Memory Stick Information for Developers

Memory Stick ▶▶ Logical Format

8. Logical Format

8.1. Overview

MS-DOS compatible format is adopted for Memory Stick logical format.

In MS-DOS compatible format, cylinder/ head [track] /sector values are used to refer data in memory. Read/write by the operating system is done in units of a cluster. In this format, cluster unit is aligned to the erase block unit. (Setting by capacity will be described later.)

See "PC Card Standard - Media Storage Formats Specification" for terms in detail.

8.1.1. Structure

The structure is set on user block as shown in the figure below.

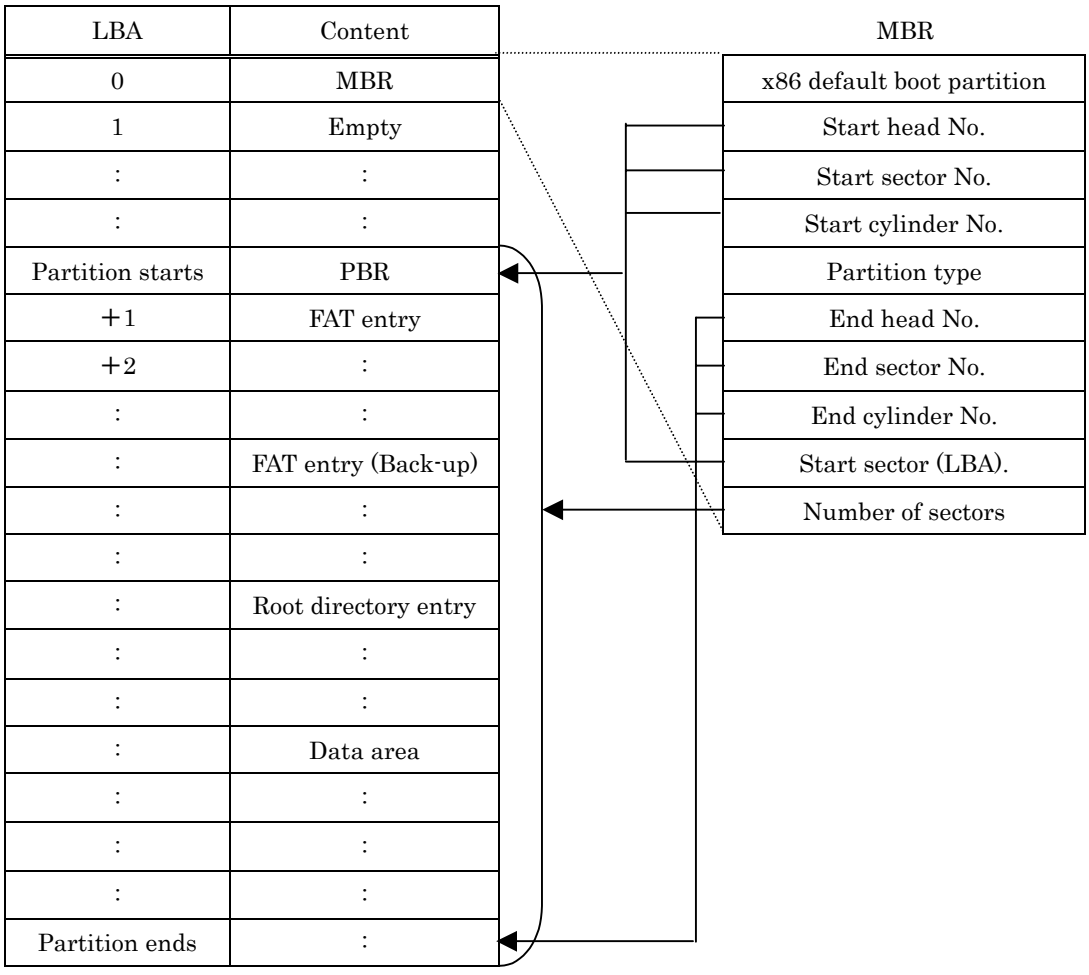

Fig. 8.1.1 Structure

8.1.2. Master Boot Record (MBR)

Master Boot Record (MBR) is placed at the top sector in user area. In this format, only partition 1 is defined and partitions 2~4 are disabled.

Table 8.1.1 MBR

Offset	Size	Parameter		
0x000	0x1BE	Boot code		
0x1BE	1	Partition 1	x86 default boot partition	
0x1BF	1		Start head No.	
0x1C0	1		Start sector No. (*1)	
0x1C1	1		Start cylinder No. (*2)	
0x1C2	1		Partition type	
0x1C3	1		End head No.	
0x1C4	1		End sector No. (*1)	
0x1C5	1		End cylinder No. (*2)	
0x1C6	4		Start Sector (LBA)	
0x1CA	4		Number of sectors	
0x1CE	16	Partition 2		
0x1DE	16	Partition 3		
0x1EE	16	Partition 4		
0x1FE	2	Signature Word		

(*1)
Sector number is expressed in six bits.
Bits zero to five represent the sector number, and bits six to seven represent the high order two bits of the succeeding cylinder number.
(*2)
The cylinder number is expressed in ten bits.
The ten bits consist of bit 6 and 7 from the preceding sector number and the eight bits of the cylinder number.

8.1.3. Partition Boot Record (PBR)

Partition Boot Record (PBR) is placed at the top sector of partition designated by MBR.

Table 8.1.2 PBR

Offset	Size	Parameter	
0x000	3	Jump code	
0x003	8	OEM name and version (ASCII 8 bytes)	
0x00B	2	Number of bytes per sector	
0x00D	1	Number of sectors in a cluster	
0x00E	2	Number of reserved sectors	
0x010	1	Number of FATs	
0x011	2	Number of root directory entries	
0x013	2	Total sectors (<65536)	
0x015	1	Media ID	
0x016	2	Number of sectors in a FAT	
0x018	2	Number of sectors on a head(track)	
0x01A	2	Number of heads	
0x01C	4	Number of hidden sectors	
0x020	4	Total sectors (>=65536)	
0x024	1	Drive No.	
0x025	1	Reserved	
0x026	1	Extension boot signature	
0x027	4	Volume ID	
0x02B	11	Volume label (ASCII 11 bytes)	
0x036	8	File system type (ASCII 8 bytes)	
0x03E	0x1C0	Boot code	
0x1FE	2	Signature word	

8.1.4. File Allocation Table (FAT) Entry

The cluster chain handled in data area is recorded in FAT. Normally, FAT is created in each cluster by 12 bits (FAT 12). However, if the total number of clusters exceeds 4085, it is created by 16 bits (FAT 16). Each entry in FAT corresponds to cluster one-to- one. In FAT 12, one FAT entry occupies 1.5 byte area, and two occupy 3 byte area, and in FAT 16, one FAT entry occupies 2 bytes. "F8"in the figure below is FAT ID to show disk type, and "FF" is a dummy for starting cluster number from 2.

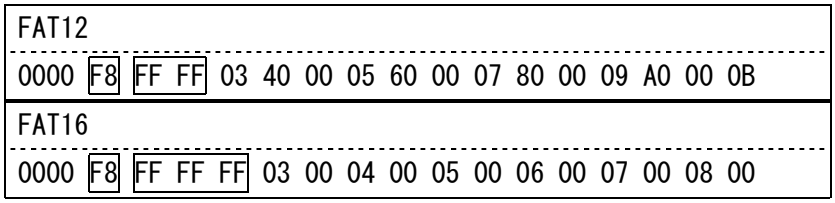

Fig. 8.1.2 FAT Entry

8.1.5. Root Directory Entry

Root directory entry, each consists of 32 bytes, make up the number of 512(fixed) entries. The format is shown in the table below.

Table 8.1.3 Root Directory Entry

Offset	Size	Contents
0x00	8	File name
0x08	3	Extension
0x0B	1	Attribute
0x0C	10	Reserved
0x16	2	Last edit time
0x18	2	Last edit date
0x1A	2	Start cluster No.
0x1C	4	File size (in byte)

8.3. Digital Read Protect Bit

Digital Read Protect Bit (management flag 5 and 4 bit) is applicable only to actual data sector of file. It is not applicable to management data sectors such as PBR, FAT Entry, or Directory Entry, etc.

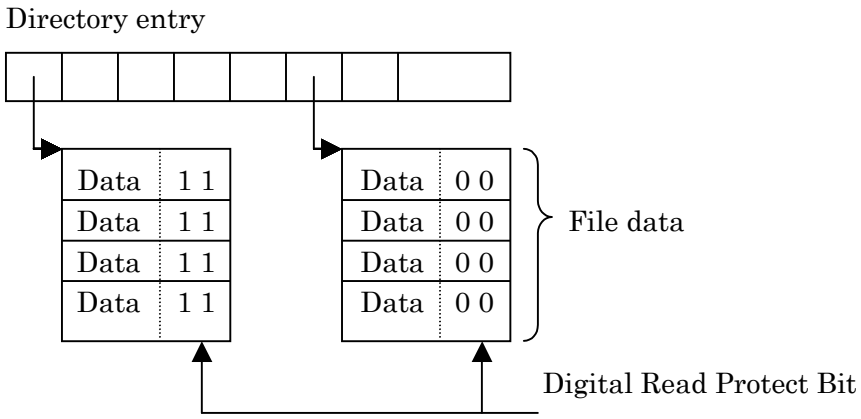

Fig. 8.3.1 Digital Read Protect Bit to be set on File Data

- See Section 7.3.1.3 Management Flag for details on Digital Read Protect Bit.
- Digital Read Protect Bit of data sector in the relevant file shall all be set the same.
- As an Appliance for Memory Stick not supporting copyright-protection features, the file of which Digital Read Protect Bit is other than [1 1], can be confirmed the existence and the name of files through Directory Entry, but the contents shall not be handled. (e.g.: The file with other than [1 1] Digital Read Protect Bit, shall not be displayed on the image display equipment.)
- Appliances without copyright-protection features, shall not be able to copy files with other than [1 1] Digital Read Protect Bit, irrespective of their supporting copy function.
- Appliances without copyright-protection feature, shall not be able to output the file with other than [1 1] Digital Read Protect Bit via PC interface, irrespective of their supporting PC interface.

8.4. Special File

Memory Stick is distinguished from other kinds of media by placing a special file in root directory. Directory entry of special file is shown in the list below.

Table 8.4.1 MEMSTICK.IND File Setting Contents

Offset	Size	Contents	
0x00	8	File name	
0x08	3	Extension	
0x0B	1	Attribute	
0x0C	10	Reserved	
0x16	2	Last edit time	
0x18	2	Last edit date	
0x1A	2	Start cluster No.	
0x1C	4	File size (in bytes)	

*(1) Use the time and date set in boot block.

If not possible, decide in the following priority:

1. Appliances managing time and date → The time and date when special file was created.
2. Pad with 0.

8.5. Relation between Logical Sector and Logical Address

Suppose the number of sectors per block is S and logical sector is N.

- To get logical address B from logical sector N:
  B = N / S
- To get page no. P of the physical block in which logical address B is set:
  P = N−B×S

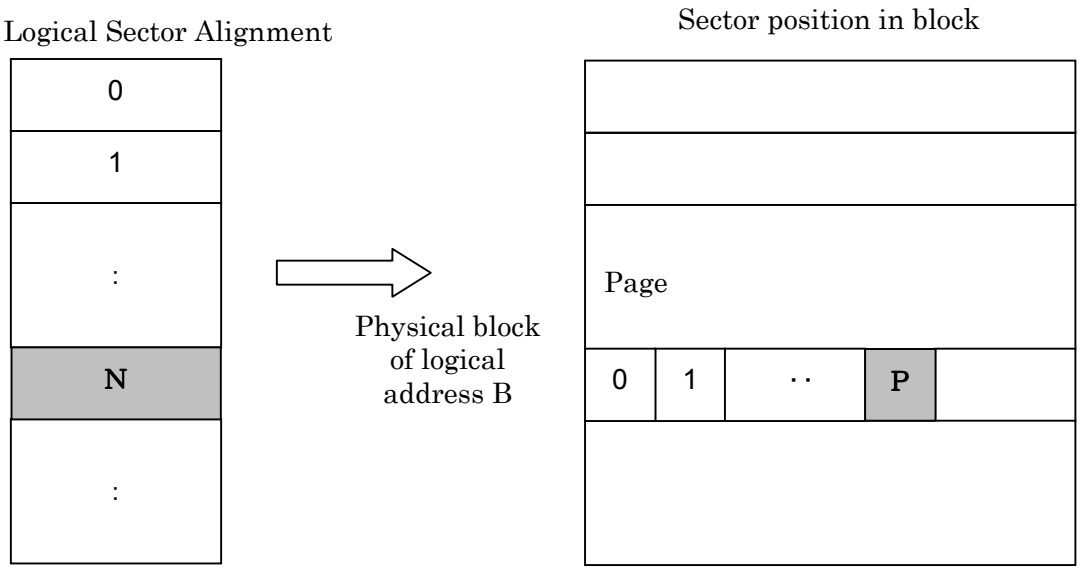

Fig. 8.5.1 Logical Sector and Physical Block

8.6. Notes on Format Processing

Notes on format processing of Memory Stick are as follows:

- Do not rewrite boot block.
- It is recommended not to erase MBR, but when it is, set the value defined in Section 8.2.
- When resetting PBR, set the value defined in Section 8.2.
- When clearing whole data area, do not erase the disabled block. It is recommended not to erase or reuse later-developing defect block.
- After user block is all cleared, it is indispensable to set file defined in Section 8.4 Special File, and to set the logical address defined in Fig.7.1.1 Block Structure to the available user block.