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Solid State Drive

1. Introduction

1.1 Overview

MicroStorage SATAIII 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. MicroStorage SATAIII SSD doesn't have a moving parts and it has a same host interface and same 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, MicroStorage SATAIII SSD can be a good storage device for NB and Tabletop PC .

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

1.2 Feature

- Performance

External Transfer Rate(Host Transfer Rate):6Gbps

Sequential Data Read/Write:

Density	60GB	120GB	240GB	480GB	960GB
Channel	4CH	4CH	4CH	4CH	4CH
Speed(MB/s)	480~510	480~520	490~520	500~530	500~530
	150~200	190~280	270~380	410~470	440~490
Cache	64MB	128MB	128MB	256MB	512MB

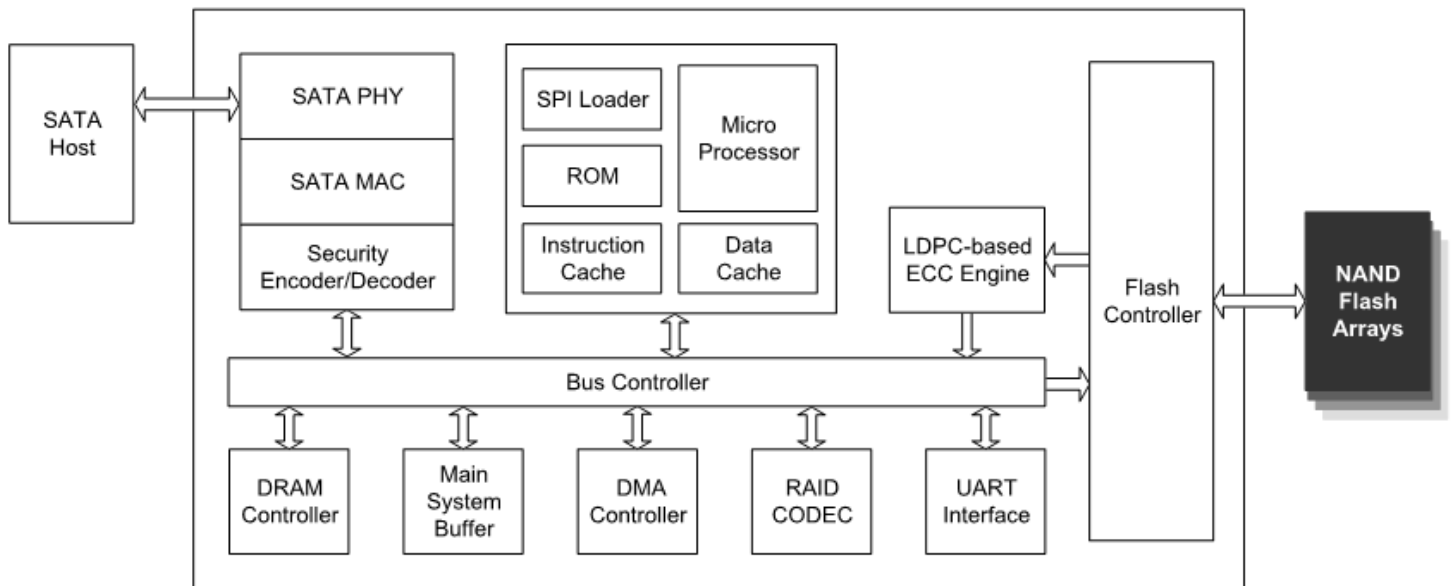
Form factor: 2.5-inch (100.2mm x 69.85mm x 7.0mm)

- Interface standard: Serial ATA Revision 3.0
- Input voltage:5V (±5%)
- Commercial operating temperature range form 0 to +70°C
- Flash management algorithm: static and dynamic wear-leveling, bad block management algorithm
- Supports dynamic power management and SMART (Self-Monitoring, Analysis and Reporting Technology), NCQ, Trim.
- ECC (Error Correction Code):Hardware LDPC ECC engine with hard-decision and soft-decision decoding
- Write endurance: >5 years @ 100GB write/ day
- Read endurance: unlimited

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- Data retention: 10 years
- MTBF:1,000,000 Hours

2. Block Diagram

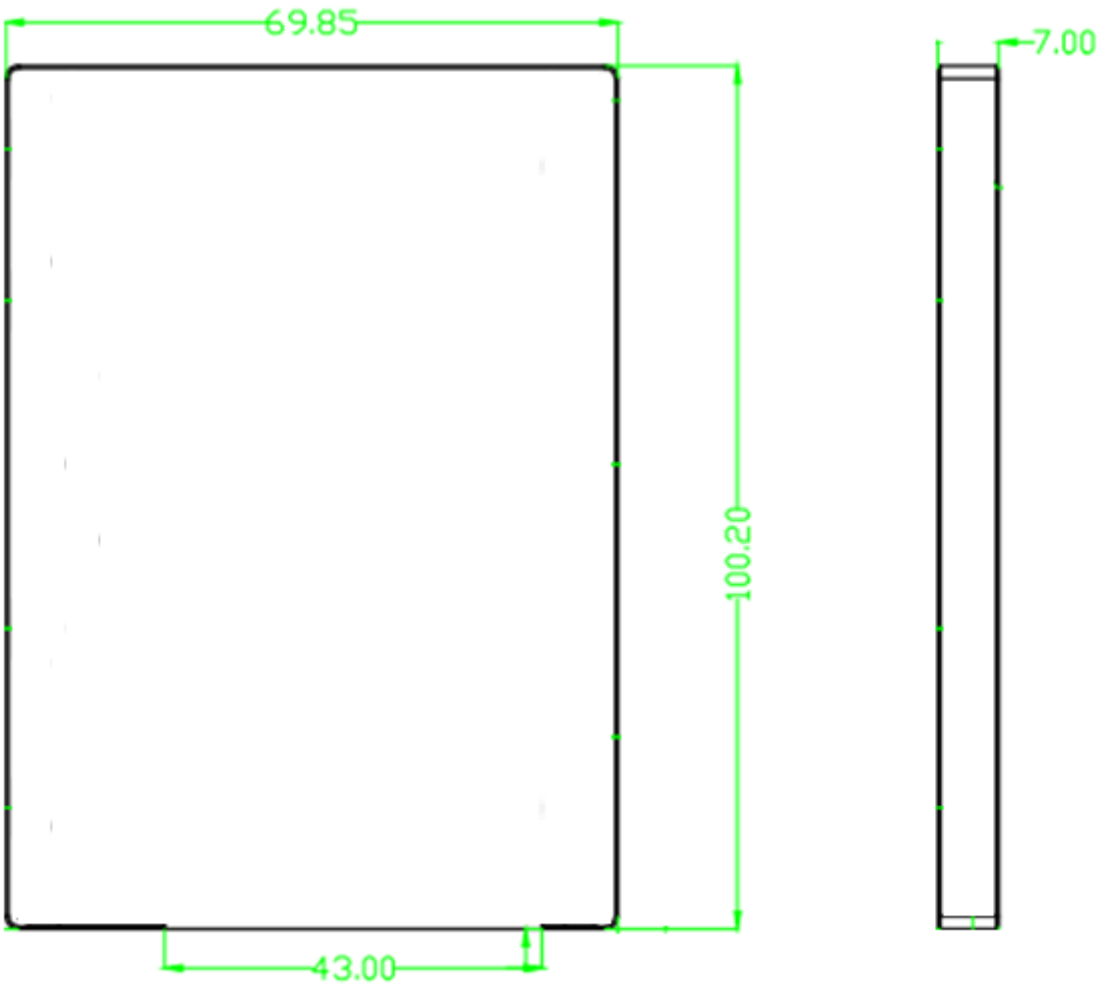


3. Product Specifications

3.1 Physical Specifications

Tabel 1 Physical dimensions and weight

Model	Height (mm)	Width (mm)	Length (mm)	Weight(g)
64GB,128GB,256GB,512GB,1TB	7.0+/-0.25	69.85+/-0.25	100.2+/-0.25	TBD



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3.2 Interface

The interface of SSD complies with the standard serial ATA revision 3.0:

- ① Host Transfer Rate is 6.0Gb/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

3.3 Performance Testing

3.3.1 Maximum Data Transfer Rate:

- Maximum sustained read: 510MB/s
- Maximum sustained write: 280MB/s

Note:

- 1). CPU: Intel® Core (TM) i5-2400 CPU @ 3.10GHz
Chipset: Intel® Z68 Express Chipset
OS: Microsoft Windows 7 Professional 64-bit
AHCI Driver: Server Express Chipset SATA AHCI Controller
BIOS Settings: AHCI Mode
- 2). Test Program: CrystalDiskMark3_0_0
- 3). Test Drive: P3-128

3.3.2 IO Performance:

Table2 IO Performance Values For 2.5" SATA SSD

Access Type	IOPS Operation unit size	
	512Byte	4KByte
Sequential Read	83000	59000
Sequential Write	110000	68000
Random Read	91000	85000
Random Write	35000	76000

Note:

- 1). CPU: Intel® Core (TM) i5-2400 CPU @ 3.10GHz
Chipset: Intel® Z68 Express Chipset
OS: Microsoft Windows 7 Professional 64-bit
AHCI Driver: Server Express Chipset SATA AHCI Controller
BIOS Settings: AHCI Mode
- 2). Test Program: Iometer2008
- 3). Test Drive: P3-128

3.3.3 Access Time:

- 1). CPU: Intel® Core (TM) i5-2400 CPU @ 3.10GHz
Chipset: Intel® Z68 Express Chipset
OS: Microsoft Windows 7 Professional 64-bit
AHCI Driver: Server Express Chipset SATA AHCI Controller
BIOS Settings: AHCI Mode
- 2). Test Program: HD Tune Pro 3.50

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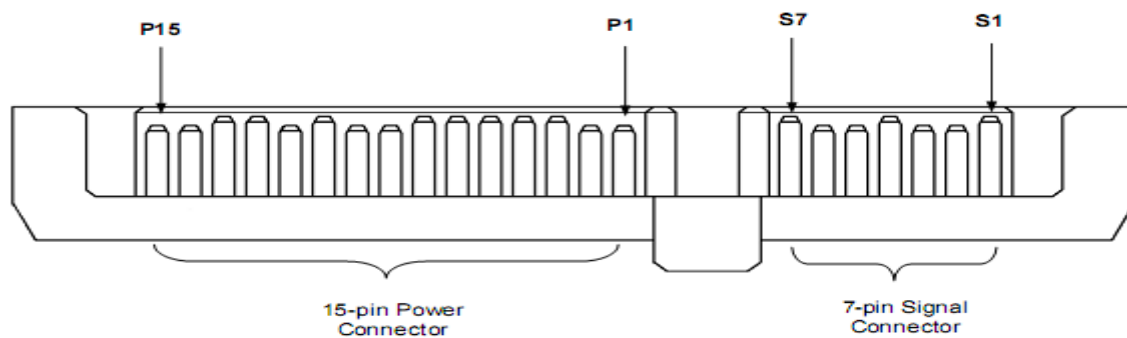
3).Test Drive:P3-128

Random access time: 0.15 msec

4. Interface Description

4.1 Pin Assignment

The following diagram identifies the pin location of Kingspec SATA SSD.



4.2 Pin Description

Table 3 SATA Connector Pinout

Signal		
Pin#	Signal Name	Description
S1	GND	2 nd mate
S2	A+	Differential signal pair A From physical layer electronics
S3	A-	
S4	GND	2 nd mate
S5	B-	Differential signal pair B From physical layer electronics
S6	B+	
S7	GND	2 nd mate
Power		
P1	V33	NC
P2	V33	NC
P3	V33	NC
P4	GND	1 st mate
P5	GND	2 nd mate
P6	GND	2 nd mate
P7	V5	5V Power, pre-charge, 2 nd mate
P8	V5	5V Power
P9	V5	5V Power
P10	GND	2 nd mate

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P11	DAS/DSS	Device Activity Signal/Disable Staggered spinup(Unused)
P12	GND	1 st mate
P13	V12	NC
P14	V12	NC
P15	V12	NC

5.Product Trait

5.1 Environment Specification

Table 4 Environmental Specifications

Features	Operating
Temperature	0~70℃
Humidity	5-95%

5.2 Power Specification

Recommended DC Operating Voltage:4.75V~5.25V

Table 5 Power Consumption

Parameter		Typical	Unit
Standby		0.36	W
Idel		0.35	W
4KByte Sample Data	Sequential Read	0.85	W
	Sequential Write	1.54	W
	Random Read	0.68	W
	Random Write	1.64	W
512KByte Sample Data	Sequential Read	0.68	W
	Sequential Write	1.21	W
	Random Read	0.87	W
	Random Write	1.76	W

Note:

1. The power consumption can differ depending on the disk capacity and the type of flash memory being used
2. The test drive: P3-128
3. Supply voltage:5V+/-5%

5.3 Reliability Specification

Wear-leveling

MicroStorage SATAIII SSD support both static and dynamic 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 endurance: >5 years @ 100GB write/ day

Read endurance: unlimited

ECC

ECC (Error Correction Code): Hardware LDPC ECC engine with hard-decision and soft-decision decoding

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) of MicroStorage SSD: 1, 000, 000 hours

Data retention

Data retention at 25°C of SSD:>10 years

6. Electrical Characteristics

Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Core Power Supply	VCKK	1.08	1.2	1.32	V
DDR3 Power Supply	DDR_VDDQ	1.43	1.5	1.57	V
DDR3L Power Supply	DDR_VDDQ	1.29	1.35	1.45	V
DRAM Reference Voltage	DDR_VREF	0.49 x DDR_VDDQ	0.5 x DDR_VDDQ	0.51 x DDR_VDDQ	V
I/O Pad Power Supply	VCCGQ	1.7	1.8	1.95	V
		2.7	3.3	3.6	
Flash I/O Power Supply	VCCFQ	1.7	1.8	1.95	V
		2.7	3.3	3.6	V
Flash I/O Reference Voltage	FSH_VREF	0.5 x VCCFQ			V
Analog Power Supply	V12A_PAD	1.08	1.2	1.32	V
	VCCAH	2.7	3.3	3.6	V
	CRY_VDD33	2.7	3.3	3.6	V
SATA PHY Power Supply	PHY_VPH	3.07	3.3	3.63	V
	PHY_VPTX	1.12	1.2	1.32	V
	PHY_VP	1.12	1.2	1.32	V

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7.Command Descriptions

7.1 Support Command

Command	Code	Protocol
General Feature Set		
Execute Device Diagnostic	90h	Execute device diagnostic
Flush Cache	E7h	Non-data
Identify Device	ECh	PIO data-in
Initialize Drive Parameters	91h	Non-data
Read DMA	C8h	DMA
Read Log Ext	2Fh	PIO data-in
Read Multiple	C4h	PIO data-in
Read Sector(s)	20h	PIO data-in
Read Verify Sector(s)	40h or 41h	Non-data
Set Feature	EFh	Non-data
Set Multiple Mode	C6h	Non-data
Write DMA	CAh	DMA
Write Multiple	C5h	PIO data-out
Write Sector(s)	30h	PIO data-out
NOP	00h	Non-data
Read Buffer	E4h	PIO data-in
Write Buffer	E8h	PIO data-out
Download Microcode	92h	PIO data-out
Download Microcode DMA	93h	DMA
Power Management Feature Set		

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Check Power Mode	E5h or 98h	Non-data
Idle	E3h or 97h	Non-data
Idle Immediate	E1h or 95h	Non-data
Sleep	E6h or 99h	Non-data
Standby	E2h or 96h	Non-data
Standby Immediate	E0h or 94h	Non-data
Security Mode Feature Set		
Security Set Password	F1h	PIO data-out
Security Unlock	F2h	PIO data-out
Security Erase Prepare	F3h	Non-data
Security Erase Unit	F4h	PIO data-out

Command	Code	Protocol
Security Freeze Lock	F5h	Non-data
Security Disable Password	F6h	PIO data-out
SMART Feature Set		
SMART Disable Operations	B0h	Non-data
SMART Enable/Disable Autosave	B0h	Non-data
SMART Enable Operations	B0h	Non-data
SMART Execute OFF-LINE Immediate	B0h	Non-data
SMART Read Log	B0h	PIO data-in
SMART Read Data	B0h	PIO data-in
SMART Read Threshold	B0h	PIO data-in
SMART Return Status	B0h	Non-data
SMART Save Attribute Values	B0h	Non-data
SMART Write Log	B0h	PIO data-out
Host Protected Area Feature Set		
Read Native Max Address	F8h	Non-data
Set Max Address	F9h	Non-data
Set Max Set Password	F9h	PIO data-out
Set Max Lock	F9h	Non-data
Set Max Freeze Lock	F9h	Non-data
Set Max Unlock	F9h	PIO data-out
48-bit Address Feature Set		
Flush Cache Ext	EAh	Non-data

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Read Sector(s) Ext	24h	PIO data-in
Read DMA Ext	25h	DMA
Read Multiple Ext	29h	PIO data-in
Read Native Max Address Ext	27h	Non-data
Read Verify Sector(s) Ext	42h	Non-data
Set Max Address Et	37h	Non-data
Write DMA Ext	35h	DMA
Write Multiple Ext	39h	PIO data-out
Write Sector(s) Ext	34h	PIO data-out
NCQ Feature Set		
Read FPDMA Queued	60h	DMA Queued
Write FPDMA Queued	61h	DMA Queued
Others		
Data Set Management	06h	DMA
Seek	70h	Non-data

7.2 ATA COMMAND SPECIFICATIONS

The Identify Device command enables the host to receive parameter information from the SM2256. This command has the same protocol as the Read Sector(s) command. The parameter words in the buffer have the arrangement and meanings defined in the following table.

ID Table Information

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Word	F / V	Default Value	Description
0	F	0040h	General configuration
1	X	XXXXh	Default number of cylinders
2	V	0000h	Reserved
3	X	00XXh	Default number of heads
4	X	0000h	Obsolete
5	X	0240h	Obsolete
6	F	XXXXh	Default number of sectors per track
7 - 8	V	XXXXh	Number of sectors per card (Word 7 = MSW, Word 8 = LSW)
9	X	0000h	Obsolete
10 - 19	F	XXXXh	Serial number in ASCII (Right justified)
20	X	0002h	Obsolete
21	X	0002h	Obsolete
22	X	0000h	Obsolete
23 - 26	F	XXXXh	Firmware revision in ASCII Big Endian Byte Order in Word
27 - 46	F	XXh	Model number in ASCII (Left justified) Big Endian Byte Order in Word
47	F	8001h	Maximum number of sectors on Read/Write Multiple command
48	F	0000h	Reserved
49	F	0F00h	Capabilities
50	F	4000h	Capabilities
51	F	0200h	PIO data transfer cycle timing mode
52	X	0000h	Obsolete
53	F	0007h	Field validity
54	X	XXXXh	Current numbers of cylinders
55	X	XXXXh	Current numbers of heads
56	X	XXXXh	Current sectors per track
57 - 58	X	XXXXh	Current capacity in sectors (LBAs) (Word 57 = LSW, Word 58 = MSW)
59	F	0101h	Multiple sector setting
60 - 61	F	XXXXh	Total number of user addressable logical sectors for 28-bit commands (DWord)

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Word	F / V	Default Value	Description
62	X	0000h	Reserved
63	F	0207h	Multiword DMA transfer Supports MDMA mode 0, 1 and 2
64	F	0003h	Advanced PIO modes supported
65	F	0078h	Minimum Multiword DMA transfer cycle time per word
66	F	0078h	Recommended Multiword DMA transfer cycle time
67	F	0078h	Minimum PIO transfer cycle time without flow control
68	F	0078h	Minimum PIO transfer cycle time with IORDY flow control
69	F	4000h	Additional supported
70 - 74	F	0000h	Reserved
75	F	001Fh	Queue depth
76	F	070Eh	Serial ATA capabilities • Supports Serial ATA Gen3 • Supports Serial ATA Gen2 • Supports Serial ATA Gen1 • Supports Phy event counters log • Supports receipt of host initiated power management requests • Supports Native Command Queuing
77	F	0080h	Serial ATA additional capability • DevSleep_to_ReducedPwrState
78	F	0148h	Serial ATA features supported • Supports Device Sleep • Supports software settings preservation • Device support initiating power management
79	V	0040h	Reserved
80	F	3F0h	Major version number (ACS-3)
81	F	0000h	Minor version number
82	F	742Bh	Command sets supported 0
83	F	7500h	Command sets supported 1
84		4023h	Command sets supported 2
85 - 87	V	XXXXh	Command set/feature enabled
88	V	007Fh	Ultra DMA mode supported and selected
89	F	0003h	Time required for a Normal Erase mode Security Erase Unit command
90	F	0001h	Time required for an Enhanced Erase mode Security Erase Unit command
91	V	0000h	Current advanced power management value
92	V	FFFEh	Master password identifier
93 - 99	V	0000h	Reserved
100 - 103	V	XXXXh	Maximum user LBA for 48-bit address feature set
104	V	0000h	Reserved
105	F	0100h	Maximum number of 512-byte blocks per Data Set Management command

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Word	F / V	Default Value	Description
106 - 127	V	0000h	Reserved
128	V	0001h	Security status
129 - 159	X	XXXXh	Vendor specific
160	F	0000h	Power requirement description
161	X	0000h	Reserved
162	F	0000h	Key management schemes supported
163	F	0000h	CF Advanced True IDE Timing mode capability and setting
164 - 168	V	0000h	Reserved
169	F	0001h	Data Set Management supported
170 - 216	V	XXXXh	Reserved
217	F	0001h	Non-rotating media (SSD)
218 - 221	X	0000h	Reserved
222	F	107Fh	Transport major revision (SATA Rev 3.1)
223 - 254	X	0000h	Reserved
255	X	XXXXh	Integrity word

Notes:

- 1 F = content (byte) is fixed and does not change.
- 2 V = content (byte) is variable and may change depending on the state of the device or the commands executed by the device.
- 3 X = content (byte) is vendor specific and may be fixed or variable.

8. Ordering Information

P3-XXX

P3: P3 series

XXX: Density

XXX	Density
128	128GB
256	256GB
512	512GB
1TB	1TB