M-Systems
Flash Disk Pioneers

User Manual

DiskOnChip® PCI Evaluation Board

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1 Introduction

The DiskOnChip PCI Evaluation Board (EVB) provides a quick, easy way to evaluate the DiskOnChip in platforms with a PCI extension slot. The EVB is a useful tool for designers who need to evaluate, program, duplicate or test the DiskOnChip, even before their target platform is available. Once installed, the DiskOnChip PCI EVB can be accessed as an additional disk drive or as a boot device.

M-Systems' DiskOnChip products are high-performance, single-chip flash disks that provide full hard drive emulation for all major operating systems and platforms. This unique product line offers a complete data storage solution for applications in which mechanical hard drives cannot be used, such as embedded systems, Internet access devices, network computers and mobile systems. DiskOnChip Millennium Plus provides superior performance through a true 16-bit bus interface, and offers security-enabling and data-protection features.

1.1 Supported Devices

The DiskOnChip PCI EVB supports the entire DiskOnChip product line, including:

- **DiskOnChip Millennium Plus**: 48-pin TSOP-I single-chip flash disk. Available capacity: 32MB. Features a true 16-bit data bus, data read/write protection and security-enabling capabilities, 1KB XIP boot block and a ROM-like One Time Programming area (OTP).

- **Mobile DiskOnChip**: 63-ball BGA single-chip flash disk. Available capacity: 16MB. Includes a 1KB XIP boot block.

- **DiskOnChip 2000 TSOP**: 48-pin TSOP-I single-chip flash disk. Available capacity: 16MB. Includes a 1KB XIP boot block.

  Note: Software utilities and driver version 5.0 and higher are required for all above devices.

- **DiskOnChip Millennium**: 32-pin DIP or 32-pin TSOP-II single-chip flash disk. Available capacity: 8MB. Includes a 512-byte XIP boot block.

- **DiskOnChip 2000**: 32-pin DIP flash disk. Available capacities: 8MB to 576MB.

- **DiskOnChip DIMM 2000**: 144-pin Small Outline DIMM (Dual In-Line Memory Module) flash disk. Available capacities: 16MB to 256MB.

A TrueFFS driver is required to work with any of the DiskOnChip products,. TrueFFS is natively supported by every major OS, such as Windows CE, Windows 2000, QNX, and VxWorks. The latest TrueFFS drivers can be obtained from M-Systems for these operating systems and others, such as DOS, Linux, pSOS and NT Embedded. For other environments (including OS-less) the TrueFFS Software Development Kit (SDK) can be obtained. When using DiskOnChip as the boot device in a non-x86 environment, M-Systems' Boot Software Development Kit (Boot SDK) package is required. Contact M-Systems regarding availability for both packages.

1.2 Features

The DiskOnChip PCI EVB includes the following features:

- Support for the current DiskOnChip product line.

- An independent memory window for each device on-board. Up to four DiskOnChip form factors can be activated simultaneously on this EVB.

- Support for 3.3V and 5V DIP and DIMM devices.

- Support for 3.3V TSOP-I and TSOP-II products.

- Variable 8-bit or 16-bit operation mode (relevant for DiskOnChip Millennium Plus).

- Support for the DiskOnChip Millennium Plus hardware protection option, including the Lock# signal.

- Two **fixed** memory base address are available for each DiskOnChip socket on board (using jumper).

- Available jumpers for disabling TSOP-I and/or TSOP-II devices soldered on-board.

2 DiskOnChip PCI EVB Package Contents

The DiskOnChip PCI EVB package includes the following:

- DiskOnChip PCI EVB

  Note: Five different ordering configurations are available. Verify you have received the one you ordered (refer to Table 7 on page 9).

- Release Letter

- Quick Installation Guide

- DiskOnChip Data CD with:

  - Software utilities and tools

  - Additional documentation

  Note: It is recommended to download the latest software utilities from our website at www.m-sys.com.

- M-Systems limited warranty

3 System Requirements

- PC or any other platform with free PCI bus slots.

- 32KB free memory space (between C800 and E800).

- It is recommended to have a bootable DOS diskette on hand as all software utilities included are compiled for DOS.

4 DiskOnChip PCI EVB Board Contents

The DiskOnChip PCI EVB can host up to four DiskOnChip form factors (DIP, DIMM, TSOP-II and TSOP-I) simultaneously. You can also cascade up to two TSOP-II devices and up to four TSOP-I devices.

Table 1: Jumpers and Indicators

Item	Description
J1	Sets the DiskOnChip start address (DiskOnChip requires only an 8KB window)
J2	Sets the data protection pin of DiskOnChip Millennium Plus (Lock#)
J3	Sets DiskOnChip Millennium Plus to 8-bit or 16-bit mode (IF_CFG)
J5	Sets DiskOnChip Millennium Plus (DIMM) to 8-bit or 16-bit mode (IF_CFG)
J6	Select 3.3V or 5V operation in the DIP and DIMM sockets
J16	Enables/Disables TSOP-II devices soldered on-board
J17	Enables/Disables TSOP-I devices soldered on-board
D1	DiskOnChip DIP and DIMM activity indicator (Chip Enable status)
D2	DiskOnChip TSOP-I and TSOP-II activity indicator (Chip Enable status)
D3	Power indicator LED

4.1 Determining the Base Address

The DiskOnChip PCI EVB supports up to four DiskOnChips in parallel, each residing in a separate memory address. Table 2 defines the memory table for J1.

Table 2: J1 DiskOnChip Memory Table

Device Type	J1, pins 1 and 2 (U8)	J1, pins 2 and 3 (U9)*
TSOP-I	C800	D000
TSOP-II	CA00	D200
DIP	CC00	D400
DIMM	CE00	D600

* Default factory settings

4.2 Selecting the Voltage

Use J6 (refer to Table 3) to determine the voltage supplied to the DIP and SODIMM sockets.

Note: TSOP sockets are 3.3V only!

Table 3: Selecting Operating Voltage – J6

Jumper	Pins 1 and 2	Pins 2 and 3*
J6	5V	3.3V

* Default factory settings

4.3 Locking Protected Areas

When setting the Lock# pin, DiskOnChip Millennium Plus will not allow writing to write-protected areas or access to read-protected areas, even when the correct password is entered.

Use J2 to set the Lock# state of DiskOnChip Millennium Plus (refer to Table 4).

Table 4: J2 Settings

#Lock	J2 State
Enable	SHORT
Disable*	N.C.

* Default factory settings

4.4 Working in 16-Bit Mode

When setting the IF_CFG pin, DiskOnChip Millennium Plus will work in full 16-bit mode, thus achieving approximately twice the performance. This is only applicable for the TSOP-I and the DIMM sockets.

Table 5: J3 and J5 Settings

Jumper	State	Outcome
J3	SHORT	TSOP-I socket will work in 8-bit mode
	N.C*	TSOP-I socket will work in 16-bit mode
J5	SHORT*	DIMM socket will work in 8-bit mode
	N.C	DIMM socket will work in 16-bit mode

* Default factory settings

4.5 Disabling TSOP Devices Soldered On-Board

You may use J16 and J17 to disable DiskOnChip devices soldered on-board (either TSOP-I or TSOP-II) without having to physically remove them from the board (refer to Table 6).

Table 6: J16 and J17 Settings

Jumper	State	Outcome
J16	SHORT	TSOP-II devices are disabled
J17	SHORT	TSOP-I devices are disabled

* The default factory setting for J16 and J17 is N.C. (meaning the TSOP-I and TSOP-II sockets are enabled).

5 Installing and Configuring the DiskOnChip PCI EVB

When installing the DiskOnChip PCI EVB as a bootable drive in operating systems other then DOS, make sure to place the relevant systems files on DiskOnChip (i.e., execute according to Section 5.1, then install the systems files and continue with Section 5.2).

In Windows systems, the **New hardware found** message is displayed each time you boot with the PCI board plugged in. To suppress this message, select the option to install a driver, then select the DOC_PCI.INF file located in the PCI_EVB directory of the DiskOnChip software utilities. This will NOT install a driver, but will inform Windows of the new hardware and prevent the message from being displayed during boot-up.

When working with the EVB in environments other then PC, you must use the DiskOnChip Boot SDK to enable your boot code to access DiskOnChip and load your OS and drivers.

Additional information, scenarios and advice regarding using DiskOnChip as a bootable drive is available in the *DiskOnChip Software Utilities User Manual*.

5.1 Installing DiskOnChip as an Additional Disk Drive
DOS Example

1. Mount DiskOnChip(s) on the EVB in the appropriate socket (SODIMM, DIP, TSOP).
2. Insert the EVB into a free PCI slot (make sure your host is powered OFF).
3. Power ON your computer (host).

    Note: TSOP devices require formatting before proceeding to step 4 (refer to the *DiskOnChip Software Utilities Manual* on our website).

You may now access the EVB as an additional drive. When using other operating systems you may need to first install the DiskOnChip driver (see the DiskOnChip OS-specific installation manuals).

5.2 Using the DiskOnChip EVB as a Boot Device (DOS Example)

The DiskOnChip EVB may be used either as an additional hard drive or as the system's boot device (drive [C:]). When shipped, DiskOnChip default settings cause it to be installed as the next available drive. This will typically be drive [D:] if the system already includes another drive. To convert it into a bootable DOS drive, perform the following:

1. Boot the system and ensure that the DiskOnChip EVB is correctly installed as an additional drive.
2. Copy your system files onto the DiskOnChip by typing **FORMAT D: /S** or **SYS D:** (assuming DiskOnChip is registered as drive [D:]).
3. Remove your hard drive or type **DFORMAT D: (or /WIN:segment) /FIRST /S:DOCnn.EXB /UPDATE**. Observe the following rules:
    - The /S flag must be used when the /FIRST flag is used. DOCnn.EXB stands for the DiskOnChip firmware file name.
    - The /UPDATE flag instructs DFORMAT to update the firmware without reformatting the flash media, keeping the information on it intact (such as the DOS systems files).
4. Reboot the system. After rebooting, the DiskOnChip is identified as drive [C:].

5.3 Identifying DiskOnChip in the EVB

There are two utilities that can identify the DiskOnChip unit mounted on the EVB. You can use **DINFO** when the drivers are correctly loaded (indicated by the sign-on messages display). If the messages were not displayed, use **DINFO/DIRECT** to search for DiskOnChip.

DINFO provides information regarding DiskOnChip size, amount of physical flash used, number of flash devices inside DiskOnChip, drive letter occupied by DiskOnChip, firmware version, and so on.

5.4 Reformatting DiskOnChip

Warning: Running DFORMAT erases all data from DiskOnChip. Make sure to back up your data before using this utility.

DiskOnChip can be reformatted on-board using the DFORMAT utility. The DFORMAT utility can be used whether or not the device was recognized by the system and assigned a drive letter. Assuming DiskOnChip is located at address 0xC800, the format command is:

DFORMAT /WIN:C800 /other flags

After running DFORMAT, you must reset the system to allow the changes to take effect.

Important: Correct initialization of your DiskOnChip must be performed before starting development. It is highly recommended to thoroughly read the *DiskOnChip Software Utilities Manual* in general, and specifically the chapter discussing DFORMAT.

6 Additional Software Utilities for the DiskOnChip PCI EVB

You can use any of the DiskOnChip DOS utilities with the DiskOnChip PCI EVB. Detailed information can be found in the *DiskOnChip Utilities User Manual*.

6.1 Using PMC Connectors

You can connect this EVB to boards in which the PCI bus is only accessible through PMC connectors (such as the MCP750 reference board), by using PMC to PCI adapter cards (vendor supplied). Additional information and links to these products is available on our website (www.m-sys.com, "Third Party Tools" located in the DiskOnChip section).

7 Order Information

The DiskOnChip PCI EVB can be ordered in various configurations, depending on the DiskOnChip unit to be evaluated. Refer to Table 7 as an aid in deciding which configuration you should order for your system. Note that the DIP and SODIMM sockets are available in all configurations.

Table 7: Ordering Information

Ordering Info	Remarks	DiskOnChip Products Supported				
		2000 DIP	2000 DIMM	Millennium TSOP-II	2000 TSOP	Millennium Plus TSOP-I
DOC-DIP-DIMM-EVB-PCI	Only DIP and SODIMM sockets are available on-board.	✓	✓			
DOCM8-TSOP-II-EVB-PCI	The 8MB TSOP-II DiskOnChip Millennium is soldered on-board and is included in the price of the package.	✓	✓	✓		
DOC2000-TSOP-I-EVB-PCI	The 16MB DiskOnChip 2000 TSOP-I is soldered on-board and is included in the price of the package.	✓	✓		✓	
DOC-TSOP-I-EVB-PCI-ZIF	TSOP-I ZIF socket plus the DIP and SODIMM sockets make this board ideal for easy evaluation of any DiskOnChip.	✓	✓		✓	✓
DOCM32-TSOP-I-EVB-PCI	The 32MB TSOP-I DiskOnChip Millennium Plus is soldered on-board and is included in the price of the package.	✓	✓			✓

8 Troubleshooting

Item	Action
The EVB is not recognized.	Make sure DiskOnChip is formatted.
	Another device may be using the same memory window. Remove unnecessary cards and check your BIOS configuration.
	Another device may be using the same memory window. Change the base memory address of the DiskOnChip using J1.
	Are you working with the EVB in Dell, Gateway, or Compaq machines? The BIOS in all of these machines reserves all legacy ISA resource for use by PCI cards. Please use a different machine.
	Many BIOSs try to reserve the legacy ISA resource for use by PCI cards. Changing the BIOS settings can modify this behavior. Look for a setting that describes "Shared ISA Memory Space" and ensure that this option is set to enable the DiskOnChip window in the base address set with JP1.
	The DiskOnChip firmware may need to be trimmed to work with your BIOS. Please refer to the DiskOnChip software tools manual and read about the various firmware flags in DFORMAT.
	Ensure that pin 1 of DiskOnChip is aligned with Pin 1 pad on the board. Reverse insertion will render the DiskOnChip unusable.
	Are you working with an 8-bit device in 16-bit mode bus? Check the J3 and J5 settings.
	Is the driver loaded? When using OSs other then DOS, follow the DiskOnChip installation instructions for your specific OS.
	When working with the EVB in non-PC architectures, you must use the DiskOnChip Boot SDK (also known as BDK) to enable your boot code to identify DiskOnChip and load its driver.
	Your system may have a reset signal that is shorter than the standard reset signal defined in the PCI design specifications. The DiskOnChip PCI EVB is not recognized by these systems.
I can't boot from the EVB.	Make sure you have placed the OS system files on DiskOnChip (In DOS – Format D: /s).
	When working with the EVB in non-PC architectures, you must use the DiskOnChip Boot SDK (also known as BDK) to enable your boot code to load your OS directly from DiskOnChip.

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Item	Action
I want to disable TSOP devices soldered on-board without removing them.	Use J16 and J17 to disable any TSOP-I and TSOP-II devices soldered on-board the EVB.
How do I suppress the "Found new hardware" message in Windows?	When the message is displayed, select the option to install a driver, then select the DOC_PCI.INF file included with the DiskOnChip software utilities package, under the PCI_EVB directory. This will not install a driver but will suppress the message.
Where can I access additional tools and information?	DiskOnChip software accessories (including DFORMAT, DINFO, PUT/GET IMAGE etc.), along with other extensive DiskOnChip documentation, can be found in the enclosed CD.

How to Contact Us

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