Data Sheet

M-Systems
Flash Disk Pioneers

DiskOnChip® 2000
MD2200/1/2/3

Features

- Single-chip plug-and-play flash disk
- Low power, single 3.3V or 5V power supply
- 16–288MB capacity (1GB in 2001)
- Pin-out and structure compatible with 8MB DiskOnChip Millennium DIP
- Simple, easy-to-integrate interface
- 32-pin DIP JEDEC standard EEPROM compatible pin-out
- Memory window size: 8KB
- Embedded TrueFFS® software provides:
  - —Full hard disk read/write emulation
  - —Third generation wear leveling
  - —Automatic block management
- Operates with DiskOnChip-OSAK in O/S-less environments, ANSI-C source code kit
- EDC/ECC for higher data reliability
- Boot capability
- Low power consumption – Static Operation
- Broad O/S support: DOS, Windows 3.X, Windows 95, Windows NT4.0/5.0, Windows CE; Additional support offered: pSOS+, QNX, VxWorks, and others
- Compatible with major processors: x86, MediaGX, PowerPC, 68K, MIPS, SHx, StrongARM, and others

Applications

- Embedded systems
- Internet access devices
- Internet set-top box or ITV, Web browser
- WBT, thin client, network computer
- Routers, networking
- Web-phones, car-PC, DVD, HPC
- Point of sale, industrial PC's
- Telecom, medical

March 2000

1. General Description

The DiskOnChip 2000 product line is the second generation of M-Systems' DiskOnChip series of products. The 2000 series provides a small, single-chip, solid-state flash disk in a standard 32-pin DIP package. Combining a disk controller with flash memory on a single chip, the DiskOnChip 2000 is *the* solution where minimal weight, space, and power consumption are essential. In consequence, the 2000 series finds use today in a wide range of products, such as information appliances, set-top boxes, thin clients, thin servers, network computers, and embedded, portable computers.

By placing the DiskOnChip 2000 in a standard socket, physical space requirements are reduced. Unlike standard IDE drives, no cables or extra space are required. The DiskOnChip 2000 has no moving parts, resulting in significantly decreased power consumption and increased reliability. It is easy to use and reduces integration overhead. The DiskOnChip 2000 is therefore a very attractive alternative to conventional hard and floppy disk drives.

Using TrueFFS® technology, the DiskOnChip 2000 delivers full hard-disk emulation. As such, the design and integration stages can be considerably reduced, thereby enabling very fast time-to-market and ease of production. Combined with its very attractive cost structure, the DiskOnChip 2000 is a superior alternative to resident flash array (RFA).

The DiskOnChip 2000 products are available in capacities ranging from 16MB up to 288MB. In addition, it is 100% pin-out and software compatible with the 8MB DiskOnChip Millennium DIP package. In future versions the capacity will be dramatically increased (up to 1GB in the year 2001). Since the same pin-out will be retained, the socket on the target platform will not have to be changed to accommodate the larger capacities.

The DiskOnChip technology has broad support for all major operating systems and processors in the market, enabling it to be readily integrated with any architecture.

The DiskOnChip 2000 is shipped as a plug-and-play device that is fully tested, formatted, and programmed with a DOS driver. Future driver, software, content upgrades, or formatting can be made on-board or off-board using the DiskOnChip utilities and accessories provided by M-Systems.

2. Detailed Feature List

TrueFFS Technology

For a flash disk to emulate a hard disk, a software management layer is required. TrueFFS is M-Systems' patented flash file system management technology that allows flash components to fully emulate hard disks, so they can be written to and read from like any other hard disk.

TrueFFS software simplifies and enhances flash memories by:

- Using third generation wear leveling, which ensures that all blocks are erased an equal number of times; this increases the life of the flash media by orders of magnitude.
- Using virtual blocking of the flash device to make erasure of large blocks transparent to the operator.
- Automatic block mapping.
- Implementing a robust power-loss recovery mechanism to guarantee absolute protection of data.
- Providing conventional address support for various architecture configurations.

  The TrueFFS driver supports 8-bit, 16-bit, and 32-bit bus architectures. Support for the 16-bit and 32-bit bus architectures, commonly used in RISC processors, can be achieved by your using the LSB of the data bus as follows:

  - For 16-bit address boundary shifts, you should shift the address lines by *one*, so that the host address line A1 will connect to DiskOnChip 2000 address line A0, the host address line A2 will connect to DiskOnChip 2000 line A1, and so on.
  - For 32-bit address boundary shifts, you should shift the address lines by *two*, so that the host address line A2 will connect to DiskOnChip 2000 address line A0, the host address line A3 will connect to DiskOnChip 2000 line A1, and so on.

  See application note AP-DOC-30 for more details.

Low Power Consumption

The internal functions are synchronized with the CPU's read and write strobes. This innovation eliminates the need for an external clock and dramatically reduce the power consumption. The DiskOnChip 2000 requires only a single 3.3V or 5V power supply, which helps to ease integration.

These features make the DiskOnChip 2000 the best cost/performance solution for computers that require minimal weight, space, and power consumption, providing a very attractive alternative to conventional hard and floppy disk drives.

Temperature Range

The DiskOnChip 2000 is available in both commercial (0º to 70ºC) and extended (-40 to +85 C) temperature ranges.

Easy to Integrate

Fast integration is ensured by the following DiskOnChip 2000 features:

- Compatible with standard EEPROM DIP pin-out.
- Supports local bus and ISA bus interface.
- Small memory map window size – only 8KB.
- Static operation – no clock required.
- 16 mA output drive (5 mA at 3.3V).

Robust Error Correction

The DiskOnChip family utilizes a Reed-Solomon Error Detection Code (EDC) and Error Correction Code (ECC), providing the following error immunity for each 512 byte block of data:

- Corrects up to two 10-bit symbols including two random bit errors.
- Corrects single bursts up to 11 bits.
- Detects single bursts up to 31 bits and double bursts up to 11 bits.
- Detects up to 4 random bit errors.

High Reliability

The DiskOnChip 2000 can be plugged into a standard DIP socket, eliminating the need for mechanical disk drives, bulky ribbon cables, and connectors. The design of the DiskOnChip 2000 ensures high reliability even when subjected to levels of shock, vibration, and temperature changes that would destroy a conventional magnetic disk drive.

High Speed

The DiskOnChip 2000 implements an integrated architecture for data transfers that eliminates bottlenecks typical in this area; it doubles read performance and significantly improves write performance in comparison to competitive alternatives. DiskOnChip 2000 can sustain a system write speed of over 550KB per second, read speed of more than 1.4MB per second (measured in ISA no wait state environment) and read/write burst transfer rates of nearly 5MB per second.

Compatibility with 8MB DiskOnChip Millennium Series

The DiskOnChip 2000 is a 32-pin Dual Inline Package (DIP) that provides 100% pin-out compatibility with the M-Systems DiskOnChip Millennium DIP (8MB). The DiskOnChip 2000 is fully software compatible with the M-Systems DiskOnChip Millennium DIP (8MB), from version 1.21 and higher.

Broad Support for Operating Systems and Processors

The DiskOnChip family of products is supplied with TrueFFS firmware that supports a wide range of operating systems (O/S), including DOS, Windows 95/98/2000, Windows CE, Windows NT, and Windows Embedded NT.

Real time operating systems (RTOS) supported include QNX, VxWorks, pSOS, Linux, FreeBSD, PharLap ETS, and VRTX.

In addition, leading operating systems such as Windows CE and Tornado offer native support for the DiskOnChip family of products for easy integration.

For O/S-less applications and customized solutions, M-Systems offers its DiskOnChip OSAK (Operating System Adaptation Kit), an ANSI-C source code kit designed specifically to support O/S-less environments.

The DiskOnChip family of products is compatible with all major processors, supporting popular processors such as x86, 68K, MediaGx, PowerPC, MIPS, SHx, StrongARM, and many others.

Portable solution – Shorter Time To Market

The development and integration time for implementing a flash disk is greatly reduced by DiskOnChip's standard software interface, which provides portability to other operating systems and processors and thereby shortens the time-to-market.

Complete Solution

The DiskOnChip 2000 series offers a full flash-disk solution that includes different voltage and temperature options, software drivers tailored to your operating system, data sheets, application support, and online email support.

Using the DiskOnChip evaluation boards (EVB), you can develop the software before the target hardware is ready.

The DiskOnChip GANG programmer cuts your production time, and facilitates fast response time to application software changes during production stages.

In all, DiskOnChip offers a complete set of tools for delivering a complete solution whenever your application can use a flash disk.

3. Package Description and Pin List

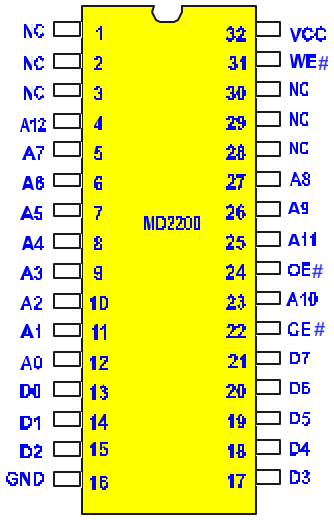

Figure 1: Package Description and Pin-Out

Pin Name	Description	Pin Number	Direction
A0 - A12	Address bus	4-12,23,25-27	Input
D0 – D7	Data bus	13-15,17-21	I/O
CE#	Chip Enable, active low	22	Input
OE#	Output Enable, active low	24	Input
WE#	Write Enable, active low	31	Input
NC	Not Connected. These pins may be left floating, tied to Vcc, GND or logic levels. Absolute Maximum Ratings must be observed.	1,2,3,28,29,30	
VCC	Power	32	
GND	Ground	16	

4. Designing with the DiskOnChip 2000 Flash Disk

4.1. Hardware

The DiskOnChip 2000 should be connected as a standard memory device using standard memory interface signals. Typically, the DiskOnChip 2000 can be mapped to any free 8KB memory space. In a PC architecture, if the memory window allocated to the DiskOnChip 2000 is larger than 8KB, an automatic anti-aliasing mechanism will prevent the firmware from being loaded more than once. Figure 3 illustrates a typical interface of the DiskOnChip 2000 to a system.

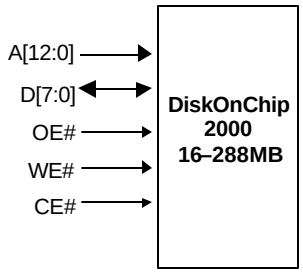

Figure 2: Simplified I/O Diagram

4.2. Software

The DiskOnChip 2000, under control of TrueFFS, is accessed using standard file system calls like any other block device. Applications can write to and read from any sector on the DiskOnChip 2000, which is compatible with all diagnostic utilities, applications, and file systems.

The flash memory within DiskOnChip 2000 is accessed by TrueFFS through an 8KB window in the CPU's memory space. TrueFFS handles the paging of this window in the flash array, as well as providing flash disk emulation that includes flash table management, wear leveling, mapping out bad blocks, and background space reclamation of unused flash blocks.

The same 8KB address space will be retained in future versions of DiskOnChip 2000 that will offer greater capacities.

4.3. Designing the DiskOnChip 2000 into PC Architecture

When used in a PC-compatible architecture, the DiskOnChip 2000 should be allocated an 8KB memory window in the BIOS expansion memory range, which is usually located between 0C8000h and 0EFFFFh.

Figure 3 shows the DiskOnChip 2000 memory window in relation to the PC memory map.

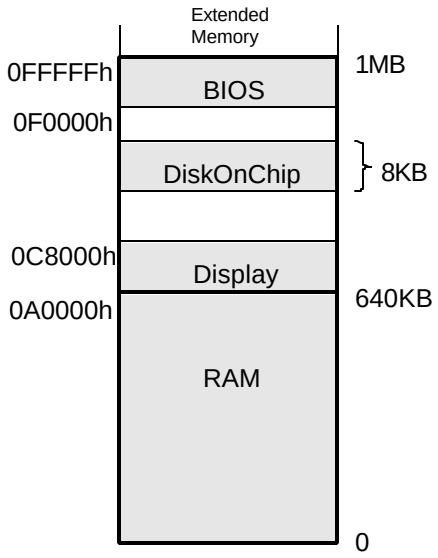

Figure 3: PC Memory Map

After reset, the BIOS executes the POST (Power On Self-Test), and then searches for all expansion ROM devices. When the DiskOnChip 2000 is found, the BIOS executes the Initial Program Loader (IPL) code located in the Boot-Block area of the DiskOnChip 2000. This code loads the TrueFFS driver into system memory, installs the DiskOnChip 2000 as a disk in the system, and returns control back to the BIOS code. The operating system subsequently attempts to identify the disks that are available and the DiskOnChip 2000 software (TrueFFS) responds by emulating a hard disk.

From this point onward, DiskOnChip 2000 appears as a standard disk drive. It is assigned a drive letter and it can be used by any software application. No BIOS set-up modifications or autoexec.bat/config.sys modifications are required. No external software is required.

DiskOnChip 2000 can be used as the only disk in the system, in which case it will be accessed as drive C. It can work with or without a floppy drive, or with additional hard disks. When working with a hard disk, the DiskOnChip 2000 can be configured as the last drive (the default configuration). In this case, the hard disk will be C and the DiskOnChip 2000 will be D. It can also be configured as the first drive. In this case, the hard disk will be D and the DiskOnChip 2000 will be C.

DiskOnChip 2000 can be used as the boot device when configured as drive C. In this configuration, you must format the DiskOnChip 2000 as a bootable device by copying the OS files onto the disk. When running DOS, this can be done by using the SYS command.

5. Disk Capacities and Contents

The capacities for the various models are presented in the following two tables.

5.1. Low Profile

Model	Formatted Capacity (bytes)	Sectors	Formatted Capacity under DOS 6.22 (bytes)	Sectors under DOS 6.22
MD2200-D16MB	16,375,808	31,984	16,324,608	31,884
MD2200-D24MB	24,592,384	48,032	24,516,608	47,884
MD2202-D32MB	32,800,768	64,064	32,724,992	63,916
MD2202-D48MB	49,233,920	96,160	49,092,608	95,884
MD2202-D64MB	65,683,456	128,288	65,525,760	127,980
MD2202-D96MB	98,566,144	192,512	98,390,016	192,168

5.2. High Profile

Model	Formatted Capacity (bytes)	Sectors	Formatted Capacity under DOS 6.22 (bytes)	Sectors under DOS 6.22
MD2201-D72MB	73,891,840	144,320	73,789,440	144,120
MD2203-D80MB	82,116,608	160,384	81,989,632	160,136
MD2203-D112MB	114,999,296	224,608	114,786,304	224,192
MD2203-D144MB	147,881,984	288,832	147,578,880	288,240
MD2203-D160MB	164,331,520	320,960	164,151,296	320,608
MD2203-D192MB	197,214,208	385,184	196,980,736	384,728
MD2203-D288MB	295,796,736	577,728	295,624,704	577,392

5.3. Media Contents

The DiskOnChip 2000 products are shipped from M-Systems fully tested, already formatted, and with a DOS driver.

6. Theory of Operation

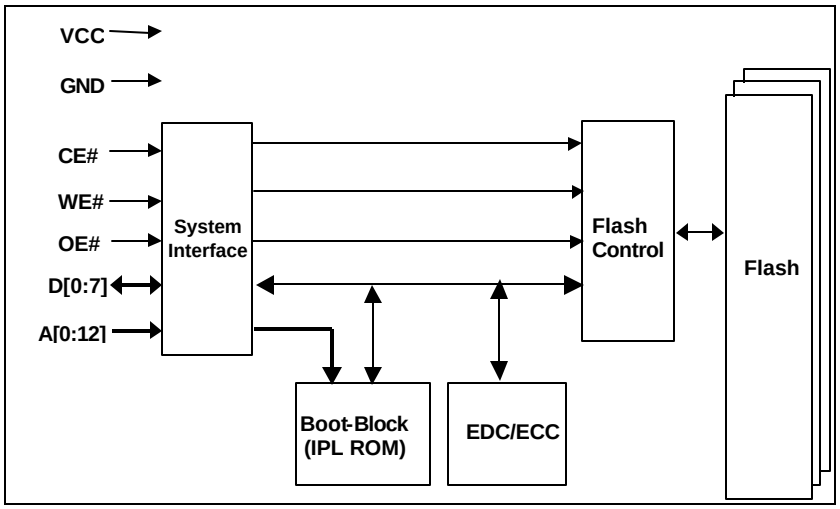

Figure 4: DiskOnChip 2000 Simplified Block Diagram

The DiskOnChip appears to the system as a standard EEPROM.

Upon power-up, the DiskOnChip 2000 downloads the Initial Program Loader (IPL) data into the IPL RAM from the first 512 bytes of flash memory. As a failsafe mechanism, DiskOnChip 2000 uses its internal Error Detection and Correction (EDC/ECC) logic to verify the integrity of this data. If DiskOnChip 2000 detects an error, it will automatically download the redundant copy of the IPL, which is stored in the following page of the flash memory. The entire download process takes less than 1 millisecond. Access to the DiskOnChip 2000 is not permitted before the download process is completed.

At the completion of the download process, the host system can execute the IPL code from the internal RAM. This code loads the TrueFFS software from the flash memory into the host's memory. This operation is necessary since the NAND-type flash memory does not support random access, and therefore cannot be used to execute the boot code. The firmware is identical for all DiskOnChip 2000 capacities, since TrueFFS automatically detects the memory capacity of the DiskOnChip 2000.

6.1. EDC/ECC

DiskOnChip uses the Reed-Solomon ECC/EDC algorithm to ensure high data reliability. Each time a block of data is written to the flash, a six-byte checksum is also written. Each time the data is read back from the flash, a new six-byte code is computed. TrueFFS uses these checksums for error detection and, if necessary, error correction.

7. Electrical Specifications

7.1. Absolute Maximum Ratings

Parameter	Symbol	3.3V Model Rating[1]	5V Model Rating[1]	Units	Notes
DC supply voltage	V_{CCS}	-0.5 to 4.6	-0.3 to 6.0	V	
Input pin voltage[2]	V_{IN}	-0.5 to V_{CC} + 0.3	-0.3 to V_{CC} + 0.3	V	
Input pin current	I_{IN}	Not Specified	-10 to 10	mA	25°C

Note 1**:** Permanent device damage may occur if absolute maximum ratings are exceeded. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Note 2**:** The voltage on any pin may undershoot to -2.0V or overshoot to Vcc+2.0V for periods <20ns.

7.2. Capacitance

Symbol	Parameter	Conditions	3.3V Model Rating	5V Model Rating	Unit
$C_{I/O}$	Input/Output Capacitance	MD2200, V_{IN} =0V	12	15	pF
		MD2201, V_{IN} =0V	36	45	pF

Note: Capacitance is not 100% tested.

7.3. Temperature Ranges

- Commercial operating temperature: 0ºC to +70ºC
- Extended operating temperature: -40ºC to +85ºC
- Storage temperature: -50ºC to +100ºC

7.4. Humidity

10% - 90% relative, non-condensing.

7.5. EDC/ECC

Enhanced Reed-Solomon ECC:

- Corrects up to two 10-bit symbols, including two random bit errors.
- Corrects single bursts up to 11 bits.
- Detects single bursts up to 31 bits and double bursts up to 11 bits.
- Detects up to 4 random bit errors.

7.6. DC Electrical Characteristics Over Operating Range

7.6.1. Vcc = 5V Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CCS}	System Supply Voltage		4.5	5.0	5.5	V
V_{IH}	High Level Input Voltage		2.0			V
V_{IL}	Low Level Input Voltage				0.8	V
V_{OH}	High Level Output Voltage	I_{OH} = -16 mA	2.4			V
V_{OL}	Low Level Output Voltage	I_{OL} = 16 mA			0.4	V
I_{IL}	Input Leakage Current	MD-2200, MD-2202			±1	µA
		MD-2201, MD-2203			±3	µA
I_{OZ}	Output Leakage Current	MD-2200, MD-2202			±10	µA
		MD-2201, MD-2203			±30	µA
I_{VCC}	Supply Current	200 ns Cycle Time, Outputs open		40	50	mA
I_{STDBY}	Standby Current	MD-2200, MD-2202		60	400	µA
		MD-2201, MD-2203		240	1200	µA

7.6.2. Vcc = 3.3V Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CCS}	System Supply Voltage		3.0	3.3	3.6	V
V_{IH}	High Level Input Voltage		2.7			V
V_{IL}	Low Level Input Voltage				0.6	V
V_{HYS}	Input Voltage Hysteresis		1.1		1.5	V
V_{OH}	High Level Output Voltage	I_{OH} = -18 mA	2.4		1.5	V
		I_{OH} = 0 mA	Vcc-0.1		1.5	V
V_{OL}	Low Level Output Voltage	I_{OL} = 18 mA			0.4	V
		I_{OL} = 0 mA			0.1	V
I_{IL}	Input Leakage Current	MD-2200, MD-2202			±10	µA
		MD-2201, MD-2203			±30	µA
I_{OZ}	Output Leakage Current	MD-2200, MD-2202			±10	µA
		MD-2201, MD-2203			±30	µA
I_{VCC}	Supply Current	150 ns Cycle Time, Outputs open		30	50	mA
I_{STDBY}	Standby Current	MD-2200, MD-2202		40	500	µA
		MD-2201, MD-2203		120	1500	µA

7.7. AC Operating Conditions

Timing specifications are based on the following conditions:

Parameter	3.3V Model	5V Model
Supply Voltage	V_{CC} = 3.3V ± 0.3V	V_{CC} = 5V ± 0.5V
Input Pulse Levels	0.2V to 2.9V	0.4V to 2.6V
Input Rise and Fall Times	1 ns	5 ns
Input and Output Timing Levels	1.5V	0.8V and 2.0V
Output Load	100 pF	50 pF

7.8. Timing Specifications

7.8.1. Read Cycle Timing

Symbol	Description	3.3V		5V		Notes
		Min (ns)	Max (ns)	Min (ns)	Max (ns)	
$T_{SU}(A)$	Address to OE# ↓ setup	0		10		
$T_{HO}(A)$	OE#↓ to Address hold	35		56		
$T_{SU}(CE0)$	CE# ↓ to OE# ↓ setup	0		0		1
$T_{HO}(CE0)$	OE#↑ to CE#=0 hold	0		0		2
$T_{HO}(CE1)$	OE# or WE#↑ to CE#=1 hold	8		42		
$T_{SU}(CE1)$	CE#↑ to WE# or OE#↓ setup time	8		42		
T_{REC}	OE#↑ to start of next cycle	20		59		
T_{ACC}	Read access time		110		130	
$T_{EN}(D)$	OE#↓ to D active delay	15	75	7	91	
$T_{DIS}(D)$	OE#↑ to D Hi-Z delay		13		44	

[1] CE# may be asserted any time before or after OE# is asserted. If CE# is asserted after OE#, all timing relative to OE# asserted will be referenced instead to the time CE# was asserted.

[2] CE# may be negated any time before or after OE# is negated. If CE# is negated before OE#, all timing relative to OE# negated will be referenced instead to the time CE# was negated.

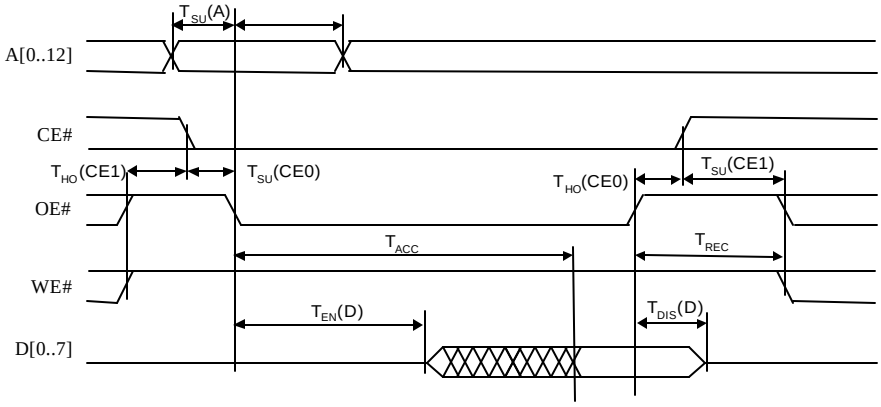

Figure 5: Read Cycle

7.8.2. Write Cycle Timing

Symbol	Description	3.3V		5V		Notes
		Min (ns)	Max (ns)	Min (ns)	Max (ns)	
T_{SU}(A)	Address to WE#↓ setup time	0		10		
T_{HO}(A)	WE#↓ to Address hold time	35		56		
T_W(WE)	WE# asserted width	62		98		
T_{SU}(CE0)	CE#↓ to WE#↓ setup time	0		0		1
T_{HO}(CE0)	WE#↑ to CE#=0 hold time	0		0		2
T_{HO}(CE1)	OE# or WE#↑ to CE#=1 hold time	8		42		
T_{SU}(CE1)	CE#↑ to WE# or OE#↓ setup time	8		42		
T_{REC}	WE#↑ to start of next cycle	22		59		
T_{SU}(D)	D to WE#↑ setup time	50		48		
T_{HO}(D)	WE#↑ to D hold time	0		40		

[1] CE# may be asserted any time before or after WE# is asserted. If CE# is asserted after WE#, all timing relative to WE# asserted will be referenced instead to the time CE# was asserted.

[2] CE# may be negated any time before or after WE# is negated. If CE# is negated before WE#, all timing relative to WE# negated will be referenced instead to the time CE# was negated.

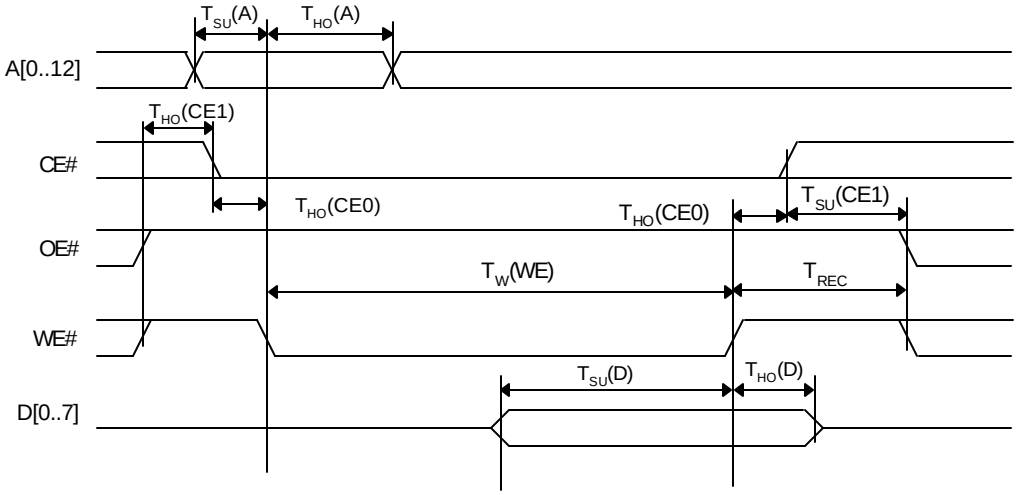

Figure 6: Write Cycle

8. Mechanical Dimensions

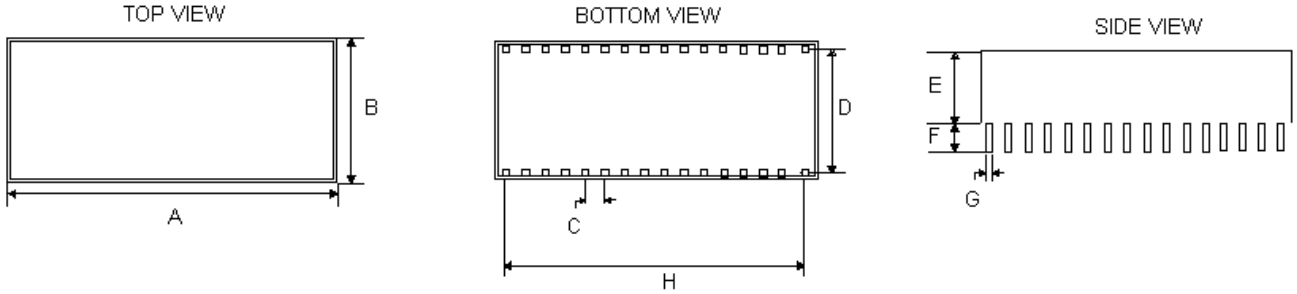

Figure 7: MD2200 Mechanical Dimensions

8.1. Low Profile

	MD-2200-Dxx (Low Profile)		MD-2202-Dxx (Low Profile)	
	Millimeters	**Inches**	**Millimeters**	**Inches**
A	41.75 ± 0.15	1.644 ± 0.006	43.75 ± 0.20	1.723 ± 0.008
B	17.90 ± 0.15	0.704 ± 0.006	18.10 ± 0.20	0.713 ± 0.008
C	2.54	0.100	2.54	0.100
D	15.24	0.600	15.24	0.600
E	5.50 ± 0.20	0.216 ± 0.008	5.80 ± 0.20	0.228 ± 0.008
F	3.80 ± 0.20	0.150 ± 0.008	3.80 ± 0.20	0.150 ± 0.008
G	0.46 ± 0.05	0.018 ± 0.002	0.46 ± 0.05	0.018 ± 0.002
H	38.10 ± 0.10	1.50 ± 0.004	38.10 ± 0.10	1.50 ± 0.004

8.2. High Profile

	MD-2201-Dxx (High Profile)		MD-2203-Dxx (High Profile)	
	Millimeters	**Inches**	**Millimeters**	**Inches**
A	41.80 + 0.20	1.650 + 0.008	43.75 ± 0.20	1.723 ± 0.008
B	18.10 + 0.20	0.713 + 0.008	18.10 ± 0.20	0.713 ± 0.008
C	2.54	0.100	2.54	0.100
D	15.24	0.600	15.24	0.600
E	12.80 ± 0.20	0.503 ± 0.008	12.80 ± 0.20	0.504 ± 0.008
F	3.80 ± 0.20	0.150 ± 0.008	3.80 ± 0.20	0.150 ± 0.008
G	0.46 ± 0.05	0.018 ± 0.002	0.46 ± 0.05	0.018 ± 0.002
H	38.10 ± 0.10	1.500 ± 0.004	38.10 ± 0.10	1.50 ± 0.004

9. Shocks and Vibrations

The following part numbers (P/N) were tested: MD2200-DXX and MD2201-DXX (including the extended temperature models).

Reliability Test	Test Conditions	Reference Standard
Vibration	100~2000Hz, 15 G* peak, 3 cycles per axis (1hr), 3 axes	STD-202F, Method 204D
Mechanical Shock	Half sine shock 50G, 11 msec, +/-3 shock per axis, 3 axes	STD-202F, Method 213B

10. Ordering Information

MD-2200-DCC-V-T (Low Profile)

CC:	Capacity (MB)	16, 24		
V:	Supply Voltage	(blank)	5V	
		V3	3.3V	
T:	Temperature Range	(blank)	Commercial	0°C to +70°C
		X	Extended	-40°C to +85°C

MD-2202-DCC-V-T (Low Profile)

CC:	Capacity (MB)	32, 48, 64, 96		
V:	Supply Voltage	(blank)	5V	
		V3	3.3V	
T:	Temperature Range	(blank)	Commercial	0°C to +70°C
		X	Extended	-40°C to +85°C

MD-2201-DCC-V-T (High Profile)

CC:	Capacity (MB)	72		
V:	Supply Voltage	(blank)	5V	
		V3	3.3V	
T:	Temperature Range	(blank)	Commercial	0°C to +70°C

MD-2203-DCC-V-T (High Profile)

CC:	Capacity (MB)	80, 112, 144, 160, 192, 288		
V:	Supply Voltage	(blank)	5V	
		V3	3.3V	
T:	Temperature Range	(blank)	Commercial	0°C to +70°C

11. Additional Information

Document/Tool	Description
DiskOnChip Utilities	DiskOnChip Utilities User Manual
DiskOnChip Quick Installation Guide	DiskOnChip Quick Installation Guide (provided with the individual package)
AP-DOC-10	Application Note: Designing with DiskOnChip DIP
AP-DOC-16	Application Note: Using DiskOnChip with QNX
AP-DOC-17	Application Note: Using DiskOnChip with Windows CE
AP-DOC-020	Application Note: DiskOnChip Boot Developers Kit
IM-DOC-21	Application Note: Using DiskOnChip with Linux O/S
IM-DOC-22	Application Note: Using DiskOnChip with VxWorks
AP-DOC-39	Application Note: Onboard Programming of the DiskOnChip Millennium
DiskOnChip OSAK Product Brief	DiskOnChip OSAK Product Brief
DiskOnChip DIP EVB	DiskOnChip DIP Evaluation Board
DiskOnChip GANG Programmer	DiskOnChip 1+8 GANG Programmer

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