

SATA Slim

J200 Series

Customer: _____

Customer

Part Number: _____

InnoDisk

Part Number: _____

InnoDisk

Model Name: _____

Date: _____

InnoDisk Approver	Customer Approver

the total solution for
industrial flash storage

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REVISION HISTORY

Revision	Description	Date
Preliminary	First Released	Feb. 2011
Rev 1.0	Add part number rule	May. 2011
Rev 1.01	Revised PCB screw size	JAN. 2012

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1. Product Overview

1.1 Introduction of InnoDisk SATA Slim J200

InnoDisk SATA Slim J200 is designed to comply with JEDEC MO-297 standard form factor, which is extremely suitable for portable / hand-held devices or thin clients. Moreover, its standard 7+15 pin SATA interface could support most of the platform with standard SATA port. InnoDisk SATA Slim J200 operates under SATA II (3.0Gb/s) protocol with good performance, the sustain read/write can reach up to 220/200MB per second (max).

InnoDisk SATA Slim J200 is also suitable in industrial field. It effectively reduces the booting time of operation system and the power consumption is less than hard disk drive (HDD). InnoDisk SATA Slim J200 complies with ATA protocol, no additional drivers are required, and the SATA Slim can be configured as a boot device or data storage device.

1.2 Product View

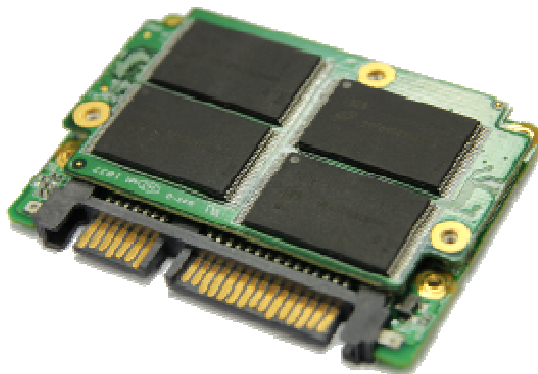


Figure 1: InnoDisk SATA Slim J200

1.3 Product Models

InnoDisk SATA Slim J200 is available in follow capacities.

SATA Slim J200 8GB (SLC) SATA Slim J200 32GB (SLC)

SATA Slim J200 16GB (SLC) SATA Slim J200 64GB (SLC)

1.4 Product features

- Interface: Serial ATA II (3.0Gbps)
- Capacity: 8GB, 16GB, 32GB, 64GB
- Data transfer rate:
 - Read- 220 MB/sec. (max.), Write- 200MB/sec. (max.)
- Access time: 0.3ms
- Error Correction Function
- Built-in ECC corrects up to 16-bit per 512Bytes
- Dimension: 30.0 x 50.95 x 6.8mm

2. Theory of operation

2.1 Overview

Figure 2 shows the operation of InnoDisk SATA Slim J200 from the system level, including the major hardware blocks.

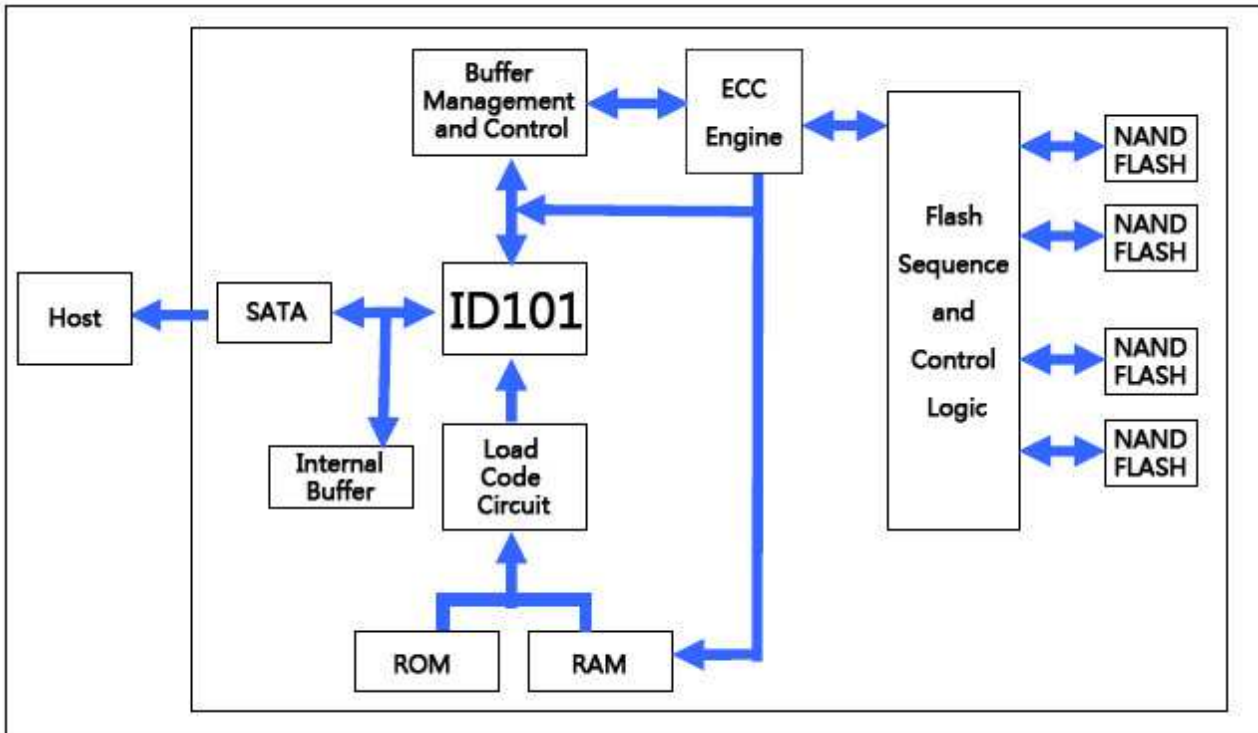


Figure 2: InnoDisk SATA Slim J200 Block Diagram

InnoDisk SATA Slim J200 integrates a SATA II 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.

2.2 SATA II Controller

The SATA II controller is 3.0 Gbps (Gen. 2), and support hot-plug. The Serial ATA physical, link and transport layers are compliant with Serial ATA Gen 1 and Gen 2 specification (Gen 2 supports 1.5Gbps/3.0Gbps data rate). The controller has 8 channels for flash interface.

The controller is equipped with 128KB of internal memory. The internal memory is used as an intermediate memory for storing data blocks during a wear-leveling procedure. A 32KB internal boot ROM includes basic routines for accessing the flash memories and for loading the main code into the internal memory.

2.3 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 16 bits per 512 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.

2.4 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 SATA Slim J200 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.

2.5 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. Installation Requirements

3.1 InnoDisk SATA Slim J200 Pin Directions

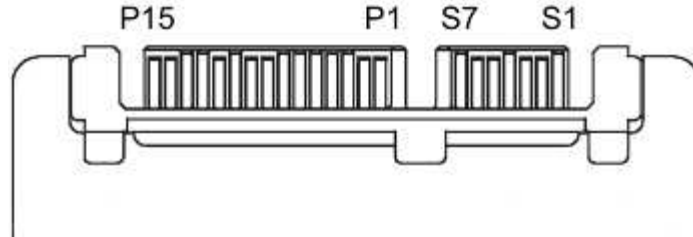


Figure 3: Signal Segment and Power Segment

3.2 Device drive

No additional device drives are required. The InnoDisk SATA Slim J200 can be configured as a boot device.

4. Specifications

4.1 CE and FCC Compatibility

InnoDisk SATA Slim J200 conforms to CE and FCC requirements.

4.2 RoHS Compliance

InnoDisk SATA Slim J200 is fully compliant with RoHS directive.

4.3 Environmental Specifications

4.3.1 Temperature Ranges

Operating Temperature Range:

- Standard Grade: 0°C to +70°C
- Industrial Grade: -40°C to +85°C

Storage Temperature Range:

- Standard Grade: -55°C to +95°C
- Industrial Grade: -55°C to +95°C

4.3.2 Humidity

Relative Humidity: 10-95%, non-condensing

4.3.3 Shock and Vibration

Table 1: Shock/Vibration Testing for InnoDisk SATA Slim J200

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

4.3.4 Mean Time between Failures (MTBF)

Table 3 summarizes the MTBF prediction results for various InnoDisk SATA Slim J200 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 2: InnoDisk SATA Slim J200 MTBF

Product	Condition	MTBF (Hours)
InnoDisk SATA Slim J200	Telcordia SR-332 GB, 25°C	> 3,000,000

4.4 Endurance

Read Cycles: Unlimited Read Cycles.

Data Retention: 10 years.

Wear-Leveling Algorithm: Support.

Bad Blocks Management: Support

Error Correct Code: Support

4.5 Transfer Mode

InnoDisk SATA Slim J200 support following transfer mode:

PIO Mode 0~4

Ultra DMA 0~6

Serial ATA I 1.5Gbps

Serial ATA II 3.0Gbps

4.6 Pin Assignment

InnoDisk SATA Slim J200 uses a standard SATA pin-out. See Table 3 for InnoDisk SATA Slim J200 pin assignments.

Table 3: InnoDisk SATA Slim J200 Pin Assignment

Name	Type	Description
S1	GND	NA
S2	A+	Differential Signal Pair A
S3	A-	
S4	GND	NA
S5	B-	Differential Signal Pair B
S6	B+	
S7	GND	NA
Key and Spacing separate signal and power segments		
P1	NC	NA
P2	NC	NA
P3	NC	NA

P4	GND	NA
P5	GND	NA
P6	GND	NA
P7	V5	5V Power, Pre-Charge
P8	V5	5V Power
P9	V5	5V Power
P10	GND	NA
P11	DAS/DSS	Device Activity Signal / Disable Staggered Spinup
P12	GND	NA
P13	NC	NA
P14	NC	NA
P15	NC	NA

4.7 Mechanical Dimensions

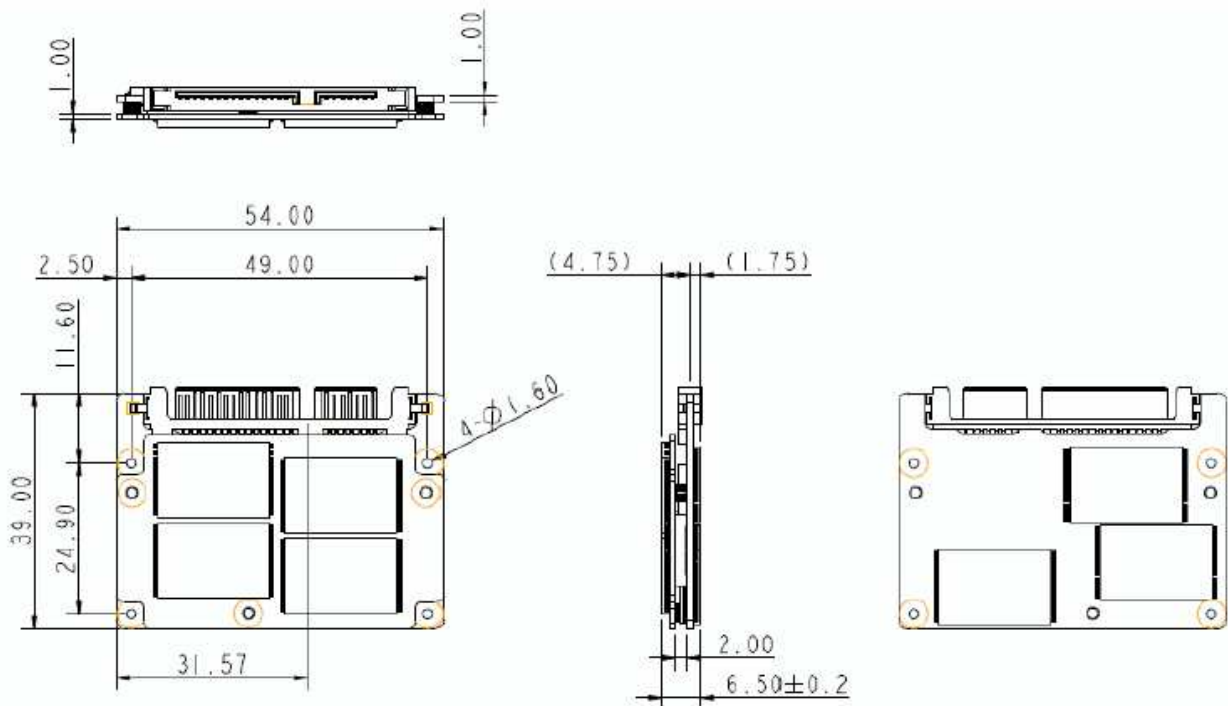


Figure 4: InnoDisk SATA Slim J200 SLC mechanical dimensions

4.8 Assembly weight

An InnoDisk SATA Slim J200 within SLC flash ICs, 32GB's weight is 15 grams approx.

4.9 Performance

Burst Transfer Rate: 3.0 Gbps

Sustained Read : 220MB/sec (max.)

Sustained Write : 200MB/sec (max.)

(based on 64GB)

4.10 Seek Time

InnoDisk SATA Slim J200 is not a magnetic rotating design. There is no seek or rotational latency required.

4.11 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.

4.12 NAND Flash Memory

InnoDisk SATA Slim J200 uses Single Level Cell (SLC) NAND flash memory, which is non-volatility, high reliability and high speed memory storage. There are only two statuses 0 or 1 of one cell. Read or Write data to flash memory for SSD is control by micro-processor.

4.13 Electrical Specifications

4.13.1 Power Requirement

Table 4: InnoDisk SATA Slim J200 Power Requirement

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

4.13.2 Power Consumption

Table 5: Power Consumption

Mode	Power Consumption (mA)
Read	300
Write	350
Idle	150

4.14 Device Parameters

SATA Slim J200 device parameters are shown in Table 6.

Table 6: Device parameters

Capacity	LBA	Cylinders	Heads	Sectors	User capacity
16GB	29323728	16383	16	63	14318.23
32GB	62533296	16383	16	63	30533.84
64GB	125045424	16383	16	63	61057.34

5. Supported ATA Commands

5.1 Supported ATA Commands

InnoDisk SATA Slim J200 supports the commands listed in Table 7.

Table 7: ATA Commands

Command Name	Code	PARAMETERS USED					
		SC	SN	CY	DR	HD	FT
CHECK POWER MODE	E5h	X	X	X	O	X	X
EXECUTE DIAGNOSTICS	90h	X	X	X	O	X	X
FLUSH CACHE	E7h	X	X	X	O	O	X
IDENTIFY DEVICE	ECh	X	X	X	O	X	X
IDLE	E3h	O	X	X	O	X	X
IDLE IMMEDIATE	E1h	X	X	X	O	X	X
INITIALIZE DEVICE PARAMETERS	91h	O	X	X	O	O	X
READ DMA	C8h or C9h	O	O	O	O	O	X
READ MULTIPLE	C4h	O	O	O	O	O	X
READ SECTOR(S)	20h or 21h	O	O	O	O	O	X
READ VERIFY SECTOR(S)	40h or 41h	O	O	O	O	O	X
RECALIBRATE	10h	X	X	X	O	X	X
SECURITY DISABLE PASSWORD	F6h	X	X	X	O	X	X
SECURITY ERASE PREPARE	F3h	X	X	X	O	X	X
SECURITY ERASE UNIT	F4h	X	X	X	O	X	X
SECURITY FREEZE LOCK	F5h	X	X	X	O	X	X
SECURITY SET PASSWORD	F1h	X	X	X	O	X	X
SECURITY UNLOCK	F2h	X	X	X	O	X	X
SEEK	7xh	X	X	O	O	O	X
SET FEATURES	EFh	O	X	X	O	X	O
SET MULTIPLE MODE	C6h	O	X	X	O	X	X
SLEEP	E6h	X	X	X	O	X	X
SMART	B0h	X	X	O	O	X	O
STANDBY	E2h	X	X	X	O	X	X
STANDBY IMMEDIATE	E0h	X	X	X	O	X	X
WRITE DMA	CAh or CBh	O	O	O	O	O	X
WRITE MULTIPLE	C5h	O	O	O	O	O	X
WRITE SECTOR(S)	30h or 31h	O	O	O	O	O	X

Note:

O = Valid,

X = Don't care

SC = Sector Count Register

SN = Sector Number Register

CY = Cylinder Low/High Register

DR = DEVICE SELECT Bit (DEVICE/HEAD Register Bit 4)

HD = HEAD SELECT Bit (DEVICE/HEAD Register Bit 3-0)

FT = Features Register

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	1	S	S	-	1	6	G	J	2	0	A	C	1	E	T				
Description	Disk	2.5" SATA 25000			-	Capacity			Category			FW	Operation Temp.	Internal Control	CH.	Flash	-	Customized Code		
Definition																				
Code 1st (Disk)											Code 13th (Operation Temperature)									
D : Disk											C: Standard Grade (0°C ~ +70°C)									
Code 2nd ~ 4th (Form Factor)											W: Industrial Grade (-40°C ~ +85°C)									
1SS: SATA Slim J200											Code 14th (Internal control)									
Code 6th ~8th (Capacity)											Code 15th (Channel of data transfer)									
08G: 08GB											E: Eight Channels									
16G: 16GB											Code 16th (Flash Type)									
32G: 32GB											T: Micron SLC									
64G: 64GB																				
Code 9th ~11th (Series)																				
J20: SATA Slim J200																				
Code 12th (Firmware version)																				
A: Standard F/W version																				

Verification of Compliance

Product Name : **SATA Slim Series**
Model Number : **D1SS-XXXJXXXXXXXX**
Applicant : **InnoDisk Corporation**
Address : **9F., No.100, Sec. 1Xintai5th Rd., Xizhi Dist., New Taipei City
221, Taiwan**
Report Number : **C22-U070-1101-404**
Issue Date : **March 3, 2011**
Applicable Standards : **EN 55022:2006+A1:2007 Class B ITE
EN 55024:1998+A1:2001+A2:2003
EN 61000-4-2:1995+A1:1998+A2:2001
EN 61000-4-3:2006+A1:2008
EN 61000-4-4:2004**

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-131, T-1441, G-10



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(Tsun-Yu Shih/ General Manager)

Date: March 3, 2011

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Product Name : **SATA Slim Series**
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221, Taiwan**
Report Number : **F-U070-1101-404**
Issue Date : **March 3, 2011**

Applicable Standards : **FCC Part 15, Subpart B Class B ITE
ANSI C63.4:2003
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-131, T-1441, G-10



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