Device parameters

iSLC		
Capacity	**LBA**	**User Capacity(MB)**
8GB	15648768	7592
16GB	31277056	15392
32GB	62532608	30976
64GB	125044736	62464

2.2 Performance

Burst Transfer Rate: up to 104 MB/s in SD 3.0 SDR104

Table 2: Performance

iSLC (ST)				
Capacity	**8GB**	**16GB**	**32GB**	**64GB**
Class	10	10	10	10
Sequential Read (max.)	45 MB/sec	60 MB/sec	60 MB/sec	61 MB/sec
Sequential Write (max.)	35 MB/sec	35 MB/sec	35 MB/sec	36 MB/sec
4K random read(QD32)	1100 IOPS	1000 IOPS	1000 IOPS	1000 IOPS
4K random Write(QD32)	1100 IOPS	1000 IOPS	1000 IOPS	1000 IOPS

iSLC (WT)				
Capacity	**8GB**	**16GB**	**32GB**	**64GB**
Class	10	10	10	10
Sequential Read (max.)	44 MB/sec	45 MB/sec	45 MB/sec	45 MB/sec
Sequential Write (max.)	34 MB/sec	31 MB/sec	31 MB/sec	31 MB/sec
4K random	1100	1000	1000	1000

read(QD32)	IOPS	IOPS	IOPS	IOPS
4K random Write(QD32)	1100 IOPS	1000 IOPS	1000 IOPS	1000 IOPS

Note: Base on CrystalDiskMark 5.1.2 with file size 1000MB

2.3 Electrical Specifications

2.3.1 Power Requirement

Table 3: Innodisk Industrial 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	69 (max.)
Write	77 (max.)
Idle	1.6 (max.)

* Target: Industrial SD card 3.0 series MLC 64GB

2.4 Environmental Specifications

2.4.1 Temperature Ranges

Table 5: Temperature range for Industrial SD card

Temperature	Range
Operating	Standard Grade: -20°C to +85°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 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 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 SD card MTBF

Product	Condition	MTBF (Hours)
Innodisk Industrial SD card 3.0 series	Telcordia SR-332 GB, 25°C	>3,000,000

2.5 CE and FCC Compatibility

Industrial SD card conforms to CE and FCC requirements.

2.6 RoHS Compliance

Industrial SD card is fully compliant with RoHS directive.

2.7 Reliability

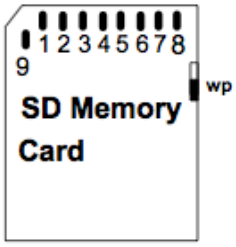
Parameter	Value
Read Cycles	Unlimited Read Cycles
Wear-Leveling Algorithm	Support
Bad Blocks Management	Support
Error Correct Code	Support
TBW (Expected TWB JEDEC Enterprise)	
8GB	46.9
16GB	94.1
32GB	188.4
64GB	377.1

2.8 Transfer Mode

Industrial SD card 3.0 series support following transfer mode:
SD 3.0 / SD 2.0

2.9 Pin Assignment

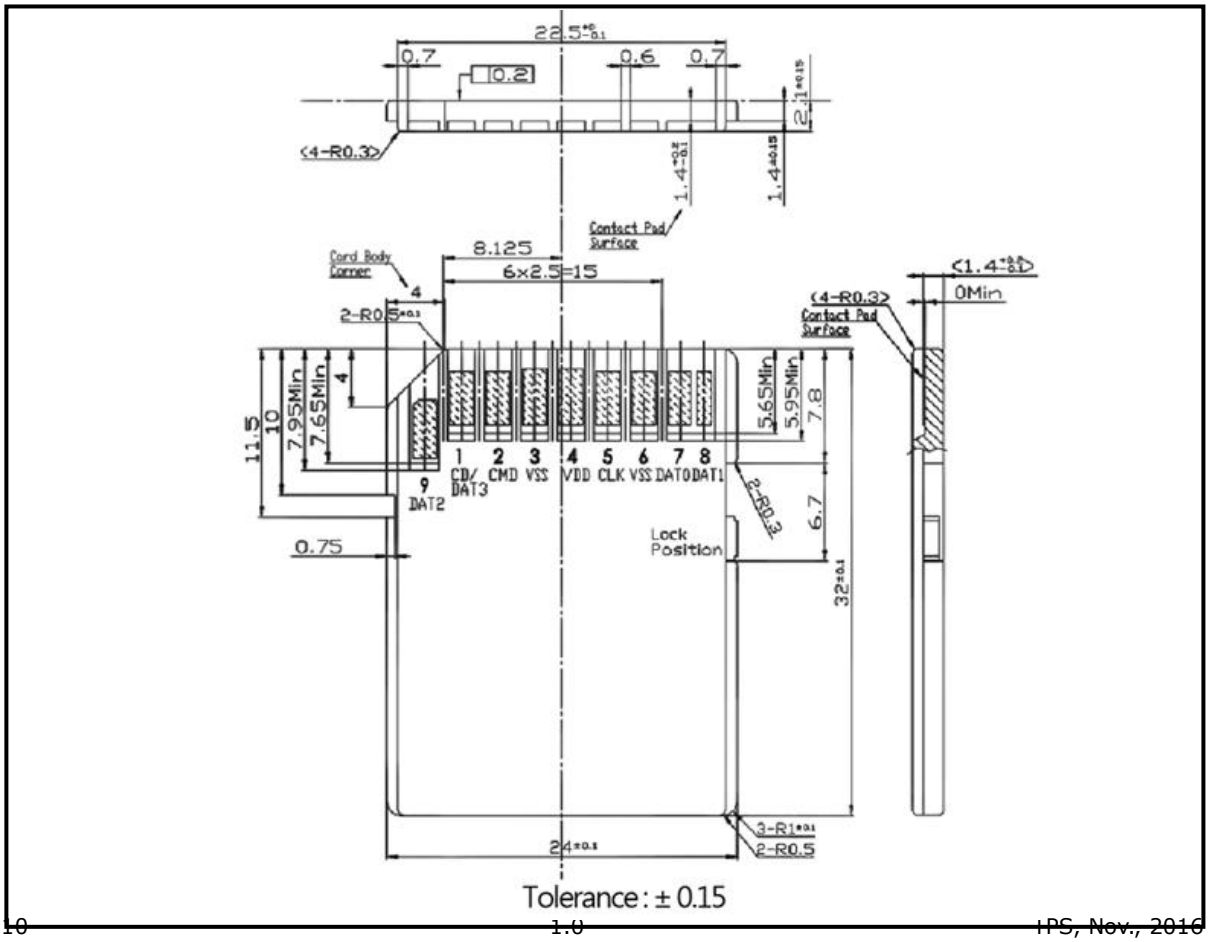
Innodisk Industrial SD card 3.0 series compliant with standard SD SPEC., please refer to Table 8 for pin assignment.



Pin #	SD Mode			SPI Mode		
	Name	Type[1]	Description	Name	Type[1]	Description
1	CD/DAT3[2]	I/O/PP[3]	Card Detect/Data Line [Bit 3]	CS	I[3]	Chip Select (Neg. True)
2	CMD	I/O/PP	Command/Response	DI	I	Data In
3	V_{SS1}	S	Supply voltage ground	V_{SS}	S	Supply voltage ground
4	V_{DD}	S	Supply voltage	V_{DD}	S	Supply voltage
5	CLK	I	Clock	SCLK	I	Clock
6	V_{SS2}	S	Supply voltage ground	V_{SS2}	S	Supply voltage ground
7	DAT0	I/O/PP	Data Line [Bit 0]	DO	O/PP	Data Out
8	DAT1[4]	I/O/PP	Data Line [Bit 1]	RSV		
9	DAT2[5]	I/O/PP	Data Line [Bit 2]	RSV		

Table 8: Innodisk Industrial SD card 3.0 series Pin Assignment

2.10 Mechanical Dimensions



2.11 Assembly Weight

An Innodisk Industrial SD card 3.0 within MLC flash ICs, 16GB's weight is TBD grams approx.

2.12 Seek Time

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

2.13 Hot Plug

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

2.14 NAND Flash Memory

Innodisk Industrial SD card 3.0 series 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 Industrial SD card 3.0 series from the system level, including the major hardware blocks.

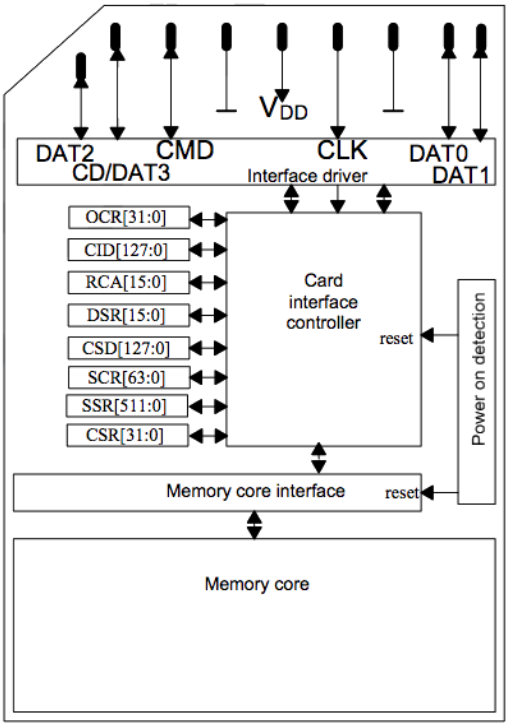


Figure 2: Innodisk Industrial SD card 3.0 series Block Diagram

Innodisk Industrial SD card 3.0 series integrates a SD 3.0 controller and NAND flash memories. Communication with the host occurs through the host interface, using the standard SD interface.

3.2 SD 3.0 Controller

Innodisk Industrial SD card 3.0 series is designed with a SD 3.0 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 96 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 SD card 3.0 series 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 SD card. When the Bad Blocks is detected, it will be flagged, and not be used anymore. The 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.

3.6 Power Failure Management

Innodisk industrial SD card 3.0 series has a power failure management feature to ensure data integrity, which is a comprehensive data protection mechanism that functions before and after a sudden power outage to SD card. 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 SD card. 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 SD's speed and lifespan.

4. Installation Requirements

4.1 Industrial SD card Pin Directions

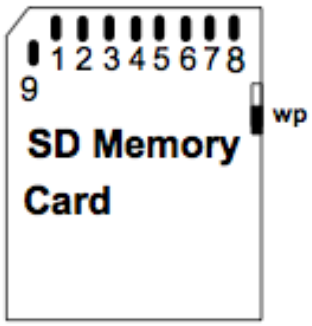


Figure 3: Signal Segment and Power Segment

4.2 Device Drive

No additional device drives are required.

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	**H**	**S**	**D**	**C**	**-**	**3**	**2**	**G**	**Y**	**8**	**1**	**B**	**C**	**3**	**S**	**C**	**-**	**X**	**X**
Description	Disk	Industrial SD card					Capacity			Category			Flash Mode	Operation Temp.	Internal Control	CH.	Flash	-	Customized Code	

Definition	
Code 1st (Disk)	**Code 13th (Flash Mode)**
D : Disk	B: Toshiba 15nm
Code 2nd ~ 5th (Form Factor)	**Code 14th (Operation Temperature)**
HSDC: Industrial SD card 3.0 iSLC series	C: Standard Grade (-20℃~ +85℃)
Code 7th ~9th (Capacity)	W: Industrial Grade (-40℃~ +85℃)
08G: 8GB	**Code 15th (Internal control)**
16G: 16GB	**Code 16th (Channel of data transfer)**
32G: 32GB	S: Single Channel
64G: 64GB	
Code 10th ~12th (Series)	**Code 17th (Flash Type)**
Y81: Industrial SD card 3.0 series	C: Toshiba MLC
	Code 19th~20th (Customized Code)

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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） Polybrominated Biphenyls（PBB）	< 1000 ppm < 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 李綉亮

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

Date 日期： 2014 / 07 / 29

(Company Stamp/公司大小章)

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）特此保證此番予貴公司之產品，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

(Company Stamp/公司大小章)

Certificate

Issue Date: May 29, 2014
Ref. Report No. ISL-14LE220CE

Product Name	:	Industrial SD Card 3.0
Model(s)	:	D@SDC-XXXY81*#1-;-&
Brand	:	Innodisk
Responsible Party	:	Innodisk Corporation
Address	:	5F.No.237, Sec. 1, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)

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 :

CE

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: 2013 and IEC 61000-3-3: 2013
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

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 / Director

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Tel: 886-3-407-1718; Fax: 886-3407-1738

Certificate

Issue Date: May 29, 2014
Ref. Report No. ISL-14LE220FB

Product Name	:	Industrial SD Card 3.0
Model(s)	:	D@SDC-XXXY81*#1-¦-&
Brand	:	Innodisk
Applicant	:	Innodisk Corporation
Address	:	5F.No.237, Sec. 1, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)

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: 2012- 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 / Director

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