



M-Systems
Flash Disk Pioneers

User Manual

DiskOnChip[®] Utilities

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1 Introduction

This User Manual describes the DOS DiskOnChip utilities supplied by M-Systems to be used with the DiskOnChip® products. These utilities are to be used by system designers and users in order to install and modify the DiskOnChip to the designed system and needs.

The DiskOnChip utilities are:

DIFORMAT, DUPDATE, DINFO, GETMIMG, PUTMIMG

This document includes the DiskOnChip utilities description and flags, including specific examples, and basic "how to" instructions. These will assist you in easy and quick installation of the DiskOnChip in your target platform.

This document is intended for system integrators who are familiar with the PC environment and the operating system in use. It is also recommended that you read the DiskOnChip relevant Application Notes and Data Sheets. See Section 7 for additional documents and tools available.

The latest version of the DiskOnChip utilities can be downloaded from M-Systems' web site at <http://www.m-sys.com>.

1.1 What is the DiskOnChip Product Family?

M-Systems' DiskOnChip is a family of high performance flash disks. The DiskOnChip series provides flash disks in three standard form factors.

- **DiskOnChip 2000:** Standard 32-pin DIP package, Single Chip flash disk
- **DiskOnChip Millennium:** Standard 32-pin DIP package or standard TSOP-II 32-pin Single Chip flash disk¹
- **DiskOnChip DIMM:** Standard 72-pin Small Outline DIMM (Dual In-line Memory Module) flash disk

This unique data storage solution offers an improved, faster and more cost-effective flash disk for Single Board embedded systems, Internet devices and portable applications with limited space. In a PC environment, the DiskOnChip product provides a flash disk (as BIOS expansion), which does not require any bus, slot, or connector. Simply insert the DiskOnChip into the socket on your CPU board (this can be added with minimal installation cost if necessary). Once the operating system files are placed on the DiskOnChip it will also act as a bootable disk.

¹ Software Utilities, version 1.21 and up, is needed for the following DiskOnChip products:

DiskOnChip 2000 Series (included Extended temperature): 32MB, 48MB, 80MB, 112MB, 144MB

DiskOnChip DIMM Series (included Extended temperature): 12MB up to 160MB

DiskOnChip Millennium Series

M-Systems' TrueFFS driver has broad O/S support. TrueFFS is natively supported by all major O/S'es, such as Windows CE, Windows NT Embedded, QNX and VxWorks. TrueFFS drivers can be obtained from M-Systems for all other operating systems such as: DOS, Linux, pSOS+, PharLap, FreeBSD and others. For any other environment (including O/S-less environment) the OSAK² (Operating System Adaptation Kit) package can be obtained. Contact M-Systems for the availability of this package.

The following sections describe the DiskOnChip utilities.

²The OSAK –DiskOnChip OS Adaptation Kit – is a source code driver package available from M-Systems under license agreement

2 DFORMAT Utility

Before the TrueFFS driver can access the DiskOnChip, it must be formatted, just as a floppy disk must be formatted. Formatting initializes the flash media on the DiskOnChip and writes to it a new and empty DOS FAT file system. When formatting is complete, the DiskOnChip contains only a root directory.

The DiskOnChip is fully tested and formatted before the product is shipped, but it can be formatted more than once. Each time it is formatted, naturally all data on the media is destroyed.

Note: When the DiskOnChip is reformatted the boot-image (i.e. firmware) is *retained* by default.

Below the most common used flags of the DFORMAT utility are described. For advanced usage of the DFORMAT utility, refer to appendix I of this manual.

The DFORMAT syntax is:

```
Usage: DFORMAT {drive-letter | /WIN:segment} [/S:firmware]
[/FIRST] [/SILENT] [/LABEL:label] [/DOSVER:n] [/NODOS] [/Y]
```

The following table describes the DFORMAT options:

DFORMAT option	Description
Drive-letter	DOS drive letter of the DiskOnChip drive.
/WIN:Segment	Memory address at which the DiskOnChip is located. Use either this parameter or the drive-letter. The segment should be specified in Hex (e.g. /WIN:D000).
/S:firmware	DiskOnChip firmware image: DOCnnn.EXB (with nnn=version number).
/FIRST	Use this flag to program the DiskOnChip to be the first available disk (drive C:) if there is more than one disk installed in the system. This flag has no effect if the DiskOnChip is the only disk in the system. The /S parameter must be supplied when the /FIRST flag is used.
/SILENT	Loads the TrueFFS driver in silent mode, i.e. no messages are displayed at the screen during boot.
/LABEL:label	A string to be used as the DOS volume label of the formatted media.
/DOSVER:dos-major-version	Format for a target system running the specified DOS version. The default is the current DOS version (the one on which DFORMAT is executed). For example, /DOSVER:3 formats for DOS 3.x. Valid values are 1 to 6.

DFORMAT option	Description
/NODOS	Do not create a DOS FAT file system while formatting. Only low-level format is performed. This is useful for non-DOS application.
/Y	Do not pause for confirmation before beginning to format.

Note: All sizes specified in DFORMAT options are in bytes if specified as simple numbers, in Kbytes if specified with the suffix **K**, or in megabytes if specified with the suffix **M**.

Note: By default the DiskOnChip is shipped from the factory, configured as the last drive. When configured as the last drive, the DiskOnChip is installed as the last drive if there are any hard disks installed, and as drive C: if no other hard disk is installed. When configured as the first drive, using the /FIRST option, the DiskOnChip is always installed as drive C:.

Example 1

```
DFORMAT C:
```

Formats the DiskOnChip (assuming the DiskOnChip is set as disk C:).

Example 2

```
DFORMAT /WIN:D000 /s:DOC121.EXB
```

Formats the DiskOnChip that is located at memory address D000h and installs firmware file DOC121.EXB. If any other hard disk is present in the system, the DiskOnChip will be identified as the last drive. If there are no other hard disks present in the system, the DiskOnChip will be installed as drive C:.

Example 3:

```
DFORMAT /WIN:D000 /S:DOC121.EXB /FIRST
```

Formats the DiskOnChip that is located at memory address D000h and installs firmware file DOC121.EXB. The DiskOnChip will be the first drive (C:), even in if there are other hard disks present in the system.

2.1 Issues related to the Firmware file

A few issues should be noticed regarding the firmware file DOCnnn.EXB of the DiskOnChip.

Plug 'n Play BIOS'es

There are typically two types of firmware supplied with every utilities version. The first, is for common use, and named without the P letter (e.g. DOC121.EXB). The second one, which should be used with Plug'n'Play type BIOS, is the firmware that carries the letter P in it's named (e.g. DOC121P.EXB).

Firmware file DOCnnn.086

The firmware file DOCnnn.086 needs to be installed when using the DiskOnChip in an 8086 environment or when your application hooks and processes hardware interrupts.

Loading DiskOnChip as a Device driver

The firmware file DOC2 . FFF is required when the TrueFFS driver is loaded as a S/W device driver. For further details, refer to Application Note 12 “Loading the DiskOnChip 2000 S/W as a Device Driver”.

When using the DiskOnChip in a Linux environment, this firmware files is also used. For further details, refer to Installation Manual 21 “Using the DiskOnChip with Linux”.

DFORMAT version vs. firmware version

The version of the DFORMAT utility needs to be the same as the version of the firmware file. If you receive the error message “File too large for specified Boot-Image size“ during formatting, then there was an incompatibility between the firmware file and the DFORMAT utility. You can solve this problem as follows:

1. Delete the previous firmware file:

```
DFORMAT /WIN:D000 /S:!
```
2. Re-install the required firmware file, i.e. DOC121 . EXB:

```
DFORMAT /WIN:D000 /S:DOC121 . EXB
```

3 DUPDATE Utility

The DUPDATE utility should be used when you want to update the firmware file of the DiskOnChip or configuring the DiskOnChip to be the first disk in the system, without having to reformat the entire flash media, thereby destroying any data that was stored on the DiskOnChip.

Note: DUPDATE requires that the DiskOnChip must already be programmed, with the previous firmware file.

The DUPDATE syntax is:

```
Usage: DUPDATE {drive-letter | /WIN:Segment} [/S:BootImage]
[/FIRST]
```

The following table describes the DUPDATE options:

DUPDATE option	Description
Drive-letter	DOS drive letter of the DiskOnChip drive
/WIN:Segment	Memory address at which the DiskOnChip is located. Use either this parameter or the drive-letter. The segment should be specified in Hex (e.g. /WIN:D000).
/S:BootImage	The new firmware file (DOCnnn.EXB) to be written to the DiskOnChip (with nnn=version number).
/FIRST	Use this flag to program the DiskOnChip to be the first disk (drive C:) if more disks are installed in the system. This flag has no effect if the DiskOnChip is the only disk in the system. The /S parameter must be supplied when the /FIRST flag is used.

Example 1:

```
DUPDATE C: /S:DOC121.EXB
```

Program the new firmware file, DOC121 . EXB, into the DiskOnChip located as drive C:

Example 2:

```
DUPDATE /WIN:D000 /S:DOC121.EXB
```

Program the new firmware file, DOC121 . EXB, into the DiskOnChip that is located at memory address D000h.

Example 3:

```
DUPDATE /WIN:D000 /S:DOC121.EXB /FIRST
```

Program the new firmware file, DOC121 . EXB, into the DiskOnChip that is located at memory address D000h. The DiskOnChip will be installed as the first drive (C:), even in if there is a hard disk available in the system.

4 Configuring the DiskOnChip as a Bootable Disk

It is possible to configure the DiskOnChip as the bootable disk for DOS. Depending on whether the DFORMAT or the DUPDATE utility is used, two configuration scenario's are possible, as described below.

If you wish to configure the DiskOnChip as a bootable disk for any other O/S, refer to the relevant Application Note for further details see Section 7.

Note: The DiskOnChip is shipped from the factory formatted, without operating system files, and configured as the last drive.

Configuration with the DFORMAT utility:

To configure the DiskOnChip to be the first bootable disk in the system, using the DFORMAT utility, the following steps are required:

1. Boot the system and make sure the DiskOnChip is installed correctly as the last drive.
2. The DiskOnChip should be the only disk in the system or should be configured as the first disk in the system, using the DFORMAT utility (see Section 2)
1. Make the DiskOnChip bootable by transferring the system files to the drive.
2. After re-booting the system, the DiskOnChip will appear as drive C: (and the hard drive will become drive D:).

Example

```
DFORMAT /WIN:D000 /S:DOC121.EXB /FIRST  
SYS D:
```

Format the DiskOnChip to be the first disk in the system and copy DOS system files to the DiskOnChip, making it bootable.

Configuration with the DUPDATE utility:

To configure the DiskOnChip to be the first bootable disk in the system, using the DUPDATE utility, the following steps are required:

1. Boot the system and make sure the DiskOnChip is installed correctly as the last drive.
2. Make the DiskOnChip bootable by transferring the system files to the drive.
3. At the DOS prompt type: DUPDATE D: /FIRST (assuming the DiskOnChip was drive D:).
4. After re-booting the system, the DiskOnChip will appear as drive C: (and the hard drive will become drive D:).

Example

```
SYS D:  
DUPDATE /WIN:D000 /FIRST
```

Copy DOS systems files the DiskOnChip, making it bootable (assuming the DiskOnChip is assigned as drive D:) and configure the DiskOnChip to be the first disk in the system.

5 DINFO Utility

The DINFO utility provides background information regarding the DiskOnChip, and the environment in which it is working. DINFO reports:

- TrueFFS drive letter
- Installed software and its version compliance
- The size of the Flash media

The DINFO syntax is:

```
DINFO
```

Example

```
DINFO /info
```

Search the system for DiskOnChip.

Following is the report that was generated in a specific system:

```
DINFO Version 3.3.7 for DiskOnChip 2000 (V1.21)
```

```
Copyright (C) M-Systems, 1992-1999
```

```
DiskOnChip 2000(R) found at D000:0000
```

```
-----
```

```
Disk statistics:
```

```
Drive letter: D
```

```
Disk size: 7,960 Kbytes
```

```
SoftWare version: 1.21
```

```
TrueFFS Compatibility: 3.3.02
```

```
FirmWare size: 48 Kbytes
```

```
Flash media statistics :
```

```
Chip size: 8,192 Kbytes
```

```
No Of Chips: 1
```

```
Chip type: Toshiba TC5864
```

```
Total units: 1024
```

Spare units: 23

Unit size: 8,192 bytes

Base: [D000]---Driver: [YES] Size: [8 Mb]

The DINFO results show the following:

- An 8MB DiskOnChip
- It was assigned drive letter D:
- The controller Chip ID number is 17.
- The disk size after format is 7,960 KB.
- Space allocated for the firmware is 48KB.
- Each unit is 8,192 bytes in size.
- The Flash media is composed of 1024 units.
- There are 24 spare units.
- The Flash media is composed of one Flash device, manufactured by Toshiba.

6 Duplicating DiskOnChip

Copying a DiskOnChip device is the procedure of copying the contents of a “source” DiskOnChip into an “image file”, and then copying the “image file” contents into as many target DiskOnChip devices as required. All target DiskOnChip devices will have exactly the same contents as the source DiskOnChip, which means they will have exactly the same functionality when plugged into the target platform. The only limitation for this process is that all target DiskOnChip devices must have the same capacity as the “source” DiskOnChip. For example, if the “source” DiskOnChip has 8MB capacity, then the “target” DiskOnChip’s must have 8MB capacity as well.

The duplicating process includes 3 stages:

1. Prepare “source” DiskOnChip.
2. Copy “source” DiskOnChip into an image file.
3. Copy the image file into as many “target” DiskOnChip devices as required.

Note: For mass duplication of the DiskOnChip, the above solution will not be efficient and you can use M-Systems GANG programmer instead. Contact M-Systems for availability and refer to the GANG programmer User Manual for further information.

6.1 Stage 1: Creating the “source” DiskOnChip

The source DiskOnChip includes all target application files. Usually, it will be bootable. The following commands are usually used in order to prepare the “source” DiskOnChip:

1. Format DiskOnChip with `DFORMAT` utility in the target platform.

2. Copy all target application files onto the DiskOnChip.
3. If required, make the DiskOnChip bootable (refer to Section 4).

After the source DiskOnChip device has been properly prepared, follow the guidelines described below in order to duplicate it as many times as required.

6.2 Stage 2: Copy the “source” DiskOnChip into an Image File

At this stage, the source DiskOnChip includes all target application files, and it is ready to be duplicated as many times as required. Each duplicated copy will function on the target platform, as the “source” DiskOnChip.

Use GETMIMG utility to copy the “source” DiskOnChip contents into an image file on the hard disk, to be used later as source file for duplications.

Run `GETMIMG image_file_name`. (For example: `GETMIMG MYDOC.SRC`)

6.3 Stage 3: Copy the Image File onto “target” DiskOnChip Devices

At this stage, the contents of the “source” DiskOnChip are stored on the hard disk in what is called the “image file”. Copying this image file into the target DiskOnChip will result in an identical DiskOnChip target device. Use the PUTMIMG utility to perform this task:

1. Power off the system.
2. Insert a target DiskOnChip with the same capacity as the source DiskOnChip into its socket.
3. Power on the system.
4. Run: `PUTMIMG image_file_name`.
(For example: `PUTMIMG MYDOC.SRC`)
5. The target DiskOnChip will have the exact contents and functionality as the source DiskOnChip when this operation is done. Repeat steps 1–4 for each additional target DiskOnChip.

All DiskOnChip devices programmed according to the above procedure are ready to be plugged into the target platforms, and will function exactly the same as the source DiskOnChip.

7 Additional Documents and Tools

A variety of Application Notes, User Manuals, data sheets and tools are available from M- Systems for usage of the different DiskOnChip Products under various Operating Systems and environments.

These documents are available through M-Systems distributors, directly from M-Systems worldwide offices and from M-Systems' web site (www.m-sys.com).

Here is a brief list of some of the documents available:

Document/Tool	Description
DiskOnChip Millennium Data Sheet	DiskOnChip Millennium Data Sheet
DiskOnChip 2000 Data Sheet	DiskOnChip 2000 Data Sheet
AP-DOC-012	Application Note – Loading the DiskOnChip 2000 S/W as a Device Driver
AP-DOC-016	Application Note – Using the DiskOnChip with QNX
AP-DOC-017	Application Note – Using the DiskOnChip with Windows CE
AP-DOC-020	Application Note – DiskOnChip Boot Developers Kit
IM-DOC-021	Installation Manual – Using the DiskOnChip with Linux
IM-DOC-022	Installation Manual – Using the DiskOnChip with pSOS
IM-DOC-023	Installation Manual – Using the DiskOnChip with VxWorks
DiskOnChip DIP EVB User Manual	DiskOnChip 32-pin DIP Evaluation Board User Manual
DiskOnChip GANG Programmer	1+8 Socket GANG Programmer User Manual

Appendix I - Advanced usage of DFORMAT utility

The DFORMAT options, as described in Section 2, will suffice for most system integrators. However, there are certain occasions that require more advanced usage of the DFORMAT utility. This appendix describes these more advanced flags and their usage.

The DFORMAT syntax is:

```
Usage: DFORMAT [/SIZE:size] [/USE:nnn] [/SPARE:n] [/FLOPPY]
[/LOG:File] [/USELOG:File] [/BDKF:Boot Image File] [/BDKN:BDK
Partition signature] [/BDKL:BDK Partition size] [/O:signature
offset]
```

The following table describes the advanced DFORMAT options:

DFORMAT option	Description
/SIZE:size	The size of the entire flash media to be formatted (including the partition that includes the firmware file). By default, the entire media is formatted by DFORMAT. This option limits the formatted size.
/USE:nnn	Percentage of available space on the flash disk partition to be used for file storage. <i>nnn</i> can be any number from 1 to 100. Default is 98 (98%). The flash disk partition is considered the size of the entire flash media minus the partition that is used by the firmware file. The value of this option may affect the write performance of TrueFFS.
/SPARE:	Number of spare units. Default is 1. A value 0 selects a WORM (Write Once Read Many). This option will have the same result as the option /USE, except that the calculation is done in absolute spare units instead of percentage of available space.
/FLOPPY	The DiskOnChip boots as drive A:
/LOG: File	Copy the bad block table, stored on the DiskOnChip into a file. This is required when a test that includes destroying the bad block table, is performed on the DiskOnChip
/USELOG: File	Restore the bad block table, stored in a file, to the DiskOnChip. This is necessary after the destructive test is finished.
/BDKF: Boot Image file	This flag specifies the name of the operating system image file.
/BDKN:Binary Partition signature	This flag specifies the 4-character prefix (signature) of the Binary Partition. XXXX can be replaced by any combination of four ASCII characters. Use capital letters. Default: BIPO.

DFORMAT option	Description
<code>/BDKL:partition size</code>	Size of Binary Partition - used to override the default file size or to force creation of a Binary Partition even when no file is specified.
<code>/O:signature offset</code>	This flag specifies the Binary Partition signature offset. Can be 0 or 8. Default: 8.

Note: For further information on the flags [/BDKF], [/BDKN], [/BDKL] and [/O], refer to Application Note 20: “DiskOnChip Boot Developer Kit”.

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