Industrial
mSATA SATA III SSD
MSA300S series
Datasheet

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Revision History

Revision	Date	Major Changes
1.0	2016/05/23	1. Formal release
1.1	2016/06/28	1. Add wide temperature series
1.2	2017/04/18	1. Add 16GB in product line 2. Add TBW information 3. Add Humidity information 4. Add LED signal definitions
1.3	2017/07/28	1. Update ordering information
1.4	2017/10/24	1. Add 4GB and 8GB in product line 2. Update ordering information
1.5	2019/01/11	1. Add 305 series
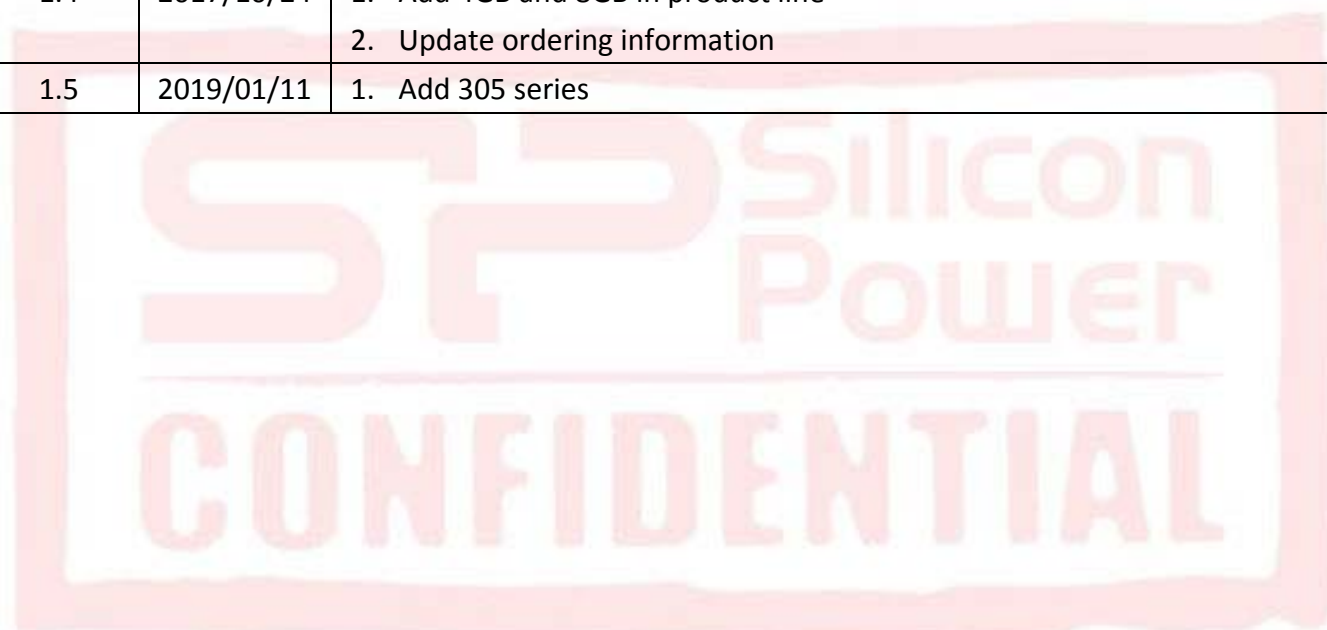
1. Product Description

1.1 Overview

Silicon Power's mSATA SATA III SSD 300S series is the storage device based on NAND flash memory technology. This product complies with mSATA standard interface that is defined by JEDEC as MO-300 with the board size compliant with PCIe mini card, and is suitable for data storage media, code storage device, or boot disk for embedded systems. In case of the applications with less write but high performance read operating, this series provide Toggle MLC solutions to support the requirements. By using solid state NAND Flashes, it operates good performance/power consumption and can have better environmental sustention for the systems.

With standard form factor, MO-300, or mSATA in alternative, the applicable appliance can add or install this SATA storage device into complete set of industrial PCs or rugged systems.

Application Fields:
 - Industrial PC and Thin Client
 - Game and Telecommunication Machine
 - Equipments or Machines for Health, Production, or Rugged applications
 - Other machines and Equipments with Serial ATA 6.0Gb/s Interface.

1.2 Features
 - MO-300 standard form factor.
 - Compliant with Serial ATA Revision 3.1 Standard. Support 1.5/3.0/6.0 Gbps, SATA I/II/III interface.
 - Compliant with ATA/ATAPI-8 Standard command protocol.
 - Support NCQ and TRIM command.
 - Support SATA DEVSLP for advance power saving.
 - High performance and reliability.
 - Noiseless and stable installation to system.
 - Memory Capacities: 4GB~256GB (MLC)
 - Operating as Boot Disk, or Code Storage Device for Embeded Operating System

1.3 System Requirements
 - SATA 6.0Gb/s Interface, backward compatible with 1.5/3.0Gb/s Interface, in mSATA, MO-300, standard form factor.
 - Voltage: DC +3.3V ± 5%
 - Operating System:
   - Windows XP/7/8/10, or Windows Embedded Systems
   - Linux

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Q-RD-402-A4

2. Specification

2.1 Physical Dimension

2.1.1 Dimension

The Dimensions of mSATA SATA III SSD are illustrated in Figure 1 and described in Table 1.
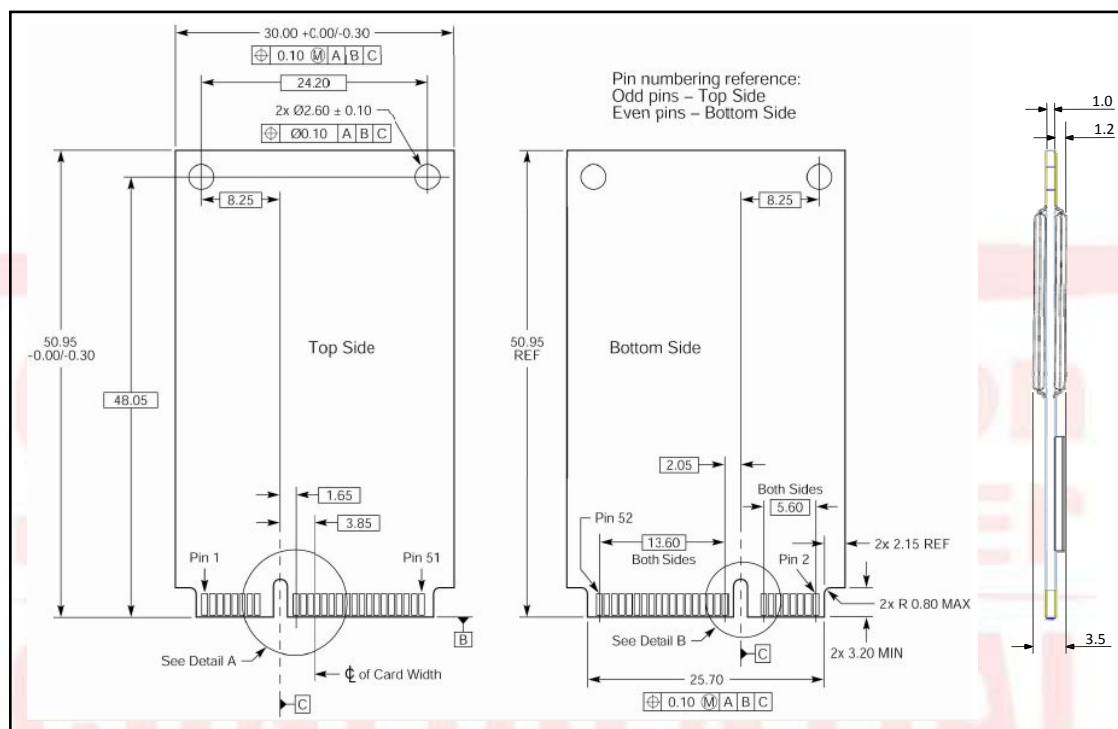
Figure 1 : mSATA SATA III SSD Dimensions

Table 1: mSATA SATA III SSD Physical Dimension

Length	50.95 $^{+0.00}_{-0.30}$ mm
Width	30.00 $^{+0.00}_{-0.30}$ mm
Thickness (Connector)	3.50 ± 0.30 mm

2.1.2 Weight

- Weight: < 8g

2.2 Electrical Specifications

2.2.1 Operating Condition

 - Supply Voltage: DC +3.3V ± 5%

 - Power Consumption (Maximum):

Mode	MLC							Unit
	4GB	**8GB**	**16GB**	**32GB**	**64GB**	**128GB**	**256GB**	
Read	210	210	210	340	340	350	360	mA
Write	190	190	220	350	350	500	780	mA
Stand-by	95							mA
Slumber	30							mA

 ※ *Testing Platform:*
  Mother-Board: ASUS P8Z77-V LX, CPU: Intel(R) Core i5-3570K CPU 3.4GHz, Chipset: Intel Z77, Main Memory: DDR3-1333 2GB X 2pcs, Operating System: Win 7, 64bit
  Test Temperature: 25°C
  Notice: *The value is various bases on the capacity and the test platform.*

2.2.2 Capacity and Block Size information

 - Capacity:

  - MLC: 4GB,8GB,16GB,32GB, 64GB, 128GB, 256GB

 - Sector Size: 512Bytes

2.2.3 External DRAM information

 - Type:

  - DDR3

 - Capacity:

  - 4GB,8GB,16GB,32GB,64GB,128GB (2Gb)

  -256GB (4Gb)

2.2.4 LED signal definitions

  - D1 : Power – to indicate the power-on status.

  - D2 : Controller Activity – to indicate the controller working status

  - D4 : Data activity to SATA interface – to indicate the data access activity on SATA interface
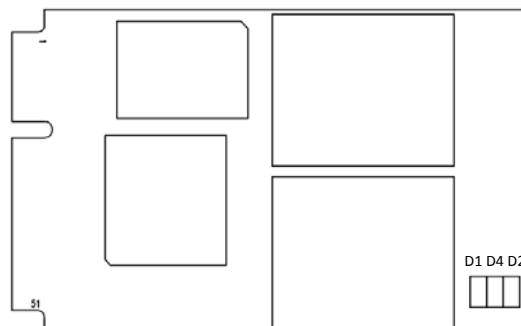
Figure 2 : mSATA SATA III SSD LED indicator

2.3 Performance

2.3.1 Transfer Modes

- Serial ATA 6.0Gb/s, backward compatible with Serial ATA 1.5/3.0Gb/s.

2.3.2 Data Access Performance

- Maximum Sustained Sequential Access

Mode	MLC							Unit
	4GB	**8GB**	**16GB**	**32GB**	**64GB**	**128GB**	**256GB**	
Read	120	120	160	530	530	530	530	MB/s
Write	10	20	40	100	90	180	360	MB/s

※ *Test Platform: Average Value is based on Serial ATA 6.0Gb/s interface.*
  Mother-Board: ASUS P8Z77-V LX, CPU: Intel(R) Core i5-3570K CPU 3.4GHz, Chipset: Intel Z77, Main Memory: DDR3-1333 2GB X 2pcs, Operating System: Win 7, 64bit
  Testing Software: CrystalDiskMark 3.0.2, Testing OS: Windows 7, 64bit
  Notice: *The value is various bases on the capacity and the test platform.*

2.3.3 TeraByte Write

- Maximum TBW data

	MLC							Unit
	4GB	**8GB**	**16GB**	**32GB**	**64GB**	**128GB**	**256GB**	
TBW	4	8	17	34	69	138	277	TB

Notice: *The data represents a theoretical data based on the client mode without degrading estimation. It could be different depended on the workload or usage containing data size and access rate.*

2.3.4 Wear-leveling

- Enhanced endurance by dynamic/static wear-leveling.

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2.4 Environmental Conditions

2.4.1 Temperature

Grade	Operating	Non-Operating
Normal Grade	0°C to +70°C	-55°C to +95°C
Wide Temperature Grade	-40°C to +85°C	

2.4.2   Humidity

Grade	Operating
Normal Grade	+10% to +95%
Wide Temperature Grade	+10% to +95%

2.5 Reliability

2.5.1 ECC/EDC Capability (Error Correction Code/Error Detection Code)

- Supports BCH ECC up to 66 bits/1K.

2.5.2 MTBF (Mean Time Between Failure)

- > 1,000,000 hrs

2.5.3 Program / Erase Endurance

- MLC: 3000 P/E cycles.

2.5.4 Data Retention

- 10% of program / Erase Endurance cycles: 10 Years

- 100% of program / Erase Endurance cycles: 1 Years

   Notice: *The value is based on normal program/erase endurance at room temperature. High environmental temperature may shorten the retention period.*

2.6 Compliance Specifications

- CE

- FCC

3. Functional Description

3.1 Architecture

SILICON POWER'S mSATA SATA III SSD 300S series is designed to operate and work as Data or Code Storage device by NAND Flash Memory and its Controller through Standard Serial ATA 3.0Gb/s Interface to Host Systems.
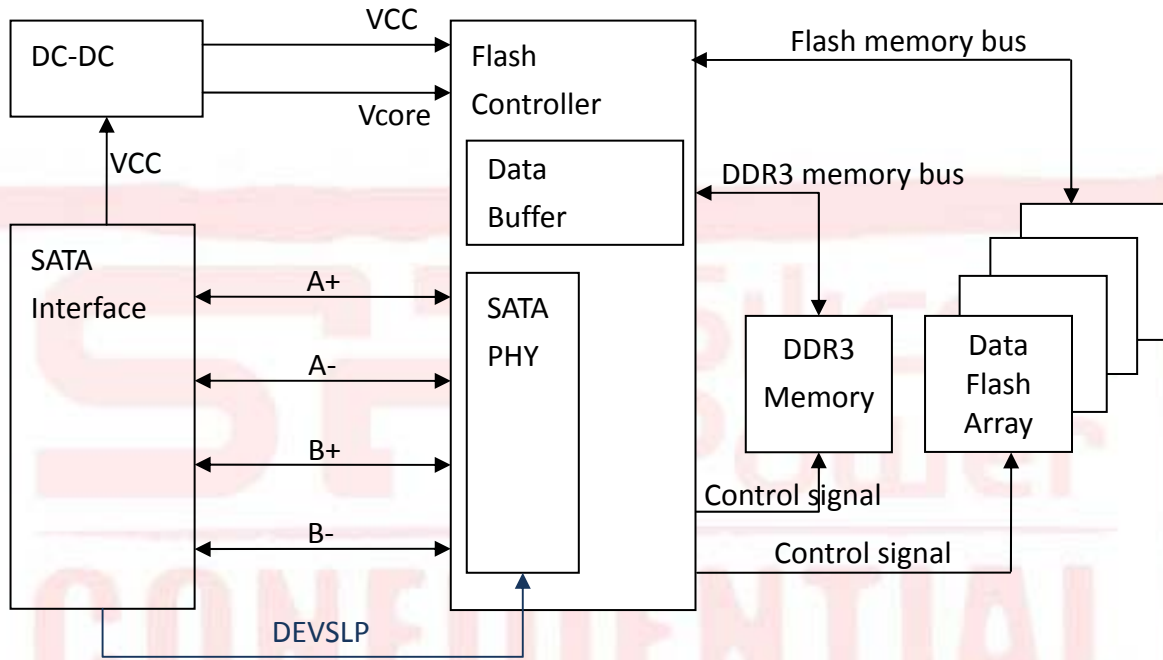
Figure 2: mSATA SATA III SSD 300S Series Block Diagram

3.2 Signal Assignment

The signals assigned for Serial ATA applications are described in the following Table and Figure.
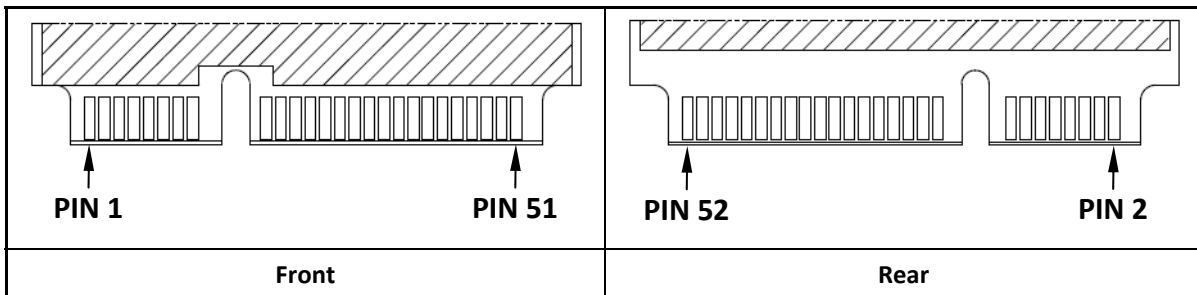
Figure 3: mSATA Signal Connector

Table 2 : mSATA connector pin definitions

Definition	Name	Pin No		Name	Definition
3.3V Power	+3.3V	P2	P1	Reserved	No Connect
Ground	GND	P4	P3	Reserved	No Connect
No Connect	+1.5V	P6	P5	Reserved	No Connect
No Connect	Reserved	P8	P7	Reserved	No Connect
No Connect	Reserved	P10	P9	GND	Ground
No Connect	Reserved	P12	P11	Reserved	No Connect
No Connect	Reserved	P14	P13	Reserved	No Connect
No Connect	Reserved	P16	P15	GND	Ground
Mechanical Key					
Ground	GND	P18	P17	Reserved	No Connect
No Connect	Reserved	P20	P19	Reserved	No Connect
No Connect	Reserved	P22	P21	GND	Ground
3.3V Power	+3.3Vaux	P24	P23	+B	SATA Differential pair TX+ of SSD
Ground	GND	P26	P25	-B	SATA Differential pair TX- of SSD
No Connect	+1.5V	P28	P27	GND	Ground
No Connect	Reserved	P30	P29	GND	Ground
No Connect	Reserved	P32	P31	-A	SATA Differential pair RX- of SSD
Ground	GND	P34	P33	+A	SATA Differential pair RX+ of SSD
No Connect	Reserved	P36	P35	GND	Ground
No Connect	Reserved	P38	P37	GND	Ground
Ground	GND	P40	P39	+3.3V	3.3V Power
No Connect	Reserved	P42	P41	+3.3V	3.3V Power
SATA PHY Power Control	DEVSLP	P44	P43	GND	Ground
No Connect	Reserved	P46	P45	Reserved	No Connect
No Connect	+1.5V	P48	P47	Reserved	No Connect
Ground	GND	P50	P49	DA/DSS	Drive Activity Signal
3.3V Power	+3.3V	P52	P51	PD	Presence Detect, Ground by device

NOTICE: *DEVSLP function is depended on Host supporting.*

3.3 Support ATA Commands

The table showed below summarizes the supported ATA command set. For detail description of the commands, please check the ATA standard or contact Silicon Power local representatives for the helps.

Table 3: ATA Command Set

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	O	O	O	O	O	X
READ DMA EXT	25h	O	O	O	O	O	X
READ FPDMA QUEUED	60h	O	O	O	O	O	X
READ LOG DMA EXT	47h	O	O	O	O	O	X
READ LOG EXT	2Fh	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	X	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	X	X	X	O	X	X

Command Name	Code	PARAMETERS USED					
WRITE DMA EXT	35h	O	O	O	O	O	X

Command Name	Code	PARAMETERS USED					
		SC	SN	CY	DR	HD	FT
WRITE FPDMA QUEUED	61h	O	O	O	O	O	X
WRITE LOG DMAE EXT	57h	O	O	O	O	O	X
WRITE LOG EXT	3Fh	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 Bit4)

HD=HEAD SELECT Bit(DEVICE/HEAD Register Bit3-0)

FT=Features Register

3.4 Device Identification

The following is the device identify table.

Table 4: Identify Device Information

Word Address	Default Value	Total Bytes	F/V	Data Field Type Information
0	0040h	2		General configuration – Bit Significant with ATA definitions.
			F	15　　0:ATAdevice
			X	14-8　Retired
			F	7　　1:removablemediadevice
			X	6　　Obsolete
			X	5-3　Retired
			F	2　　Reserved
			X	1　　Retired
			F	0　　Reserved
1	XXXXh	2	X	Default number of cylinders
2	C837h	2	V	Reserved
3	00XXh	2	X	Default number of heads
4-5	XXXXh	4	X	Reserved
6	XXXXh	2	X	Default number of sectors per track
7-8	0000h	4	V	Reserved for assignment by the CFA

Word Address	Default Value	Total Bytes	F/V	Data Field Type Information
9	XXXXh	2	X	Reserved
10-19	aaaa	20	F	Serial number in ASCII (Right Justified)
20-21	XXXXh	4	X	Reserved
22	XXXXh	2	X	Obsolete
23-26	aaaa	8	F	Firmware revision in ASCII. Big Endian Byte Order in Word
27-46	aaaa	40	F	Model number in ASCII (Left Justified) Big Endian Byte Order in Word
47	8000h	2		Maximum number of sectors on Read/Write Multiple command
			F	15-8 80h: Fixed
			F	7-0 00h: Reserved
				01h: Maximum number of 1 sectors on READ/WRITE MULTIPLE commands
48	XXXXh	2	X	Reserved
49	2F00h	2		Capabilities: DMA, LBA, IORDY supported
			F	15-14 Reserved for the IDENTIFY PACKET DEVICE command.
			F	13 1: Standby timer values as specified in this standard are supported
				0: Standby timer values shall be managed by the device
			F	12 Reserved for the IDENTIFY PACKET DEVICE command
			F	11 1: IORDY supported
				0: IORDY may be supported
			F	10 1: IORDY may be disabled
			F	9 1: LBA supported
			F	8 1: DMA supported
			X	7-0 Retired
50	4000h	2		Capabilities: Others, Fixed
			F	15 Shall be cleared to zero.
			F	14 Shall be set to one.
			F	13-2 Reserved.
			X	1 Obsolete
			F	0 Shall be set to one to indicate a device specific Standby timer value minimum
51-52	XXXXh	4	X	Obsolete
53	0007h	2		Data Fields 54 to 58, 64 to 70 and 88 are valid
			F	15-3 Reserved
			F	2 1: the fields reported in word 88 are valid
				0: the fields reported in word 88 are not valid
			F	1 1: the fields reported in words 70:64 are valid
				0: the fields reported in words 70:64 are not valid
			X	0 1: the fields reported in words 58:54 are valid
				0: the fields reported in words 58:54 are not valid
54-58	XXXXh	10	X	Obsolete
59	0000h	2		Multiple sector setting
			F	15-9 Reserved
			V	8 1: Multiple sector setting is valid

Word Address	Default Value	Total Bytes	F/V	Data Field Type Information
			V	7-0 xxh: Setting for number of sectors that shall be transferred per interrupt on R/W Multiple command
60-61	XXXXh	4	F	Total number of sectors addressable in LBA Mode
62	0000h	2	X	Obsolete
63	0007h	2		Multiword DMA transfer.
			F	15-11 Reserved
			V	10 1: Multiword DMA mode 2 is selected
				0: Multiword DMA mode 2 is not selected
			V	9 1: Multiword DMA mode 1 is selected
				0: Multiword DMA mode 1 is not selected
			V	8 1: Multiword DMA mode 0 is selected
				0: Multiword DMA mode 0 is not selected
			F	7-3 Reserved
			F	2 1: Multiword DMA mode 2 and below are supported
			F	1 1: Multiword DMA mode 1 and below are supported
			F	0 1: Multiword DMA mode 0 is supported
64	0003h	2		Advanced PIO modes 3 and 4 supported
			F	15-8 Reserved
			F	7-0 Advanced PIO modes supported
65	0078h	2	F	Minimum Multiword DMA transfer cycle time per word.
66	0078h	2	F	Recommended Multiword DMA transfer cycle time.
67	0078h	2	F	Minimum PIO transfer cycle time without flow control
68	0078h	2	F	Minimum PIO transfer cycle time with IORDY flow control
69-70	0000h	4	F	Reserved
71-74	0000h	8	X	Reserved for Identify Packet Device Command
75	0000h	2		Queue depth
			F	15-5 Reserved
			F	4-0 Maximum queue depth - 1
76	010Eh	2		Serial ATA Capabilities
			F	15-13 Reserved for Serial ATA
				12 1: supports NCQ priority information
				11 1: supports Unload while NCQ commands are outstanding
			F	10 1: supports PHY Event Counts
			F	9 1: supports receipt of Host initiated power management requests
			F	8 1: supports NCQ Feature Set
			F	7-4 Reserved for Serial ATA
			F	3 1: supports SATA Gen3 Signaling Speed (6.0Gb/s)
			F	2 1: supports SATA Gen2 Signaling Speed (3.0Gb/s)
			F	1 1: supports SATA Gen1 Signaling Speed (1.5Gb/s)
			F	0 Shall be cleared to zero
77	XXXXh	2	X	Reserved for Serial ATA
78	0044h	2		Serial ATA Feature Supported
			F	15-7 Reserved for Serial ATA
			F	6 1: supports Software Settings Preservation

Word Address	Default Value	Total Bytes	F/V	Data Field Type Information		
			F		5	Reserved for Serial ATA
			F		4	1: supports in-order data delivery
			F		3	1: supports initiating power management
			F		2	1: Supports DMA setup auto-activation
			F		1	1: Supports none-zero buffer offset
			F		0	Shall be cleared to zero
79	0040h	2		Serial ATA Feature Enabled		
			F		15-7	Reserved for Serial ATA
			F		6	1: Software Settings Preservation enabled
			F		5	Reserved for Serial ATA
			F		4	1: In-order data delivery enabled
			F		3	1: Initiating power management enabled
			F		2	1: DMA setup auto-activation enabled
			F		1	1: None-zero buffer offset enabled
			F		0	Shall be cleared to zero
80	01FEh	2		Major version number, ATA-8 support		
			F		15	Reserved
			F		14	Reserved for ATA/ATAPI-14
			F		13	Reserved for ATA/ATAPI-13
			F		12	Reserved for ATA/ATAPI-12
			F		11	Reserved for ATA/ATAPI-11
			F		10	Reserved for ATA/ATAPI10
			F		9	Reserved for ATA/ATAPI-9
			F		8	1: supports ATA/ATAPI-8
			F		7	1: supports ATA/ATAPI-7
			F		6	1: supports ATA/ATAPI-6
			F		5	1: supports ATA/ATAPI-5
			F		4	1: supports ATA/ATAPI-4
			F		3	Obsolete
			X		2	Obsolete
			X		1	Obsolete
			F		0	Reserved
81	0021h	2	F	Minor version number		
82	006Bh	2		Features/command sets supported (NOP, SMART,…)		
			X		15	Obsolete
			F		14	1: NOP command supported
			F		13	1: READ BUFFER command supported
			F		12	1: WRITE BUFFER command supported
			X		11	Obsolete
			F		10	1: Host Protected Area feature set supported
			F		9	1: DEVICE RESET command supported
			F		8	1: SERVICE interrupt supported
			F		7	1: release interrupt supported
			F		6	1: look-ahead supported
			F		5	1: write cache supported
			F		4	Shall be cleared to zero to indicate that the PACKET

Word Address	Default Value	Total Bytes	F/V		Data Field Type Information
					Command feature set is not supported.
			F	3	1: mandatory Power Management feature set supported
			F	2	1: Removable Media feature set supported
			F	1	1: Security Mode feature set supported
			F	0	1: SMART feature set supported
83	5000h	2			Features/command sets supported (Flush Cache, …)
			F	15	Shall be cleared to zero
			F	14	Shall be set to one
			F	13	Reserved
			F	12	Shall be set to one to indicate that the mandatory FLUSH CACHE command is supported
			F	11	1: DCO feature set is supported
			F	10	1: 48-bit Address feature set is supported
			F	9	1: AAM feature set is supported
			F	8	1: SET MAX security extension supported
			F	7	Reserved
			F	6	1: SET FEATURES subcommand required to spin up after power-up
			F	5	1: Power-Up In Standby feature set supported
			F	4	1: Removable Media Status Notification feature set supported
			F	3	1: Advanced Power Management feature set supported
			F	2	1: CFA feature set supported
			F	1	1: READ/WRITE DMA QUEUED supported
			F	0	1: DOWNLOAD MICROCODE command supported
84	4000h	2			Features/command sets supported (extension)
			F	15	Shall be cleared to zero
			F	14	Shall be set to one
			F	13	1: IDLE IMMEDIATE command with UNLOAD feature is supported
			F	12-11	Reserved for TLC
			F	10-9	Obsolete
			F	8	1: 64-bit World wide name is supported
			F	7	1: WRITE DMA QUEUED FUA EXT command is supported
			F	6	1: WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported
			F	5	1: GPL feature set is supported
			F	4	1: Streaming feature set is supported
			F	3	1: Media Card Pass Through Command feature set is supported
			F	2	1: Media serial number is supported
			F	1	1: SMART self-test supported
			F	0	1: SMART error logging supported
85	0008h	2			Features/command sets enabled (NOP, SMART,…)
			X	15	Obsolete
			F	14	1: NOP command enabled

Word Address	Default Value	Total Bytes	F/V		Data Field Type Information
			F	13	1: READ BUFFER command enabled
			F	12	1: WRITE BUFFER command enabled
			X	11	Obsolete
			V	10	1: Host Protected Area feature set enabled
			F	9	Shall be cleared to zero to indicate that the DEVICE RESET command is not supported
			V	8	1: SERVICE interrupt enabled
			V	7	1: release interrupt enabled
			V	6	1: look-ahead enabled
			V	5	1: write cache enabled
			F	4	Shall be cleared to zero to indicate that the PACKET Command feature set is not supported.
			F	3	Shall be set to one to indicate that the mandatory Power Management feature is supported
			X	2	Obsolete
			V	1	1: Security feature set enabled
			V	0	1: SMART feature set enabled
86	BC00h	2			Features/command sets enabled (Flush Cache, …)
			F	15	1: Word 119-120 are valid
			F	14	Reserved
			F	13	1: FLUSH CACHE EXT command supported
			F	12	1: FLUSH CACHE command supported
			F	11	1: DCO feature set is supported
			F	10	1: 48-bit Address feature set is supported
			V	9	1: AAM feature set is supported
			V	8	1: SET MAX security extension enabled by SET MAX SET PASSWORD
			X	7	Reserved for Address Offset Reserved Area Boot Method
			F	6	1: SET FEATURES subcommand required to spin-up after power-up
			V	5	1: Power-Up In Standby feature set enabled
			X	4	Obsolete
			V	3	1: Advanced Power Management feature set enabled
			F	2	1: CFA feature set is supported
			F	1	1: TCQ feature set is supported
			F	0	1: DOWNLOAD MICROCODE command supported
87	4000h	2			Features/command sets enabled (extension)
			F	15	Shall be cleared to zero
			F	14	Shall be set to one
			F	13	1: The IDLE IMMEDIATE command with UNLOAD feature is supported
			X	12-11	Reserved for TLC
			X	10-9	Obsolete
			F	8	1: 64-bit World wide name is supported
			F	7	1: WRITE DMA QUEUED FUA EXT command is supported
			F	6	1: WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT

Word Address	Default Value	Total Bytes	F/V		Data Field Type Information
					commands are supported
			F	5	1: GPL feature set is supported
			X	4	Obsolete
			V	3	1: Media Card Pass Through Command feature set is supported
			V	2	1: Media serial number is supported
			F	1	1: SMART self-test supported
			F	0	1: SMART error logging supported
88	003Fh	2			Ultra DMA Mode Supported and Selected
			F	15	Reserved
			V	14	1: Ultra DMA mode 6 is selected
					0: Ultra DMA mode 6 is not selected
			V	13	1: Ultra DMA mode 5 is selected
					0: Ultra DMA mode 5 is not selected
			V	12	1: Ultra DMA mode 4 is selected
					0: Ultra DMA mode 4 is not selected
			V	11	1: Ultra DMA mode 3 is selected
					0: Ultra DMA mode 3 is not selected
			V	10	1: Ultra DMA mode 2 is selected
					0: Ultra DMA mode 2 is not selected
			V	9	1: Ultra DMA mode 1 is selected
					0: Ultra DMA mode 1 is not selected
			V	8	1: Ultra DMA mode 0 is selected
					0: Ultra DMA mode 0 is not selected
			F	7	Reserved
			F	6	1: Ultra DMA mode 6 and below are supported
			F	5	1: Ultra DMA mode 5 and below are supported
			F	4	1: Ultra DMA mode 4 and below are supported
			F	3	1: Ultra DMA mode 3 and below are supported
			F	2	1: Ultra DMA mode 2 and below are supported
			F	1	1: Ultra DMA mode 1 and below are supported
			F	0	1: Ultra DMA mode 0 is supported
89	0000h	2	X	15-8	Reserved
			F	7-0	Time required for security erase unit completion
90	0000h	2	X	15-8	Reserved
			F	7-0	Time required for Enhanced security erase completion
91	0000h	2	V		Current advanced power management value
92	0000h	2	V		Master Password Identifier
93	0000h	2	X		Hardware Reset result
94	0000h	2			Current AAM value
			F	15-8	Vendor's recommended AAM value
			V	7-0	Current AAM value
95-99	0000h	10	X		Reserved
100-103	VVVVh	8	V		Total Number of User Addressable Logical Sectors for 48-bit commands (QWord)

Word Address	Default Value	Total Bytes	F/V		Data Field Type Information
104-105	0000h	4	X		Reserved
106	4000h	2			Physical sector size / logical sector size
			F	15	Shall be cleared to zero
			F	14	Shall be set to one
			F	13	1: Device has multiple logical sectors per physical sector
			F	12	1: Device Logical Sector longer than 256 Words
			X	11-4	Reserved
			F	3-0	2x logical sectors per physical sector
107	0000h	2	F		Inter-seek delay for ISO 7779 standard acoustic testing
108-111	XXXXh	8	F		World wide name
112-115	0000h	8	X		Reserved
116	0000h	2	X		Reserved for TLC
117-118	0000h	4	F		Logical sector size (DWord)
119	4000h	2			Commands and feature sets supported (Continued from words 84:82)
			F	15	Shall be cleared to zero
			F	14	Shall be set to one
			X	13-5	Reserved
			X	4	1: The Segmented feature for DOWNLOAD MICROCODE is supported
			F	3	1: The READ LOG DMA EXT and WRITE LOG DMA EXT commands are supported
			F	2	1: The WRITE UNCORRECTABLE EXT command is supported
			F	1	1: The Write-Read-Verify feature set is supported
			X	0	Reserved for DDT
120	4000h	2			Commands and feature sets supported or enabled (Continued from words 87:85)
			F	15	Shall be cleared to zero
			F	14	Shall be set to one
			X	13-5	Reserved
			X	4	1: The Segmented feature for DOWNLOAD MICROCODE is supported
			F	3	1: The READ LOG DMA EXT and WRITE LOG DMA EXT commands are supported
			F	2	1: The WRITE UNCORRECTABLE EXT command is supported
			F	1	1: The Write-Read-Verify feature set is enabled
			X	0	Reserved for DDT
121-126	0000h	12	X		Reserved for expended supported and enabled settings
127	0000h	2	X		Obsolete
128	0001h	2			Security status
			F	15-9	Reserved
			V	8	Security level 0: High, 1: Maximum
			X	7-6	Reserved

Word Address	Default Value	Total Bytes	F/V	Data Field Type Information
			F	5 1: Enhanced security erase supported
			V	4 1: Security count expired
			V	3 1: Security frozen
			V	2 1: Security locked
			V	1 1: Security enabled
			F	0 1: Security supported
129-159	0000h	62	X	Reserved for vendor
160	0000h	2		CFA power mode
			F	15 Word 160 supported
			X	14 Reserved
			F	13 CFA power mode 1 is required for one or more commands implemented by the device
			V	12 CFA power mode 1 disabled
			F	11-0 Maximum current in mA
161-175	XXXXh	30	X	Reserved for Compact Flash Association
176-205	0000h	60	V	Current media serial number (ATA String)
206	0000h	2		SCT Command Transport
			F	15-12 Vendor specific
			X	11-6 Reserved
			F	5 1: SCT Command Transport Data Tables supported
			F	4 1: SCT Command Transport Features Control supported
			F	3 1: SCT Command Transport Error Recovery Control supported
			F	2 1: SCT Command Transport Write Same supported
			F	1 1: SCT Command Transport Long Sector Access supported
			F	0 1: SCT Command Transport supported
207-208	0000h	4	X	Reserved
209	4000h	2		Alignment of logical blocks within a physical block
			X	15 Shall be cleared to zero
				14 Shall be set to one
			F	13-0 Logical sector offset within the first physical sector where the first logical sector is placed
210-211	0000h	4	V	Write-Read-Verify Sector Count Mode 3 (DWord)
212-213	0000h	4	F	Write-Read-Verify Sector Count Mode 2 (DWord)
214-216	0000h	6	X	Obsolete
217	0000h	2	F	Nominal Media Rotation Rate
218	0000h	2	X	Reserved
219	0000h	2	X	Obsolete
220	0000h	2	X	15-8 Reserved
			V	7-0 Write-Read-Verify feature set current mode
221	0000h	2	X	Reserved
222	0000h	2		Transport major version number, 0000h or FFFFh: device does not report version
			F	15-12 Transport Type 0h: Parallel

Word Address	Default Value	Total Bytes	F/V	Data Field Type Information		
				1h: Serial 2h-Fh: Reserved		
					Parallel (Type = 0)	Serial (Type = 1)
			X	11-7 Reserved		Reserved
			F	6 Reserved		SATA Rev 3.1
			F	5 Reserved		SATA Rev 3.0
			F	4 Reserved		SATA Rev 2.6
			F	3 Reserved		SATA Rev 2.5
			F	2 Reserved		SATA II: Extensions
			F	1 ATA/ATAPI-7		SATA 1.0a
			F	0 ATA8-APT		ATA8-AST
223	0000h	2	F	Transport minor version number		
224-229	0000h	12	X	Reserved		
230-233	0000h	8	X	Extended Number of User Addressable Sectors (QWord)		
234	0000h	2	F	Minimum number of 512-byte data blocks per DOWNLOAD MICROCODE command for mode 3		
235	0000h	2	F	Maximum number of 512-byte data blocks per DOWNLOAD MICROCODE command for mode 3		
236-254	0000h	38	X	Reserved		
255	VVVVh	2		Integrity Word		
			V	15-8 Checksum		
			V	7-0 Checksum Validity Indicator		

Note:
1. F/V: Fixed/Variable content.
2. F: The content of the word is fixed and does not change. For removable media devices, these values may change when media is removed or changed.
   V: The contents of the word are variable and may change depending on the state of the device or the commands executed by the device.
   X: The content of the word may be fixed or variable.

3.5 Set Feature Command

The table listed below is the supported feature field set in feature register

Table 5: SET FEATURES Feature field definitions

Value	Function
02h	Enable volatile write cache
03h	Set transfer mode based on value in Sector Count register
55h	Disable read look-ahead feature
82h	Disable volatile write cache
90h	Disable use of SATA feature
AAh	Enable read look-ahead feature

3.6 SMART Feature Command

SILICON POWER'S mSATA SATA III SSD 300S series supports SMART function. It response the up-to-date SMART command set with the SMART data structure as following:

Table 6: SMART Feature registers values

Value	Command
D0h	SMART Read Data
D2h	SMART Enable/Disable Attribute Autosave
D8h	SMART Enable Operations
D9h	SMART Disable Operations
DAh	SMART Return Status
Others	Reserved

Table 7: Device SMART Data Structure

Offset	Description
0-1	SMAT Structure Revision code
2-361	Attribute entries 1 to 30 (12 bytes each)
362	Off-line data collection status (No off-line data collection) (Fixed)
363	Self-test execution status byte (Self-test completed) (Fixed)
364-366	Reserved
367	Off-line data collection capability (No Off-line data collection) (Fixed)
368-369	SMART capability
370	Error logging capability (No error logging) (Fixed)
371	Reserved
372	Short self-test routine recommended polling time (in minutes) (Fixed)
373	Extended self-test routine recommended polling time (in minutes) (Fixed)
374-510	Reserved
511	Data structure checksum

- (0-1) Revision code

This revision code area defines the firmware revision for the device.

- (2-361) Attribute entries 1 to 30 (12 bytes each)

There are five attributes that are defined for this device. These return their data in the attribute section of the SMART data, using a 12 byte data field. Rest of the area is reserved. The Individual attribute data structure is defined as following:

Byte	Description
0	Attribute ID
1-2	Status Flag
3	Attribute Value
4	Worst Ever normalized Attribute Value
5-10	Raw Attribute Value
11	Reserved

The following is the list of effective IDs and the attributes.

Offset	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11
Attribute	ID	Flag		Init	Worst	Raw Attribute Value						Rsv
Power-On hours Count	09h	12h	00h	64h	00h	(1)		00h	00h	00h	00h	00h
Drive Power Cycle Count	0Ch	12h	00h	64h	00h	(2)		00h	00h	00h	00h	00h
SSD Protect Mode	A7h	22h	00h	64h	00h	(3)	00h	00h	00h	00h	00h	00h
SATA PHY Error Count	A8h	12h	00h	64h	00h	(4)		00h	00h	00h	00h	00h
Bad Block Count	A9h	13h	00h	(5)	0Ah	(13)		(14)		(15)		00h
Erase Count	ADh	12h	00h	(6)	00h	(16)		(17)		(18)		00h
Bad Cluster Table Count	AFh	13h	00h	(7)	0Ah	00h	00h	00h	00h	00h	00h	00h
Unexpected Power Loss Count	C0h	12h	00h	64h	00h	(8)		00h	00h	00h	00h	00h
Temperature	C2h	22h	00h	(9)	1Eh	(10)	00h	(11)	00h	(12)	00h	00h

Value Definition:

(1) Power-On Hours Count

(2) Power-On Cycle Count

(3) SSD Protect Mode: 0=Read/Write Mode, 3=Read Only Mode

(4) SATA PHY Error Count: include command fail case

(5) Bad Block Count: good block percentage, initial value = 100

(6) Erase Count: available erase count percentage, initial value = 200

(7) ECC Fail Count: initial value = 100

(8) Power Loss Count

(9) Temperature: normalized temperature, = 100 - Current Temperature*

(10) Current Temperature*

(11) Minimum Temperature*

(12) Maximum Temperature*

(13) Maximum Bad Block Number of Die

(14) Total Bad Block Count

(15) Later Bad Block Count

Offset	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11
(16) Average Erase Count												
(17) Maximum Erase Count												
(18) Minimum Erase Count												

Note: Use "Little Endian" rule. If the data is in two bytes length, LSB is in lower bytes and MSB is in higher byte. All of the data are in HEX format.

*Temperature report is an option feature in this product.

- (368-369) SMART capabilities

The following describes the definition for the SMART capabilities bits.

- Bit 0 - If this bit is set to one, the device saves SMART data prior to going into a power saving mode (Idle, Standby, or Sleep) or immediately upon return to Active or Idle mode from a Standby mode. If this bit is cleared to zero, the device does not save SMART data prior to going into a power saving mode (Idle, Standby, or Sleep) or immediately upon return to Active or Idle mode from a Standby mode.

- Bit 1 - This bit shall be set to one to indicate that the device supports the SMART ENABLE/DISABLE ATTRIBUTE AUTOSAVE command.

- Bits (15:2) (Reserved).

- (372) Self-test routine recommended polling time

The self-test routine recommended polling time shall be equal to the number of minutes that is the minimum recommended time before which the host should first poll for test completion status. Actual test time could be several times this value. Polling before this time could extend the self-test execution time or abort the test depending on the state of bit 2 of the off-line data capability bits.

- (511) Data structure checksum

The data structure checksum is the two's complement of the sum of the first 511 bytes in the data structure. Each byte shall be added with unsigned arithmetic, and overflow shall be ignored. The sum of all 512 bytes will be zero when the checksum is correct. The checksum is placed in byte 511.

4. Installation

4.1 Installation

**For Installation of mSATA SATA III SSD to your system, please follow up below steps;**

1. Make sure your computer is turned the power off before the installation.
2. Plug the mSATA SATA III SSD carefully into the mSATA slot on your computer or on the mSATA to SATA converting board.
3. If you use mSATA to SATA converting board, please make sure the Serial ATA Power Cable and the SATA signal cable are connected correctly and are
4. Check mSATA SATA III SSD and cable connections are firm enough.

4.2 Partition

For Windows Operating System:

- To partition your new mSATA SATA III SSD, for example use Microsoft Windows 7 or WES 7:

1. In your windows system, You can Click the 『Start』 → 『Control Panel』 → 『System and Security』 →『Administrative Tools』→『Computer Management』 then select 『Storage』→『Disk Management』 to setup the partition.
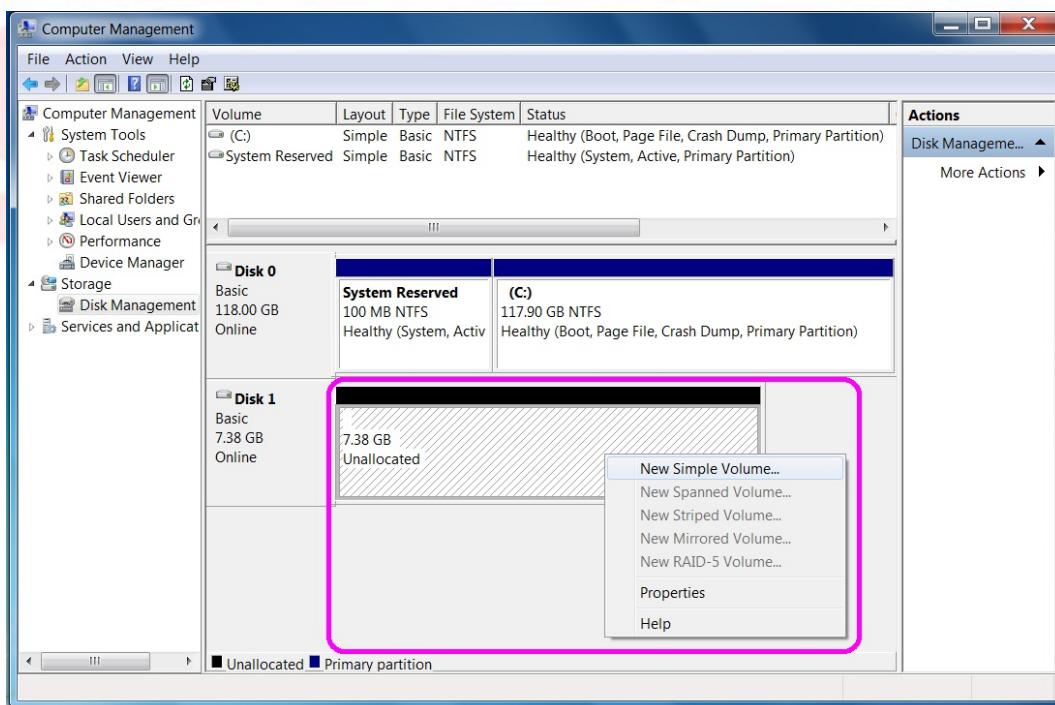
4.3 Format

For Windows Operating System:

- To format your new mSATA SATA III SSD, for example use Microsoft Windows 7 or WES7:

1. Click the 『Start』→『Control Panel』→『System and Security』→『Administrative Tools』→『Computer Management』 then select 『Storage』→『Disk Management』 to setup the file format. With such setup procedure, the format type of File system may have more choice depended on the capacity of the device.

2. Select suitable format type for usage.
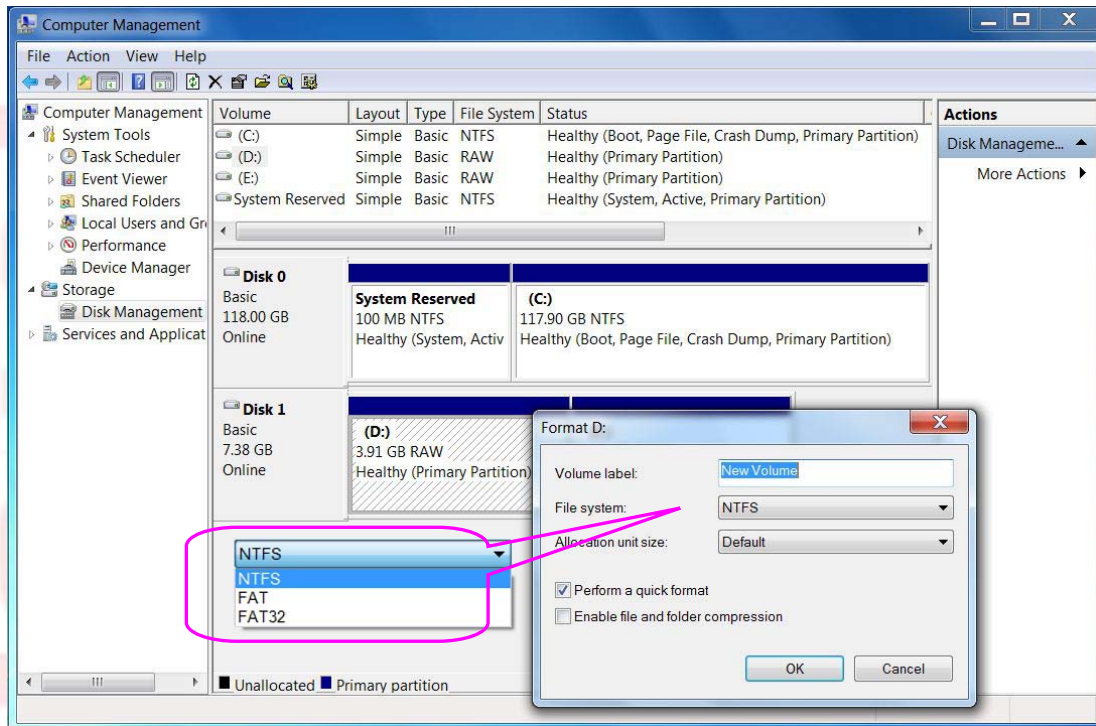
5. Troubleshooting

5.1 BIOS can not identify mSATA SATA III SSD

5.1.1 Check Locker of the connector.

5.1.2 Check Power status

5.1.3 Check the slot is with mSATA signaling, not with PCIe signaling. If the slot is in PCIe mini card signaling, please DO NOT install mSATA SATA III SSD.

5.2 mSATA SATA III SSD can not boot the system

5.2.1 Check BIOS setting

5.2.2 Reinstall your system

Notice: *Please contact your closest Silicon Power office or local representatives for verifying your other troubles.*

6. Ordering Information

6.1 Part Number Definition

SP	XXXX	I	MSA	3	0	1	S	X	0
|	|	|	|	|	|	|	|	|	|
Prefix	Capacity	Industrial Product	Form Factor	Flash Type	Controller	Flash Brand	SSD Series	Temp	Reserve

Code	Definition	Description
XXXX	Capacity	004G:4GB,008G:008GB,016G: 16GB, 032G: 32GB, 064G: 64GB, 128G: 128GB, 256G: 256GB
MSA	Form Factor	SSD: 2.5" SSD MSA: mSATA MSM:mSATA mini MDA: M.2 2242 MDB: M.2 2260 MDC: M.2 2280 MDD:M.2 22110 HSD: Half Slim SFM: SATA DOM
3	Flash Type	7: SLC 5: pSLC 3: MLC
0	Controller	0: SM2246EN 1: SM2246XT 2:SF2281 B04
1	Flash	0: Micron 1: Toshiba 5:Sandisk
S	SSD Series	R: Robust & Extreme S: Performance E:Embedded
X	Operation Temp	W:Wide Temp -40 - +85℃ E:Extended Temp -25 - +85℃ V:Normal temp: 0 - +70℃

Standard mSATA SATA III SSD 300S series Information

Capacity	Part Number	BOM Code	Description	R/W Performance (MB/s)	IOPS (R/W)
Industrial mSATA SSD300S series, 7mm, MLC, Normal Temperature					
4GB	SP004GIMSA301SV0	004GIMSA301SV0-010	SM2246EN AA + 15nm 32Gb*1	120/10	15K/3K
8GB	SP008GIMSA301SV0	008GIMSA301SV0-010	SM2246EN AA + 15nm 32Gb*2	240/22	27K/6K
16GB	SP016GIMSA301SV0	016GIMSA301SV0-010	SM2246EN AA + 15nm 32Gb*4	270 / 45	27K / 12K
		016GIMSA301SV0-020	SM2246EN AA + 15nm 64Gb*2	270 / 45	27K / 12K
		016GIMSA301SV0-030	SM2246EN AA + A19nm 128Gb*1	150 / 40	15K / 20K
16GB	SP016GIMSA305SV0	016GIMSA305SV0-010	SM2246EN AA + 1Znm 128Gb*1	TBD	TBD

Capacity	Part Number	BOM Code	Description	R/W Performance (MB/s)	IOPS (R/W)
32GB	SP032GIMSA301SV0	032GIMSA301SV0-020	SM2246EN AA + 15nm 64Gb*4	290 / 75	72K / 28K
		032GIMSA301SV0-030	SM2246EN AA + A19nm 128Gb*2	290 / 75	30K / 20K
		032GIMSA301SV0-040	SM2246EN AA + 15nm 128Gb*2	280 / 45	26K / 11K
32GB	SP032GIMSA305SV0	032GIMSA305SV0-010	SM2246EN AA + 1Znm 128Gb*2	TBD	TBD
64GB	SP064GIMSA301SV0	064GIMSA301SV0-020	SM2246EN AA + 15nm 128Gb*4	480 / 80	50K / 22K
		064GIMSA301SV0-030	SM2246EN AA + A19nm 128Gb*4	480 / 80	58K / 39K
64GB	SP064GIMSA305SV0	064GIMSA305SV0-010	SM2246EN AA + 1Znm 128Gb*4	480 / 80	50K / 23K

Capacity	Part Number	BOM Code	Description	R/W Performance (MB/s)	IOPS (R/W)
Industrial mSATA SSD300S series, 7mm, MLC, Normal Temperature					
128GB	SP128GIMSA301SV0	128GIMSA301SV0-020	SM2246EN AA + 15nm 256Gb*4	490 / 160	70K / 44K
		128GIMSA301SV0-030	SM2246EN AA + A19nm 256Gb*4	490 / 320	74K / 61K
128GB	SP128GIMSA305SV0	128GIMSA305SV0-010	SM2246EN AA + 1Znm 256Gb*4	490 / 170	72K / 46K

Capacity	Part Number	BOM Code	Description	R/W Performance (MB/s)	IOPS (R/W)
Industrial mSATA SSD300S series, 7mm, MLC, Wide Temperature					
32GB	SP032GIMSA301SW0	032GIMSA301SW0-010	SM2246EN AA + 15nm 64Gb*4	290 / 75	72K / 28K
64GB	SP064GIMSA301SW0	064GIMSA301SW0-010	SM2246EN AA + 15nm 128Gb*4	480 / 80	50K / 22K
128GB	SP128GIMSA301SW0	128GIMSA301SW0-010	SM2246EN AA + 15nm 256Gb*4	490 / 160	70K / 44K
256GB	SP256GIMSA301SW0	256GIMSA301SW0-010	SM2246EN AA + 15nm 512Gb*4	490 / 320	71K / 78K

6.2 Contact Information

Silicon Power Computer & Communications Incorporation, a solid state memory or storage business company, provides total solutions in the design and marketing of SSD, Flash Module, and Industry Card

products. For further supporting or detail information related to the products, please inform us through the following contact email address: isupport@silicon-power.com. We will response the requests soon.