Memoright HSM-18 Series
Half Slim Form Factor
NAND Flash Solid State Drive

Model Code: MRSAJ5*******18*00

Product Specification

Version 1.6
June. 2012

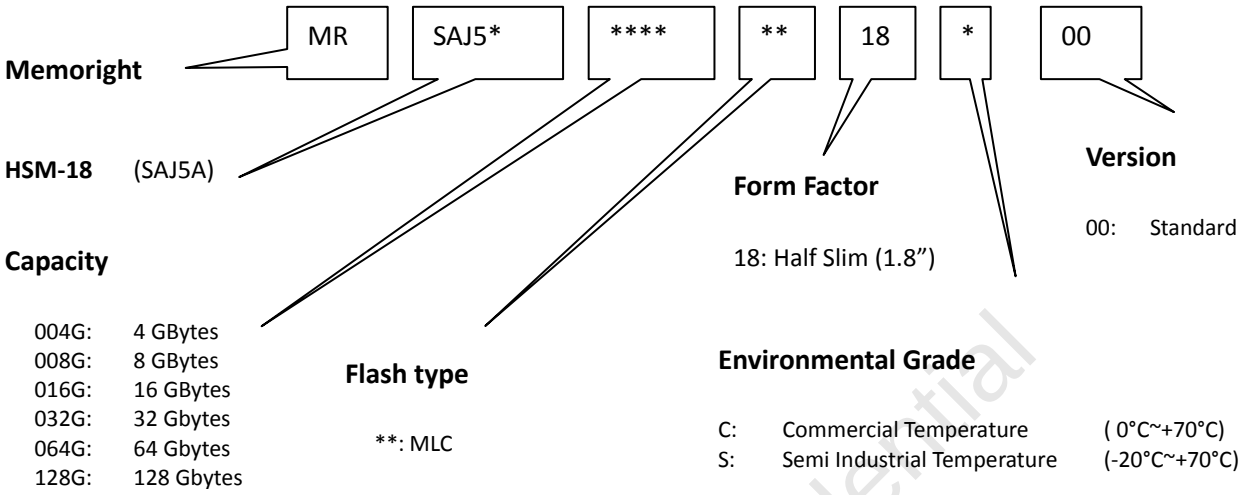
Overview

This document serves as reference basis for HSM-18 Series Half Slim Solid State Drive's technical characteristics and help you choose Memoright commercial and semi-industrial operating temperature range MLC NAND Flash solutions.

For updates or additional information about Memoright products, contact your nearest Memoright office.

Ordering information

Decoder



Product code

Memoright HSM-18 Series (MLC, C-Temp)	
Part Number	Description
MRSAJ5A004GC118C00	4 GB, MLC, Half Slim, C-temp solution
MRSAJ5A008GC118C00	7 GB, MLC, Half Slim, C-temp solution
MRSAJ5A016GC118C00	15 GB, MLC, Half Slim, C-temp solution
MRSAJ5A032GC218C00	30 GB, MLC, Half Slim, C-temp solution
MRSAJ5A064GC318C00	60 GB, MLC, Half Slim, C-temp solution
MRSAJ5A128GC718C00	120 GB, MLC, Half Slim, C-temp solution

Memoright HSM-18 Series (MLC, S-Temp)	
Part Number	**Description**
MRSAJ5A004GC118S00	4 GB, MLC, Half Slim, S-temp solution
MRSAJ5A008GC118S00	7 GB, MLC, Half Slim, S-temp solution
MRSAJ5A016GC118S00	15 GB, MLC, Half Slim, S-temp solution
MRSAJ5A032GC218S00	30 GB, MLC, Half Slim, S-temp solution
MRSAJ5A064GC318S00	60 GB, MLC, Half Slim, S-temp solution
MRSAJ5A128GC718S00	120 GB, MLC, Half Slim, S-temp solution

For the latest ordering information, please consult Memoright's sales representatives or check on our website: http://www.memoright.com

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1. General Description

The HSM-18 series is a Half Slim (SATA 7+15 interface) flash memory driver that feature a flash disk controller chip and NAND type flash memory devices.

The HSM-18 series is available in 8 GB to 128 GB capacities.

The drives support SATA I / II data transfer. The Half Slim HSM-18 is geared specifically to the industrial market for use in such products as ATM, factory automation machines, POS terminals, Measuring products, Ticket-vending machines, parking systems and other industrial products that require high tolerance to environmental.

1.1 Raw capacity

MLC: 4 to 128 GBytes,

1.2 Form Factor

Half Slim (JEDEC MO-297: 1.8" SSD)
W54mm*L39mm*H4mm

1.3 Host interface

Serial ATA 2.0 specification compliant

1.4 Performance

Host Interface: 3.0Gbps
MLC read/write transfer rate: Up to 150/90 MB
Access time: < 0.3 ms
Random IOPS Read @4Kbytes: up to 6,500

1.5 Reliability

1.5.1 Wear Leveling

Both dynamic and static wear leveling strategy, which ensures all blocks have nearly same wear level, reducing dependence of write endurance on access pattern.

1.5.2 Endurance

> 3 yrs sequential write (for a half drive's capacity write per day)

1.5.3 ECC

It provides Enhanced ECC algorithm, which reduces error Built-in 24 bit/1024 bytes BCH-ECC engine. Enforces write endurance at same time.

1.5.4 Bad block management algorithm

This drive has a certain number of reserved blocks. When a user data block fails, a reserved block will replace the failed block. The replacement of bad block is transparent to user.

1.5.5 Mean Time between Failures

More than 2,100,000 hours
based on Part Stress Analysis

1.6 Power consumption

Input voltage: +5V DC, ±5%
Write: 0.95 W(Average)
Idle: 0.29 W(Average)
Test under room temperature @ 5V

1.7 Environmental

1.7.1 Temperature

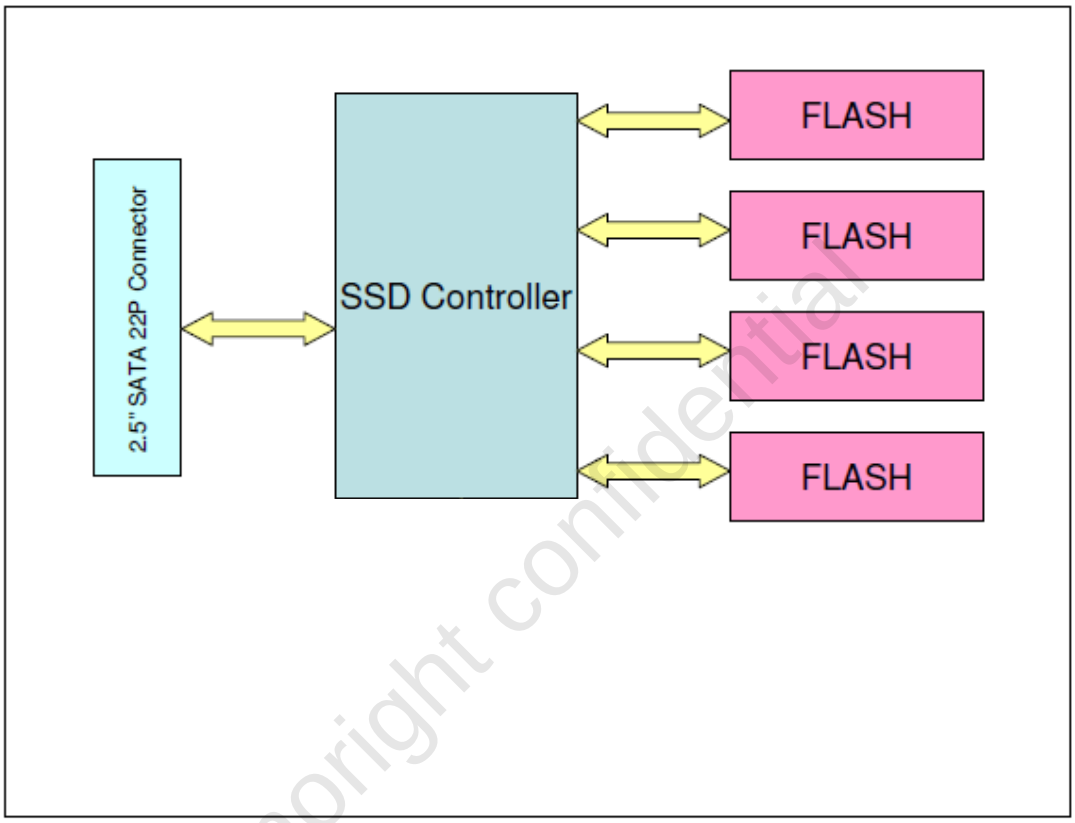
Operating: 0°C ~ +70°C (C-Temp)
-20°C ~ +70°C (S-Temp)
Non-Operating: -40°C ~ +85°C (C/S-Temp)

1.8 Certification

CE, FCC, RoHS

2. Functional Block Diagram

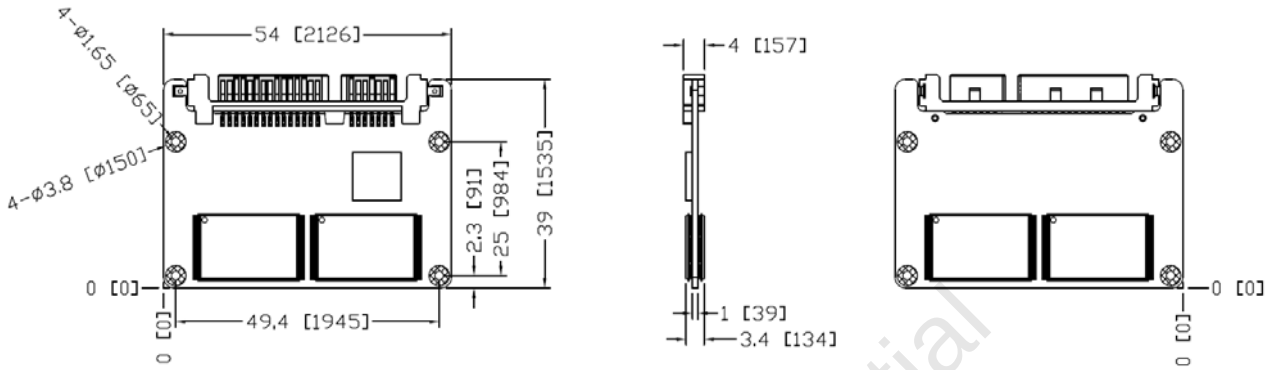
Figure 1: Block diagram



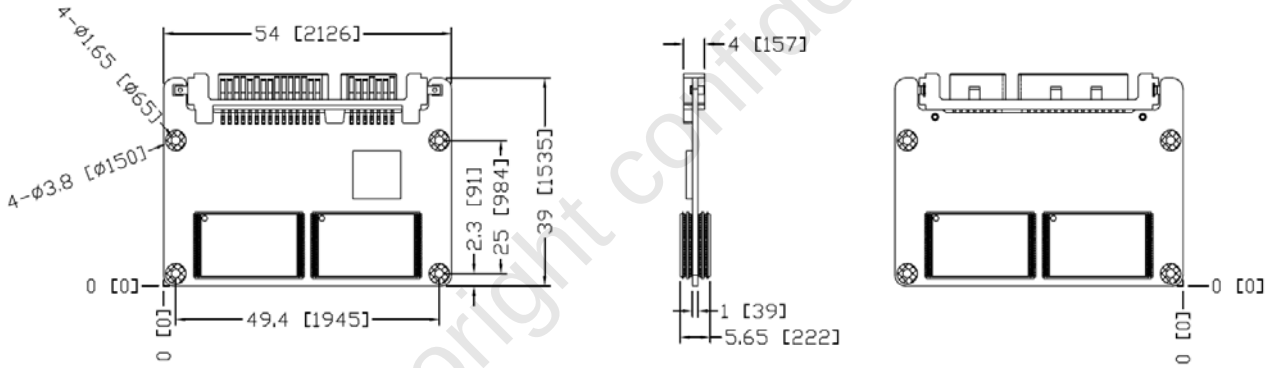
3. Physical specifications

Figure 2: Dimension

8, 16, 32, 64, 128 GB: W54mm*L39mm*H4.0mm



32 GB (stacking): W54mm*L39mm*H5.65mm



3.1 Specification Summary Table

Unformatted capacity *[1]	4 GB	7 GB	15 GB	30 GB	60 GB	120GB
Access Time	<0.3ms					
Sequential Read transfer rate*[2]	Up to 35 MB/s	Up to 65 MB/s	Up to 130 MB/s	Up to 140 MB/s	Up to 150 MB/s	Up to 140 MB/s
Sustained Write transfer rate*[2]	Up to 7 MB/s	Up to 20 MB/s	Up to 40 MB/s	Up to 40 MB/s	Up to 90 MB/s	Up to 80 MB/s
Channels	2		4			
Media type	Multi Layer Cell (MLC) NAND Flash					
Random 4KByte IOPS (read)	5,300	4,500	4,500	6,500	5,700	4,500
Random 4KByte IOPS (write)	25	10	6	20	10	3
Interface	Serial ATA 1.0/2.0 (1.5Gb/sec and 3.0Gbps auto-negotiated)					
Height	5.65 mm (stacking), 4 mm (Non-Stacking)					
Width	39 mm					
Length	54mm					
Average latency (Typical)	0.1 ms					
Idle mode power (Typical) *[3]	1.5 W	0.7 W	1.07 W	1.2 W	1 W	0.8W
Voltage	3.3V+/-5%					
Sustain Write/1MB	1.7 W	1.2 W	1.3 W	2.2 W	1.4 W	1.6W
Temperature (Operating)	0°C to 70°C (commercial),					
Temperature (Non-Operating)	-40 ~85°C					
Humidity (non-condensing)	5% ~ 95%					
Drive acoustics, sound power (dB)	0 dB					
Shock (Operating)	1000G (duration 0.5msec, Half Sine Wave)					
Shock (Non-Operating)	1500G (Duration 0.5msec, Half Sine Wave)					
Vibration (Operating)	10 (Peak, 10~2000Hz)					
Non-recoverable read errors	$<10^{-16}$					
Mean Time Before Failure (MTBF)	>2,100,000 hours					
Altitude	-1000 ~ 60,000 feet					

Table 1: Specifications Summary

*[1] 1GB = 1,000,000,000 Bytes
*[2] 1GB = 1024 Mega Bytes
*[3] Typical value under room temperature

3.2 Unformatted capacity

Table 2: Products capacity

HSM-18

Model	Unformatted capacity	Guaranteed sectors	Bytes per sector
MRSAJ5A004G**18*00	4 GB	5,881,680	512
MRSAJ5A008G**18*00	7 GB	13,695,696	512
MRSAJ5A016G**18*00	15 GB	29,323,728	512
MRSAJ5A032G**18*00	30 GB	58,626,288	512
MRSAJ5A064G**18*00	60 GB	117,231,408	512
MRSAJ5A128G**18*00	120 GB	234,441,648	512

3.3 default logic geometry

Table 3: Default logic geometry

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Model	Cylinders	Read/write heads	Sectors per track
MRSAJ5A004G**18*00	5835	16	63
MRSAJ5A008G**18*00	TBD	TBD	63
MRSAJ5A016G**18*00	TBD	TBD	63
MRSAJ5A032G**18*00	TBD	TBD	63
MRSAJ5A064G**18*00	116301	16	63
MRSAJ5A128G**18*00	TBD	TBD	63

LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to n–1, where n is the number of guaranteed sectors as defined above.

3.4 Physical organization

Table 4: Physical organization

HSM-18

Unformatted capacity *[1]	4 GB	7 GB	15 GB	30 GB	60 GB	120 GB
Channels	1	2	4			

4. Environmental specifications

4.1 Operating temperature

Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Above 1,000 feet (305 meters), the maximum temperature is decreased linearly by 1°C every 1000 feet.

Table 5: Ambient temperature

Operating	**S-Temp**	-20° to 70°C
	C-Temp	0° to 70°C
Non-Operating		-40° to 85°C
Maximum temperature gradient		25°C per hour

4.2 Humidity

Relative Humidity: 10-95%, non-condensing

4.3 Vibration

Parameter	Specifications
Operating	10G (Peak, 10~2000Hz)

4.4 Shock

Parameter	Acceleration (G)	Half-sine Pulse (ms)
Operating	500	2
	1,000	1
	1,000	0.5
Non-Operating	200	10
	1,500	1
	1,500	0.5

4.5 Reliability

It's well known that the reliability of a chip configuration is better than a mechanical configuration. Because the mechanical configuration is affected by too many factors, it influences the reliability of HDD very much. While the chip configuration is opposite, it makes that HSM-18 Series SSD has a nice reliability.

4.6 Agency certification

HSM-18 Series SSD products have passed the following agency certification: FCC, CE, RoHS

4.7 Environmental protection

HSM-18 Series Half Slim SSD produces almost no quantity of heat and the noise is 0 dB when it is working. At the same time, the HSM-18 Series SSD products and the enclosed components/devices and/or assemblies are lead-free. It has no influence on environment.

5. Configuring and mounting the drive

This section contains the specifications and the instructions for configuring and mounting the drive.

5.1 Static discharge and handling precautions

After unpacking and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

Caution:

- Keep the drive in the electrostatic discharge (ESD) bag until you are ready to installation to limit the drive's exposure to ESD.
- Before handling the drive, put on a grounded wrist strap, or ground yourself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.
- Handle the drive only by its edges or frame.
- The drive is fragile, and handles it with care. Do not press down on the drive top cover.
- Always rest the drive on a padded, antistatic surface until you mount it in the computer.
- Do not touch the connector pins or the printed circuit board.
- Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

5.2 Drive mounting

You can mount the drive using four screws in the side-mounting holes or four screws in the bottom-mounting holes. See Figure 2 for drive mounting dimensions (dimensions in inches with mm in parentheses). Follow these important mounting precautions when mounting the drive:

- Allow a minimum clearance of 0.030 inches (0.76 mm) around the entire perimeter of the drive for cooling.
- Use only M3 x 6mounting screws.
- Do not over tighten the mounting screws (maximum torque: 5.0 inch-lb).
- Four (4) threads (0.080 inches) minimum screw engagement recommended.

5.3 Installation considerations

The advantages of HSM-18 Series Half Slim are obvious comparing to HDD. More and more users of computers replace the hard drive with HSM-18 Series Half Slim SSD, or planning to do so. Refer to your system's user manual for the location of the hard drive compartment and the specific instructions regarding replacement. Refer to your system manufacturer's support website for the most up-to-date information. Read and follow all instructions regarding the proper steps to be taken when replacing the system hard drive. Some mobile systems are sealed and require specialized tools to gain access to the hard drive. Special training or tools may be needed to service some mobile computers. In some cases, opening the case may void your warranty. Consult your system documentation. Memoright recommends taking your system to an authorized service technician to replace your hard drive.

- Unpack the drive and keep it away from any potential ESD (Electrostatic Discharge) hazard area.
- Mount the drive with 4 screws either through the two sides of the drive or at the bottom of the drive.
- Use M3 x 6mm screws which you may find in the packing box.
- Connect the 15-Pin power cable to the power connector of the drive and connect the 7-Pin signal cable to the signal connector of the drive properly.
- Power on your host and then format the SSD or initiate the SSD through the RAID card with the standard drive format procedure.
- Please install the windows XP first then Vista if coexisted systems required.

6. SATA interface

The drive uses the industry-standard Serial ATA interface that supports 16-bit data transfers. It supports programmed input/output (PIO) modes 0–4; Ultra DMA modes 0–6. The drive also supports the use of the IORDY signal to provide reliable high-speed data transfers.

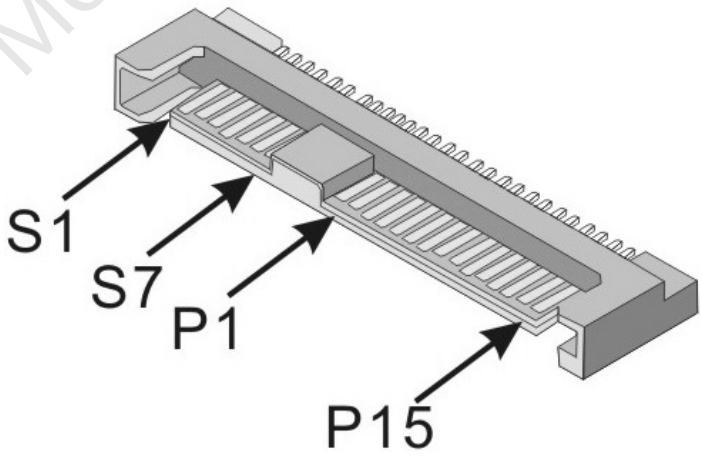
For detailed information about the Serial ATA interface, refer to the draft of AT Attachment with Packet Interface Extension (ATA/ATAPI-7), NCITS T13 1410D, subsequently referred to as the Draft ATA-7 Standard.

6.1 SATA interface signals and connector pins

The connector on Memoright HSM-18 Series Half Slim is divided into a signal Segment and a power Segment. The following tables summarize the signals on the SATA interface connector. For a detailed description of these signals, refer to the Draft ATA-7 Standard.

6.2 Signal Segment Pin-out Configuration

Figure 3: SATA Pin



The SATA signal cable uses a protocol transmitted over a 7-pin cable. The following table lists the signal definitions of the 7-pin segment.

Table 6: SATA Connector Signal Definitions

Pin	Signal Name	Signal Definitions
S1	Ground	Second Mate
S2	R+	+Differential Receive Signal
S3	R-	-Differential Receive Signal
S4	Ground	Second Mate
S5	T-	-Differential Transmit Signal
S6	T+	+Differential Transmit Signal
S7	Ground	Second Mate

6.3 Power Segment Pin-out Configuration

The SATA power connector consists of 15 pins. The following table lists the signal definitions of the 15-pin segment.

Table 7: SATA Connector Power segment Definitions

Pin	Signal Name	Signal Definitions
P1	V3.3	3.3V Power(Not used)
P2	V3.3	3.3V Power(Not used)
P3	V3.3	3.3V Power(Not used)
P4	Ground	First Mate
P5	Ground	Second Mate
P6	Ground	Second Mate
P7	V5	5V Power, pre-charge, Second Mate
P8	V5	5V Power
P9	V5	5V Power
P10	Ground	Second Mate
P11	Reserved	Reserved
P12	Ground	First Mate
P13	V12	12V Power(Not used)
P14	V12	12V Power(Not used)
P15	V12	12V Power(Not used)

6.4 Supported ATA commands

Command Name	Command Code	Support
Check Power Mode	E5H (98H)	Yes
Execute Device Diagnostic	90H	Yes
Format Track	(50H)	Yes
Identify Device	ECH	Yes
Idle	E3H (97H)	Yes
Idle immediate	E1H (95H)	Yes
Initialize Device Parameters	(91H)	Yes
NOP	00H	Yes
Read Buffer	E4H	Yes
Read Long Sector	(22H or 23H)	Yes
Read Multiple	C4H	Yes
Read Sector(s)	20H or 21H	Yes
Read Verify Sector	40H or 41H	Yes
Read DMA	C8H	Yes
Recalibrate	(1XH)	Yes
Seek	70H	Yes
Set Features	EFH	Yes
Set Multiple Mode	C6H	Yes
Set Sleep Mode	E6H (99H)	Yes
Standby	E2H (96H)	Yes
Standby Immediate	E0H (94H)	Yes
Write Buffer	E8H	Yes
Write Multiple	C5H	Yes
Write Sector	30H	Yes
Write DMA	CAH	Yes
Write Verify	(3CH)	Yes
Security Set Password	F1H	Yes
Security Unlock	F2H	Yes
Security Erase Prepare	F3H	Yes
Security Erase Unit	F4H	Yes
Security Freeze Lock	F5H	Yes
Security Disable Password	F6H	Yes

7. Sales and technical support

For data sheet, documentation, customization for specific application and technical support, please contact Memoright SSD Design Center

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