



## ReCaData Technology

### SATA Mini PCI-e 30\*50mm Solid State Drive Datasheet

(Based on SLC NAND Flash)

RDM-M50SMN-XXX10

Ver.: 1.0

Aug, 2012

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Version	Date	Remark
1.0	Aug,2012	Release

# 1 Introduction

## 1.1 Overview

RecaData's SSD (Solid State Drive) is a high performance and high reliability storage device based on NAND Flash technology that designed to solve the bottleneck of computing system by traditional hard disk drives. ReCaData's SSD doesn't have a moving parts and it has the same host interface and physical dimension with Hard Disk Drive, so it can be drop-in replaced with the hard disk drives without anything. With a high performance and low power consumption, ReCaData's SSD can be a good storage device for NB and Tabletop PC.

RecaData's SSD purely consists of semiconductor devices and NAND flash memories, which give rugged features against shock and vibration, uses in extreme environment such as industrial PC an increased MTBF. Further more, ReCaData's SSD has highly advanced flash memory management algorithm to guarantee higher performance and data integrity.

## 1.2 Part Type Introduction

This chapter is about the specifications of the ReCaData's Solid State Drive SSD with Mini PCI-e interface.

Product Type	Capacity	interface
RDM-M50SMN-00810	8G	Mini PCI-e
RDM-M50SMN-01610	16G	Mini PCI-e
RDM-M50SMN-03210	32G	Mini PCI-e

Table 1 Capacity Specifications

## 2 Outline

Based spec	Interface	Mini PCI-e
	Dimension	51x30x3.6 mm
	Weight <sup>①</sup>	60 g(max)
	Capacity	8G~32G
	Flash type	SLC NAND Flash
Read/Write Performance <sup>②</sup>	Sequential Read	Up to 100MB/s
	Sequential Write	Up to 100MB/s
	4KB Random Read IOPS	2400
	4KB Random Write IOPS	500
	Response Time	0.1ms
Power Consumption	Power Supply	3.3V $\pm$ 5%
	Standby	0.5W
	4KB Random Write	2W
Reliability	Write endurance: 8 years @ 100G write/day(32G)	
	Read endurance: unlimited	
	MTBF: >1,000,000 hours	
	Data retention: >20years @ 25℃	
	Data erase do not support	
	Sudden power-off recovery support	
	ECC: 24bits in 512bytes	
	S.M.A.R.T and dynamic power management support	
	Static and dynamic wear-leveling	
	Bad block management algorithm	
Environment	Storage temperature: -55~95℃	
	Operation temperature: -40~85℃	
	Humidity: 5%~95%	
	Vibration: 20G Peak, 10 ~ 2000Hz, (15mins/ Axis) x3 Axis	
	Shock: 1500G (@0.5ms half sine wave)	
Warranty	3 years	

Table 2 outline of the driver

①,②:The Read/Write performance and weight vary with different capacity of products.

②: The testing environment is below:

OS: Microsoft Windows XP professional SP3

CPU: Intel Pentium<sup>®</sup> Dual-Core E5300 @2.6GHz

Memory: 2GB

Motherboard: GIGABYTE GA-G41M-ES2L

Test program: HDspeed(sequential R/W speed)

IOmeter (IOPS)

HDtune(response time)

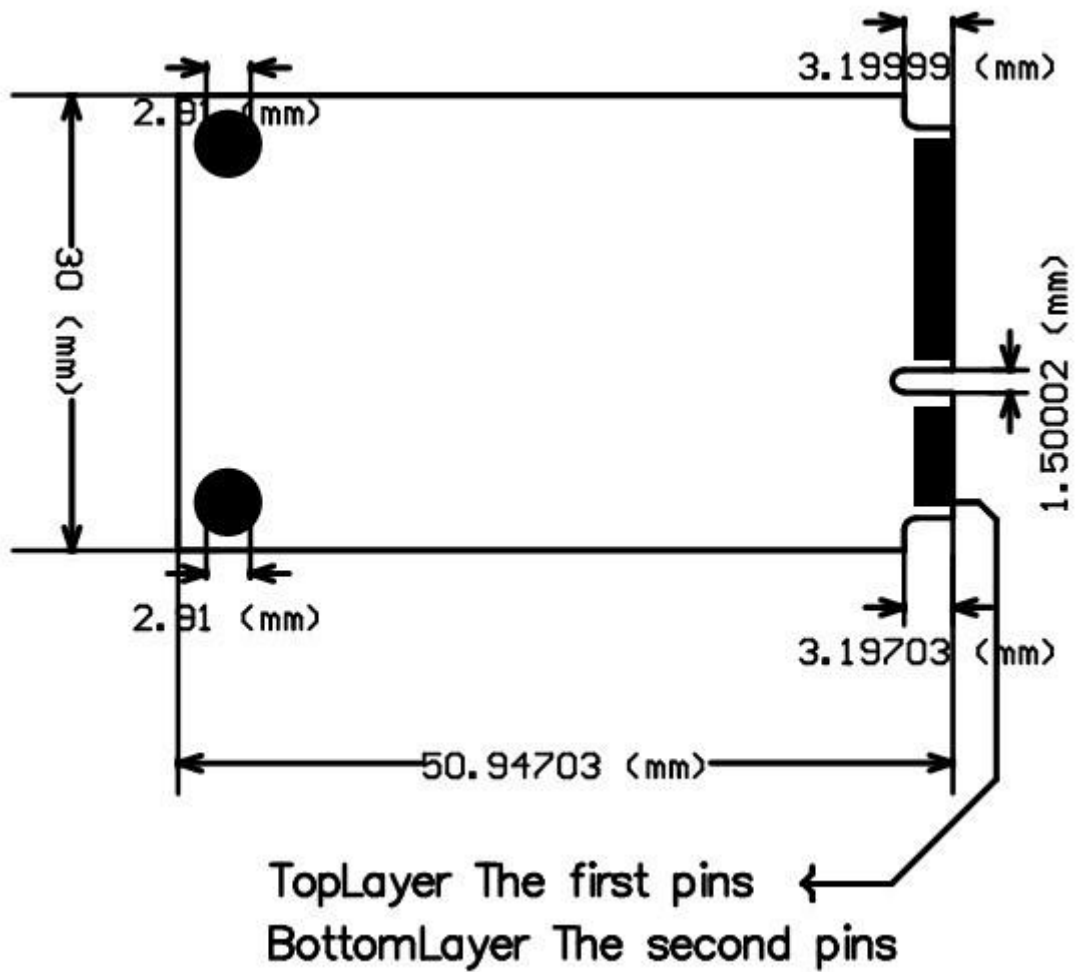
Test Drive : RDM-M50SMN-03210 (SLC)

### 3 Product Specifications

#### 3.1 Physical dimensions

Parameter	Value
Length	51±0.1 mm
width	30±0.1 mm
height	3.6±0.1 mm

Table 3 Physical dimensions of the driver



## 3.2 Interface Specification

### 3.2.1 Pin assignment

a). For ASUS EPC

Pin number	Signal name	Pin number	Signal name
1	Reserved	2	Reserved
3	Reserved	4	GND
5	Reserved	6	Reserved
7	Reserved	8	Reserved
9	GND	10	Reserved
11	Reserved	12	Reserved
13	Reserved	14	Reserved
15	GND	16	Reserved
17	Reserved	18	GND
19	Reserved	20	Reserved
21	GND	22	Reserved
23	TX-	24	Reserved
25	TX+	26	Reserved
27	GND	28	Reserved
29	GND	30	Reserved
31	RX-	32	Reserved
33	RX+	34	GND
35	GND	36	Reserved
37	Reserved	38	Reserved
39	Reserved	40	GND
41	Reserved	42	Reserved
43	Reserved	44	Reserved
45	Reserved	46	Reserved
47	3.3V	48	Reserved
49	3.3V	50	GND
51	3.3V	52	Reserved

Table 4 Mini PCI-e interface Pin assignment

b). For Intel

Pin number	Signal name	Pin number	Signal name
1	Reserved	2	3.3V
3	Reserved	4	GND
5	Reserved	6	Reserved
7	Reserved	8	Reserved
9	GND	10	Reserved
11	Reserved	12	Reserved
13	Reserved	14	Reserved
15	GND	16	Reserved
17	Reserved	18	GND
19	Reserved	20	Reserved
21	GND	22	Reserved
23	TX+	24	Reserved
25	TX-	26	Reserved
27	GND	28	Reserved
29	GND	30	Reserved
31	RX-	32	Reserved
33	RX+	34	GND
35	GND	36	Reserved
37	Reserved	38	Reserved
39	3.3V	40	GND
41	3.3V	42	Reserved
43	Reserved	44	Reserved
45	Reserved	46	Reserved
47	Reserved	48	Reserved
49	Reserved	50	GND
51	Reserved	52	3.3V

Table 5 Mini PCI-e interface Pin assignment

### 3.2.2 Interface Mode

The interface of ReCaData's SSD complies with the standard Serial ATA version 2.6:

- ① Host Transfer Rate is 300MB/s(3.0Gb/s)
- ② PIO mode 0,1,2,3,4
- ③ DMA mode 0,1,2
- ④ UDMA mode 0,1,2,3,4,5,6



## 4 Electrical Characteristics

### 4.1 Absolute Maximum Rating

Parameter	Symbol	Condition	Min	Max	Unit
TSGT	Storage temperature		-55	95	°C
AVDDH	Analog Power supply		-0.5	6	V
DVDD	Digital I/O Power Supply		-0.5	6	V
VI(D)	Digital I/O Input Voltage		-0.4	DVDD+0.4	V

Table 5 absolute maximum rating

### 4.2 Recommended Power Supply Operation Conditions

Parameter	Symbol	Condition	Min	Typical	Max	Unit
Operation digital power supply	PV33		3.0	3.3	3.6	V
	D1V8		1.75	1.8	1.85	V
Operation analog power supply	ASV33		3.0	3.3	3.6	V
	ASV18		1.75	1.8	1.85	V
	AVDDH		3.0	3.3	3.6	V
Ambient operation temperature	T <sub>A</sub>	For military	-40		85	°C
Junction temperature	T <sub>J</sub>		-55		95	°C

Table 6 recommended power supply operation conditions

### 4.3 Recommended External Clock Conditions

Parameter	Symbol	Condition	Min	Typical	Max	Unit
External reference clock				30		MHz
Clock duty cycle			45	50	55	%

Table 7 recommended external clock conditions

### 4.4 I/O DC Characteristics

Parameter	Symbol	Condition	Min	Typical	Max	Unit
Input low voltage	V <sub>IL</sub>				0.8	V
Input high voltage	V <sub>HL</sub>		2.0			V
Output low voltage	V <sub>OL</sub>		0		0.4	V
Output high voltage	V <sub>OH</sub>		2.6		0.36	V

Table 8 I/O DC characteristics

## 5 Product trait

### 5.1 Environment Specification

temperature	Storage	-55~95℃
	Operation	-40~85℃
humidity	5%~95%	
vibration	20G(40~2000Hz)	
shock	1500G(@0.3ms half sine wave)	
altitude	-8000~10000 foot	

Table 9 environment specifications

### 5.2 Power specification

Recommended DC operation voltage: 3.3V  $\pm$ 5%

Parameter	Typical	Unit	
Standby	0.5	W	
Idle	0.65	W	
4KB sample data	Sequential read	1.2	W
	Sequential write	1.5	W
	Random read	1.2	W
	Random write	1.7	W
512KB sample data	Sequential read	1.05	W
	Sequential write	1.6	W
	Random read	1.05	W
	Random write	1.65	W

Table 10 power consumption

Note: 1. the power consumption can differ depending on the disk capacity and the type of flash memory being used.

2. the test drive : RDM-M50SMN-03210

3. Supply voltage :3.3V $\pm$ 5%

### 5.3 Reliability Specification

#### ➤ Wear-leveling

RecaData's SSD support both dynamic and static wear-leveling. These two algorithms guarantee all type of flash memory at same level of erase cycles to improve lifetime limitation of NAND based storage.

#### ➤ Endurance

Write edurance:8years @ 100G write/day (32G)

- Read endurance: unlimited
- ECC  
ECC(Error Correction Code):BCH ECC 24 bits in 512bytes
- Bad block management algorithm  
This algorithm replaces bad blocks with new ones from available spares on media error conditions
- MTBF  
MTBF(Mean Time Between Failures): >2,000,000 hours
- Data retention  
Data retention:20years @25°C

## 6 Command Descriptions

### 6.1 Support ATA Commands

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

Table 11 ATA commands list

### 6.2 ATA Commands Specifications

- CHECK POWER MODE(E5h)  
The host can use this command determine the current power management mode
- EXECUTE DIAGNOSTICS(90h)  
This command performs the internal diagnostic tests implemented by the drive.See error register for diagnostic mode
- FLUSH CACHE(E7h)  
This command is used by the host to request the device to flush the write cache.If there is data

in the write cache,that data shall be written to the media.The BSY bit should remain set to one until all data has been written or an error occurs.

- **IDENTIFY DEVICE(Ech)**  
This commands read out 512Bytes of the drive parameter information.Parameter information consists of the arrangement and value as shown in the follow table.This command enables the host to receive the identify drive information from the device.
- **IDLE(E3h)**  
This command causes the device set BSY, enter the Idle mode,clear BSY and generate an interrupt.If sectors is non-zero,the automatic power down mode is enable.If the sectors is zero,the automatic power down mode is disable.
- **IDLE IMMEDIATE(E1h)**  
This command causes the device set BSY,enter the Idle(read) mode,clear BSY and generate an interrupt.
- **INITIALIZE DEVICE PARAMETER(91h)**  
This command enables the host to set the number of sectors per track and the number of tracks per heads.
- **READ DMA(C8h)**  
Read data from sectors during Ultra DMA and Multiword DMA transfer.Use the SET FEATURES command to specify the mode value. A sector count of zero requests 256 sectors.
- **READ MULTIPLE(C4h)**  
This command performs similarly to the Read Sector command.Interrupts are not generate on each sector,but on the transfer of a block which contains the number of sectors defined by a Set Multiple command.
- **READ SECTOR(S)(20h or 21h)**  
This command reads 1 to 256 sectors as specified in the sector count register from sectors which is set by Sector number register.A sector count of zero requests 256 sectors.The transfer being specified in the Ssector Nnumber register.
- **READ VERIFY SECTOR(S)(40h or 41h)**  
This command verifies one or more sectors on the device by transferring data from the flash media on the data buffer in the drive and verifying that the ECC is correct.This command is identical to the Read Sectors command,except that DRQ is never set and no data is transferred to the host.
- **RECALIBRATE(10h)**  
The current drive performs no processing if it receives this command.It's supported for backward compatibility with previous devices.
- **SECURITY DISABLE PASSWORD(F6h)**  
Disable any previously set user password and cancels the lock.The host transfers 512Bytes data,as shown in the following table, to the device.The transferred data contains a user or master password,which the device compares with the saved password.If they match,the device cancels the lock.The master password is still saved.It's re-enabled issuing the SECURITY SET PASSWORD command to re-set a user password.
- **SECURITY ERASE PREPARE(F3h)**  
This command shall be issued immediately before the Security Erase Unit command to enable

erasing and unlocking.This command prevents accidental lost data on the device.

➤ SECURITY ERASE UNIT(F4h)

The host uses this command to transfer 512Bytes data,as shown in the following table,to the drive.The transferred data contains a user or master password,which the device compares with the saved password.If they match,the device delete the user data,disable the user password,and cancels the lock. The master password is still saved.It's re-enabled by issuing the SECURITY SET PASSWORD command to re-set a user password.

➤ SECURITY FREEZE LOCK(F5h)

Caused the device enter FROZEN mode.Once this command has been executed,the following commands to update a lock result in the Aborted Command error:

- ◆ SECURITY SET PASSWORD
- ◆ SECURITY UNLOCK
- ◆ SECURITY DIABLE PASSWORD
- ◆ SECURITY ERASE PREPARE
- ◆ SECURITY ERASE UNIT

The drive exits from the FROZEN mode upon a power-off or hard reset.If the SECURITY FREEZE LOCK command issued when the device is placed in FROZEN mode,the drive execute the command,staying FROZEN mode.

➤ SECURITY SET PASSWORD(F1h)

This command set user password or master password.The host outputs sector data with PIO data-out protocol to indicate the information defined in the following table.

➤ SECURITY UNLOCK(F2h)

This command disabled LOCKED MODE of the device.This command transfers 512Bytes data from the host with PIO data-out protocol.The following table defines the content of this information.

➤ SEEK(7xh)

This command effectively a NOP command to the device although it dose perform a range check.

➤ SET FEATURES(EFh)

This command set parameter to Features register and set drive operation. For transfer mode, parameter is set to Sector Count register. This command is used by the host to establish or select certain features.

Value	Function
02h	Enable write cache
03h	Set transfer mode based on value in sector Count register
55h	Disable read look-ahead feature
82h	Disable write cache
AAh	Enable read look-ahead feature

Table 12 Features register Value and settable operating mode

➤ SET MULTIPLE MODE(C6h)

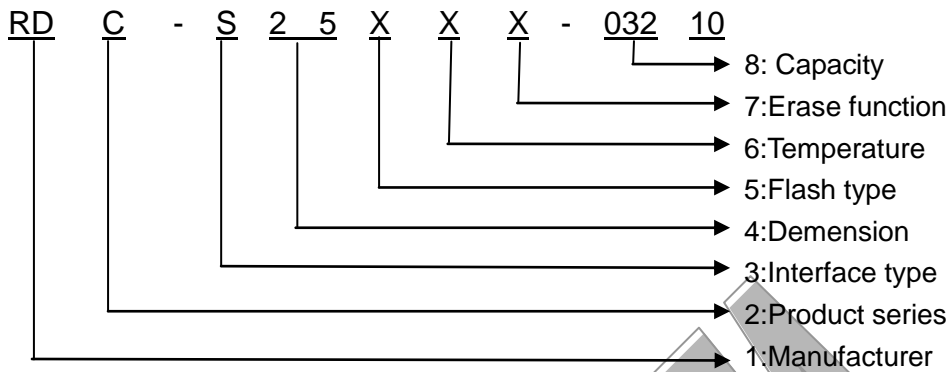
This command enables the device to perform READ MULTIPLE and WRITE MULTIPLE operations and establishes the block count of these commands.

➤ SLEEP(E6h)

This command causes the device to set BSY,enter the sleep mode,clear BSY and generation

- an interrupt.
- **SMART(B0h)**  
Performs different processing required for predicting device failures, according to the subcommand specified in the Features register. If the Features register contains an unsupported value, the Aborted Command error is returned. If the SMART function is disabled, any subcommand other than SMART ENABLE OPERATIONS results in the Aborted Command error.
  - **STANDBY(E2h)**  
This command causes the device to set BSY, enter the Sleep mode (which corresponds to the ATA!Standby Mode), clear BSY and return the interrupt immediately.
  - **STANDBY IMMEDIATE(E0h)**  
This command causes the drive to set BSY, enter the Sleep mode (which corresponds to the ATA !Standby Mode), clear BSY and return the interrupt immediately.
  - **WRITE DMA((CAh or CBh)**  
Write data to sectors during Ultra DMA and Multiword DMA transfer. Use the SET FEATURES command to specify the mode value.
  - **WRITE MULTIPLE(C5h)**  
This command is similar to the Write Sectors command. Interrupts are not presented on each sector, but on the transfer of a block which contains the number of sectors defined by Set Multiple command.
  - **WRITE SECTOR(S) (30h or 31h)**  
Write data to a specified number of sectors (1 to 256, as specified with the Sector Count register) from the specified address. Specify "00h"– to write 256 sectors

## 7 Part numbering scheme



Number	Character	meanings
1	R	RecaData Technology
2	C	Commercial
	M	Military
	I	Industrial
3	S	SATA
	P	PATA
	M	Mini PCIe
4	18	1.8 inch
	25	2.5 inch
	50	50 mm
5	S	SLC
	M	MLC
6	C	0~70
	I	-20~70
7	M	-40~85
	N	Standard function
8	D	Erase function
	004	4GB
	008	8GB
	016	16GB
	032	32GB
	064	64GB
128	128GB	

Table 13 Part numbering scheme

## 8 Related documentation

For more information, visit [www.recadata.com](http://www.recadata.com) or contact [supports@recadata.com](mailto:supports@recadata.com).