innodisk

Total Solution For Industrial Flash Storage

Industrial SD Card

3IE3

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 0.1	First release	Nov, 2020
V1.0	Update capacity information	Jan. 2021
V 2.0	Update product specification information	Jan. 2021
V 2.1	P/E cycle correction	Feb. 2021
V 2.2	Operating temperature collection	July 2022

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1. Product Overview

1.1 Introduction of Innodisk Industrial SD 3IE3

Innodisk 3IE3 is an industrial-grade SD card solution with an integrated industrial controller, which is designed for embedded applications. With enhanced flash technologies and a powerful configurable BCH ECC engine, SD 3IE3 can achieve high-speed data transfer rates.

Innodisk industrial SD 3IE3 provides a wide range of capacities from 8GB to 128GB with iSLC NAND Flash, and is fully compliant with SD3.0 and SD2.0 specifications.

Innodisk industrial SD 3IE3 are specifically designed for industrial PC and embedded applications for high performance. With its low power consumption and the above mentioned features, Innodisk industrial SD 3IE3 can be applied for industrial automation, SBC (single-board computer), medical equipment, infotainment, and mobile applications.

1.2 Product View and Models

Innodisk Industrial SD 3IE3 is available from 4GB up to 64GB capacities within iSLC Flash IC.

Figure 1: Innodisk Industrial SD 3IE3

1.3 SD 3.0 Interface

Innodisk Industrial SD 3IE3 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

Capacity	LBA
4GB	7929856
8GB	15859712
16GB	31719424
32GB	63438848
64GB	126877696

2.2 Performance

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

Table 2: Performance

Capacity	4GB	8GB	16GB	32GB	64GB
Class	10	10	10	10	10
Sequential Read (max.)	82 MB/sec	82 MB/sec	80 MB/sec	80 MB/sec	80 MB/sec
Sequential Write (max.)	40 MB/sec	40 MB/sec	70 MB/sec	70 MB/sec	70 MB/sec

Note: Base on CrystalDiskMark 6.0.2 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)				
Capacity	4GB	8GB	16GB	32GB	64GB
Read (rms)	127	129	127	132	137
Write (rms)	100	106	135	136	143
Peak (max)	166	183	177	185	186
Idle (rms)	0.15	0.15	0.16	0.2	0.26

2.4 Environmental Specifications

2.4.1 Temperature Ranges

Table 5: Temperature range for Industrial SD card

Temperature	Range
Operating	Standard Grade: -25°C to +85°C
	Industrial Grade:-40°C to +85°C
Storage	-40°C to +85°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 3IE3	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

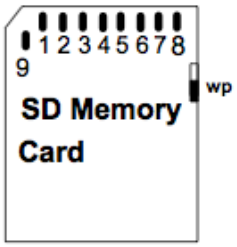
Parameter	Value
Read Cycles	Unlimited Read Cycles
Flash endurance	20,000 P/E cycles
Wear-Leveling Algorithm	Support
Bad Blocks Management	Support
Error Correct Code	Support
TBW(Sequential Write)	iSLC
4GB	71.0
8GB	142.0
16GB	284.1
32GB	568.2
64GB	1136.4
*TBW Base on Industrial SD 3.0 iSLC solution	

2.8 Transfer Mode

Industrial SD 3IE3 support following transfer mode:
SD 3.0 / SD 2.0

2.9 Pin Assignment

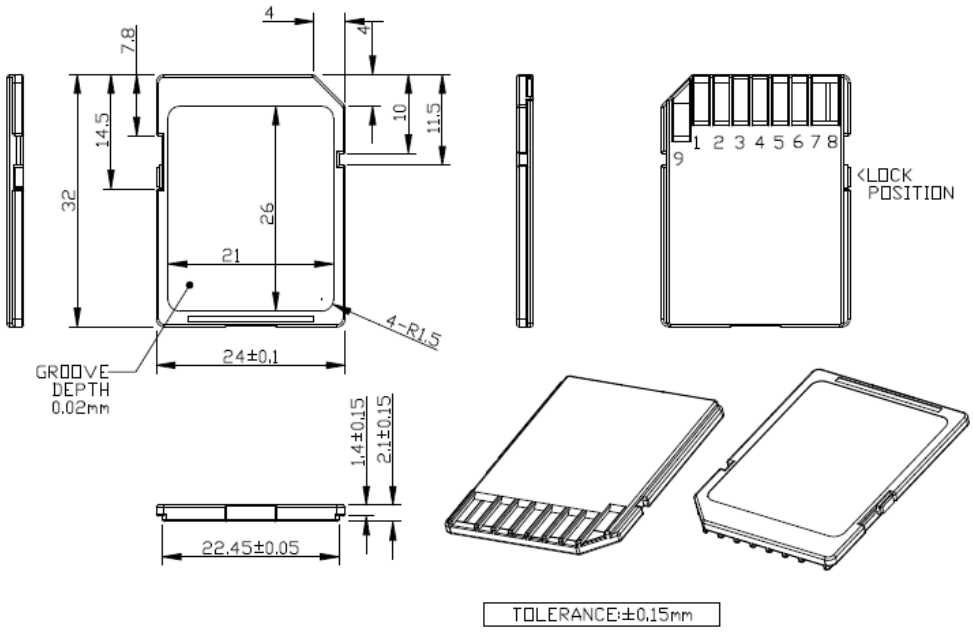
Innodisk Industrial SD 3IE3 compliant with standard SD SPEC., please refer to Table 8 for pin assignment.



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 3IE3 Pin Assignment

2.10 Mechanical Dimensions



2.11 Assembly Weight

An Innodisk Industrial SD card 3.0 within iSLC flash ICs, 8GB's weight is 2 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 3IE3 uses iSLC 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 3IE3 from the system level, including the major hardware blocks.

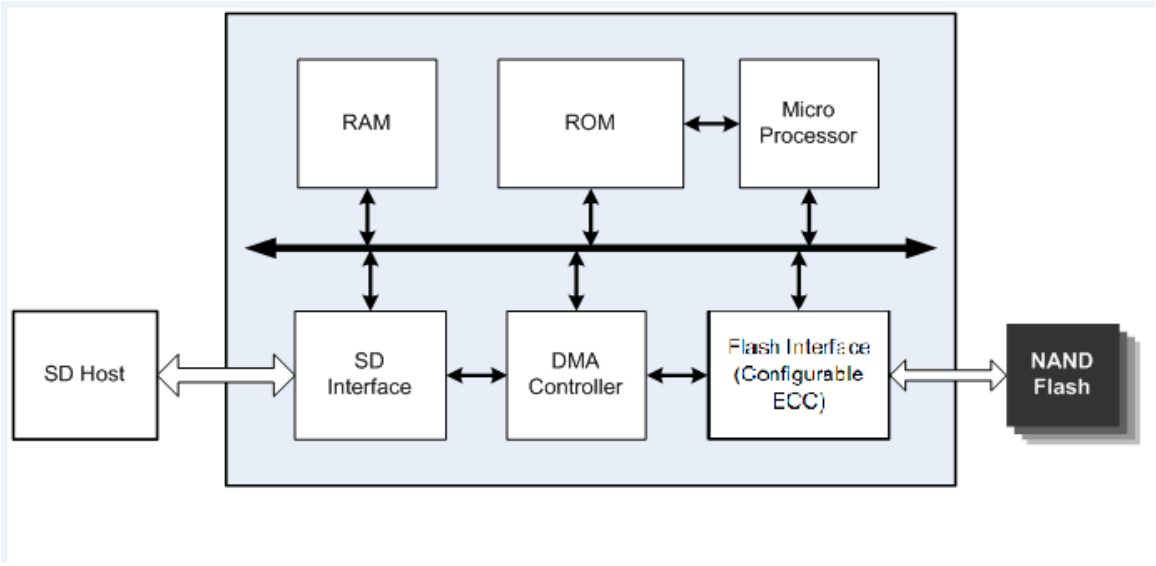


Figure 2: Innodisk Industrial SD 3IE3 Block Diagram

Innodisk Industrial SD 3IE3 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 3IE3 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 43 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 3IE3 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 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.

3.7 Power cycling

Innodisk's SD/MSDs provide the complete data protection mechanism during every abnormal power shutdown situation. Such as: power failure at programming data, updating system tables, erasing blocks, etc. The mechanism can maintain the data correctness and increase the reliability of the data stored in the NAND Flash memory.

4. Installation Requirements

4.1 Industrial SD card Pin Directions

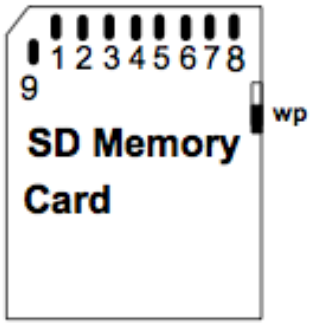


Figure 3: Signal Segment and Power Segment

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**	**S**	**0**	**2**	**B**	**E**	**1**	**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: MLC Flash
Code 2nd ~ 5th (Form Factor)	**Code 14th (Operation Temperature)**
HSDC: Industrial SD iSLC	E: Extend Grade (-25℃~ +85℃)
Code 7th ~9th (Capacity)	W: Industrial Grade (-40℃~ +85℃)
04G: 4GB	**Code 15th (Internal control)**
08G: 8GB	**Code 16th (Channel of data transfer)**
16G: 16GB	S: Single Channel
32G: 32GB	**Code 17th (Flash Type)**
64G: 64GB	C: Toshiba MLC
Code 10th ~12th (Series)	**Code 19th~20th (Customized Code)**
S02: SMI 2702BAC	

宜鼎國際股份有限公司
Innodisk Corporation
REACH Declaration

Tel:(02)7703-3000 Fax:(02) 7703-3555 Internet: https://www.innodisk.com/

Innodisk Corporation pursues its social responsibility for global environmental preservation by committing to be compliant with REACH regulation (REGULATION (EC) No 1907/2006). We hereby confirm that the product(s) delivered to

Innodisk P/N	Description
All Innodisk EM FLASH Products	

☐ contain(s) **no** hazardous substances or constituents exceeding the defined threshold 0.1 % by weight in homogenous material if not otherwise specified, as described in the candidate list table currently including 209 substances and shown on the ECHA website (http://echa.europa.eu/de/candidate-list-table).

☑ contain(s) one or more hazardous substances or constituents exceeding 0.1 % by weight in homogenous material if not otherwise specified in candidate list table. Where the threshold value is exceeded, the substances in question are to be declared in accompanying Appendix A .

☑ Comply with REACH Annex XVII.

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： 2020 / 07/ 01

innodisk

宜鼎國際股份有限公司
Innodisk Corporation

Tel:(02)7703-3000 Internet: https://www.innodisk.com/

RoHS 自我宣告書(RoHS Declaration of Conformity)

Manufacturer Products: All Innodisk EM FLASH, DRAM and EP 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.

三、 本公司聲明我們的產品符合 RoHS 指令的附件中(7a)、(7c-I)允許豁免。
We declare, our products permitted by the following exemptions specified in the Annex of the RoHS directive.
※ (7a) Lead in high melting temperature type solders(i.e. lead-based alloys containing 85% by weight or more lead).
※ (7C-I) Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectric devices, or in a glass or ceramic matrix compound.

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： 2020 / 03 / 03

DECLARATION OF CONFORMITY

This Declaration of Conformity is hereby issued to the below named company and for below described device, based on

Technical Standard: FCC 47 CFR Part 15
Subpart B, Class B
ISED ICES-003 Issue 6, 2016

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: SD 3.0
Brand Name: Innodisk
Model Number: SD 3$*#
$:Flash type: (S:SLC, I:iSLC, 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);
SD type include (Industrial SD Card SD 3.0)

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 tested and found to be in compliance with the measurement procedures specified in the Standards & Specifications listed above and as indicated in the measurement report with the number: TI70707D04-D

The test results shown in this report are applicable only to the investigated sample identified in this report.

Sam Hu

Sam Hu / Assistant Manager
Date: July 12, 2017

CE

VERIFICATION OF COMPLIANCE

This Verification of Compliance is hereby issued to the below named company and for below described product, based on

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: SD 3.0
Brand Name: Innodisk
Model Number: SD 3$*#
$:Flash type: (S:SLC, I:iSLC, M:MLC, T:3D TLC, A~Z:Others);
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#:Product Generation: (empty, 0~9);
SD type include (Industrial SD Card SD 3.0)

Measurement Standard

EN 55032: 2015 / AC: 2016
CISPR 32: 2015 (Ed 2.0) / C1: 2016
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)

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Tel: +886-2-22170894 / Fax: +886-2-22171029

This device has been tested and found to be in compliance with the measurement procedures specified in the Standards & Specifications listed above and as indicated in the measurement report with the number: T170707D04-E

The test results shown in this report are applicable only to the investigated sample identified in this report.

Sam Hu

Sam Hu / Assistant Manager
Date: July 12, 2017