Memory Stick Information for Developers

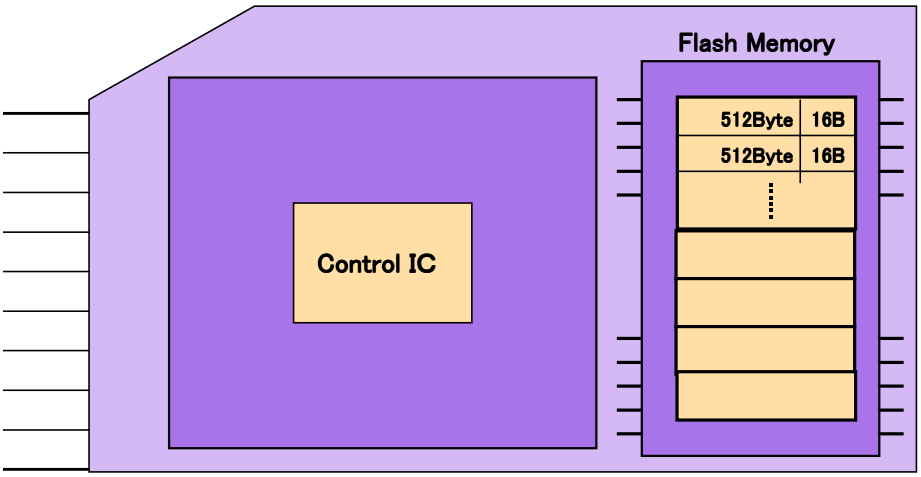
Basic Technology on Memory Stick ▶▶ Physical Formats

Basic Technology on Memory Stick

Physical Formats

Memory Stick Physical Format

- Logical Physical Block Management by Segment
- Attribute and Manufacturer Information in BOOT Block
- Write Process by Alternate Block, Update Status
  (Data Process Suitable to Flash Memory Characteristics)



As physical format, data format of flash memory inside Memory Stick and data process methods are explained.

Characteristics are shown this page. Notably, write process by alternate block and update status is suitable for flash memory's characteristics that data cannot be overwritten and repeated write/erase operations shorten block life.

In this way, blocks in flash memory will be used evenly.

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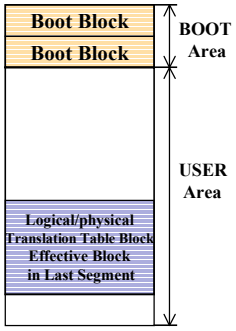
Memory Stick Capacity List

Block SIZE	Capa-city	Number of Blocks (Initial Defect)(Spare)	Effective Block (System Reserve)	User Block (User Capacity)
8K Byte	4M Byte	512 (10)(4)	498 (4)	494 (4,046,848 Byte)
	8M Byte	1024 (20)(10)	994 (4)	990 (8,110,080 Byte)
16K Byte	16M Byte	1024 (20)(10)	994 (4)	990 (16,220,160 Byte)
	32M Byte	2048 (40)(22)	1986 (4)	1982 (32,473,088 Byte)
	64M Byte	4096 (80)(46)	3970 (4)	3966 (64,978,944 Byte)



BLOCK : Memory Erase Unit [8K Byte or 16K Byte]
PAGE : Memory Write/Read Unit [512Byte]
Initial Defect : Maximum Number of Defective Blocks upon Delivery from Manufacturer
Spare : Number of Blocks including Later-developing Defect and Alternate Block
User Capacity(Byte) = Number of User Blocks x Number of Pages per Block [16(8K Byte) or 32(16K Byte)] x Number of Bytes per Page[512Byte]

Memory Stick capacity.

Memory Stick capacities are defined as shown. Block means erase unit and page means write unit.

Initial defect is the maximum value of initial defect block, and most cases it is smaller than the value.

When initial defect is less, alternate block number will increase. System reserve block is explained in another page.

This is how capacity for user's usage is calculated.

For example, 4MB Memory Stick has 8KB block. 4M flash memory has 512 block.

Ten out of 512 blocks are allowed as initial defect. Four blocks beside the ten is number of spare blocks, which are replacement of initial defect and later-developing defect.

Effective blocks are 498 (=512 – 10 – 4), and 4 blocks for system reserve will be deducted.
Therefore, 494 blocks (effective blocks 498 – 4) are user blocks

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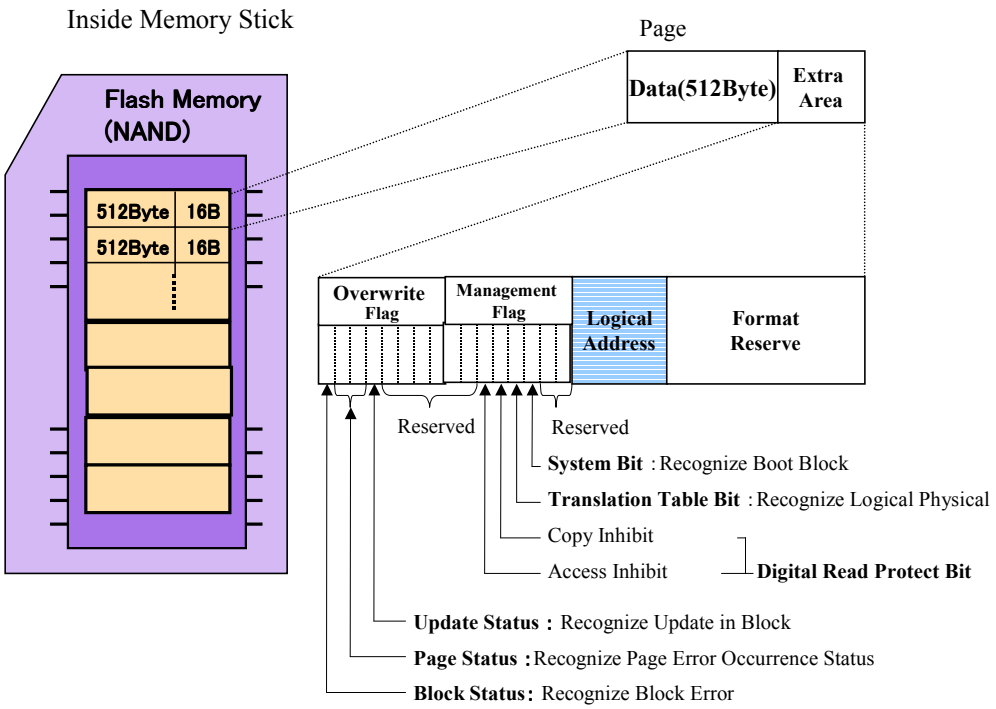
Page Physical Structure



Page structure as Memory Stick write/read unit

Each page data, 512 byte has 16 byte of extra area with control information.

This extra area shows block information by block status to detect block defect and update status to detect update status.

For page information, there are page status to detect page error occurrence and control graph to show data contents.

Logical address set for the extra area is overwritten upon rewrite. Overwriting process is explained in another page.

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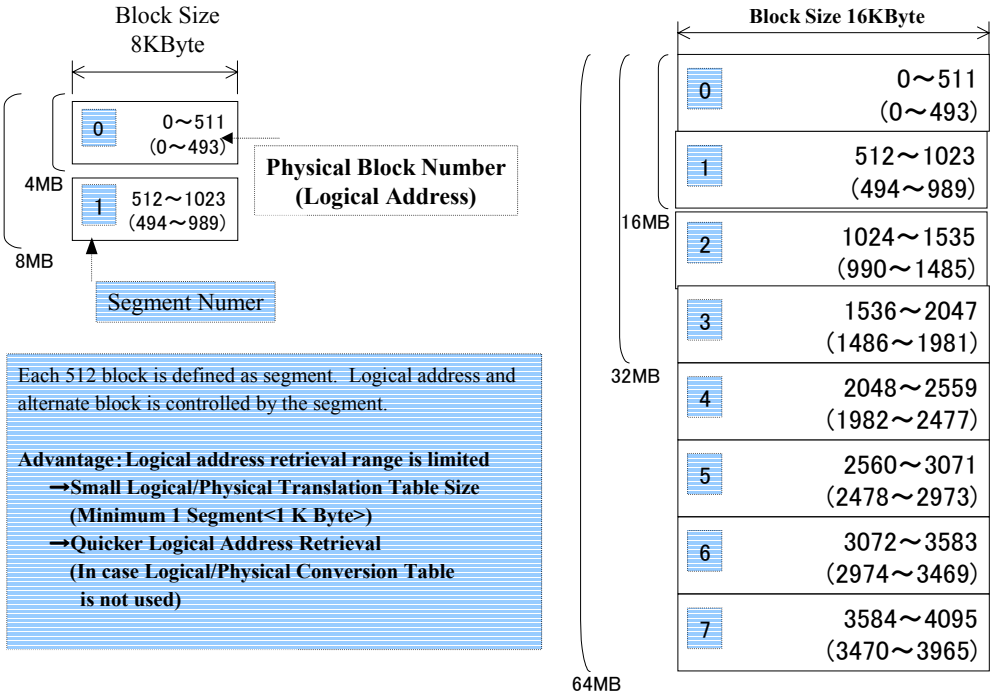
Segment



Concept of segment.

Each 512 block is defined as segment. Each segment manages logical address and alternate block.

In 8 MG Memory Stick, there are four spare block in segment. Spare block is used within segment.

Specified logical address is managed to be in the segment.

In this way, logical/physical translation table size can be small and logical address retrieval is done quickly.

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Boot Block Structure

Boot block is set in two effective blocks from the top of Memory Stick

Header	Block ID, Number of Entry in System Entry
System Entry	Pointer Information to Entry (Disabled Block Data, CIS/IDI)
Boot &Attribute Information	Attributes and Manufacturer Information
Disabled Block Data	
CIS	PC Card Information
IDI	ATA Drive Information

Boot Block Structure.

Starting with header which contains number of entries for boot block recognition.

System entry contains pointer information to entries.

Boot & attribute information contains attributes and production data of Memory Stick.

CIS contains PC card information, while IDI contains ATA drive information. Both has data to structure PC card adaptor.

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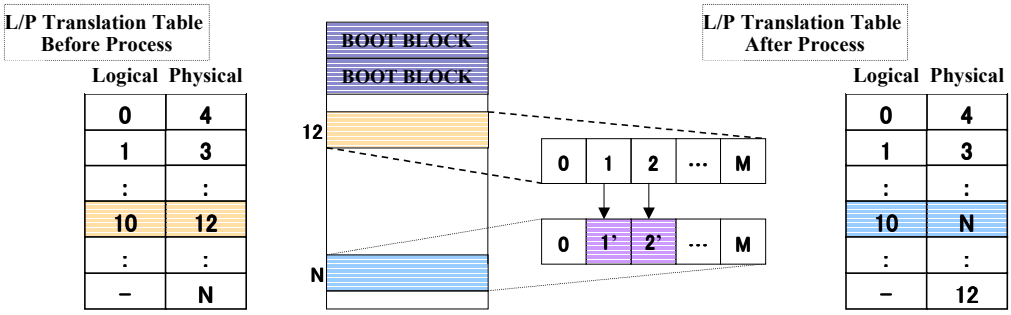
Write Process Example



① Retrieve physical block (e.g. physical block #12) in logical/physical translation table corresponds to logical address(e.g. logical address 10) to be updated.

②Read out data and extra data area of physical block (e.g. physical block #12).

③Change update status to "Update under process".

④Change the readout data(e.g. change Page 1 and 2)

⑤Erase unused block(e.g. physical block N)

⑥Write updated data and extra data area in erased block (e.g. physical block N). When error occurs during write Process, change block status of the accessed block (e.g. physical block N) to "NG" and write in another unused block.

⑦Update the value in logical/physical translation table.

⑧Erase physical block (e.g. physical block 12).

Write process example; write process to logical address 10 corresponding to physical block N.

First, upon insertion of Memory Stick, host generates logical/physical translation table.
① Retrieve physical block (e.g. physical block #12) in logical/physical translation table corresponds to logical address(e.g. logical address 10) to be updated.
②Read out data and extra data area of physical block (e.g. physical block #12).
③Change update status to "Update under process".
④Change the readout data(e.g. change Page 1 and 2)
⑤Erase unused block(e.g. physical block N)
⑥Write updated data and extra data area in erased block (e.g. physical block N). When error occurs during write Process, change block status of the accessed block (e.g. physical block N) to "NG" and write in another unused block.
⑦Update the value in logical/physical translation table.
⑧Erase physical block (e.g. physical block 12).
In this way, flash memory is evenly used and life of Memory Stick is maintained for usage.