SanDisk

SanDisk Memory Stick Micro M2

Product Manual

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SanDisk Corporation

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<u>*Revision History*</u>

Date	Revision	Change
06/2006	1.0	First release
10/2006	1.1	Revised units of measure for card capacities; added MB/GB disclaimer as footnote to capacities; other minor edits
01/2007	1.2	Added 128 capacity to Chap. 1 and App. A; included Limited Warranty as Appendix B.

TABLE OF CONTENTS

1   Introduction

1.1   General Description

SanDisk and Sony Corporation collaborated to develop a new Memory Stick form factor for the mobile handset market. The Memory Stick Micro (M2) is approximately one-third the size of the existing MS PRO Duo (MS PRO) product. The Memory Stick M2 continues the Memory Stick PRO Duo legacy by supporting full backwards compatibility (using a mechanical adaptor) with all Memory Stick PRO hosts. In addition, an optional low voltage interface addresses the 1.8V power supply requirements of the mobile handset market.

The Memory Stick M2 measures 12.5mm x 15.0mm x 1.2mm, weighs 0.42 grams and meets all previously established mechanical, environmental and regulatory requirements of the legacy MS PRO Duo.

The Memory Stick M2 offers host designers numerous advantages over the previous versions of the Memory Stick and Memory Stick PRO Duo. These advantages include easier and smaller host mechanical designs, support for low voltage 1.8V interface and longer host-system battery life. Similar to its Memory Stick PRO Duo predecessor, the Memory Stick M2 has a theoretical maximum of 32GB capacity and data transfer speeds of up to 20MB/sec.

The Memory Stick M2 also features advanced MagicGate® copyright-protection capability, access control and a minimum write speed of 15Mb per second[*] to assure real-time recording of high-resolution audio and video.

The Memory Stick M2 contains the exact same internal operational scheme as its Memory Stick PRO predecessors but with an additional feature of low voltage interface support.

Figure 1-1   Memory Stick M2 Block Diagram
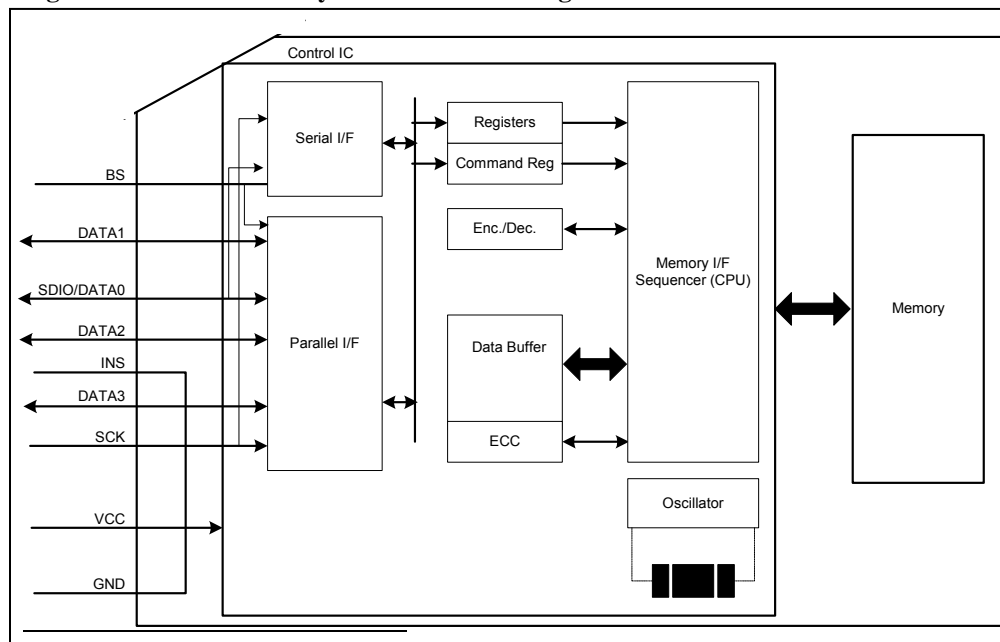
[*] SanDisk will have two or more memory suppliers for the 64MB capacity point, however, it is currently unknown if the new memory suppliers can meet the Class 2 performance. Part of the logo set will display a special "Class 0" logo if Class 2 performance cannot be met.

1.2   Features

The Memory Stick M2 provides the following features:

►**Full backward compatibility (using mechanical adaptor) to MS-PRO hosts**

►**Supports Magic Gate R (MG-R) security scheme as defined for the MS-PRO**

►**Access Control feature which allows users to lock data**

► **Supply voltages of 1.70V~1.95V and 2.70~3.60 V, single power source**

► **11-pin connector, planar electrode one-row**

► **Half-duplex serial and parallel (x4) protocol one-row**

► **Operating Current**

Parallel Access Mode   Up to 100 mA max

Serial Access Mode   Up to 65 mA max.

► **Operating Temperature: -25° C to 85° C**

►**Dimensions**

12.5 mm x 15 mm x 1.2 mm, Weight: 0.42 grams

► **Access Modes**

Parallel   40 MHz clock

Serial   20 MHz clock

►**Data Transfer Rate up to 20 MB/s**

Data bursts in Parallel Access Mode

►**Continuous Write Performance guaranteed**

Based on MS-PRO specification – minimum 15 Mb/s[1]

►**Memory**

64 MB	512-Mb NAND Flash Memory x 1 component
128 MB	1-Gb NAND Flash Memory x 1 component
256 MB	2-Gb NAND Flash Memory x 1 component
512 MB	2-Gb NAND Flash Memory x 2 components
512 MB	4-Gb NAND Flash Memory x 1 components
1 GB	4-Gb NAND Flash Memory x 2 components
2 GB	4-Gb NAND Flash Memory x 4 components

56nm Technology for 2007

1 GB	8-Gb NAND Flash Memory x 1 component
2 GB	8-Gb NAND Flash Memory x 2 components
4 GB	8-Gb NAND Flash Memory x 4 components

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[1] SanDisk will have two or more memory suppliers for the 64MB capacity point, however, it is currently unknown if the new memory suppliers can meet the Class 2 performance. Part of the logo set will display a special "Class 0" logo if Class 2 performance cannot be met.

1.3   Electrical Specifications

The Memory Stick M2 complies with the *Memory Stick PRO Format Specification* (Ref. 1) and the *Memory Stick PRO Media Format Specification* (Ref. 2).

In addition, the Memory Stick M2 complies with the new *Memory Stick Micro Format Specification* (Ref. 3) and the *Memory Stick Micro Media Format Specification* (Ref. 4)

These specifications are available to Memory Stick licensees only at www.memorystick.org in the *Information from Licensor [Licensee Only]* section.

1.4   Reference Documents

Ref. 1   Memory Stick PRO Format Specification v1.02-00

Ref. 2   Memory Stick PRO Media Format Specification v1.03-00

Ref. 3   Memory Stick Micro Format Specification v1.00-00

Ref. 4   Memory Stick Micro Media Format Specification v1.00-00

2   Timing Information

The timing information for the Memory Stick M2 complies with the *Memory Stick PRO Format Specification* (Ref. 1) and *Memory Stick PRO Media Format Specification* (Ref. 2)*.*

3   Pin Functions

3.1   Overview

The Memory Stick M2 configuration closely parallels that of the legacy MS-PRO; pin assignments, names, and functions are available in the *Memory Stick Micro Format Specification* (Ref. 3). The pin configuration depicted in Figure 3-1 below is for reference only.

Figure 3-1   Memory Stick M2 Pin Description*

1	BS
2	DATA1
3	DATA0
4	DATA2
5	INS
6	DATA3
7	SCLK
8	VCC
9	VSS
10	Reserved
11	Reserved

*NOTE: Pins 10 and 11 are "no connect".

4   Card Operation
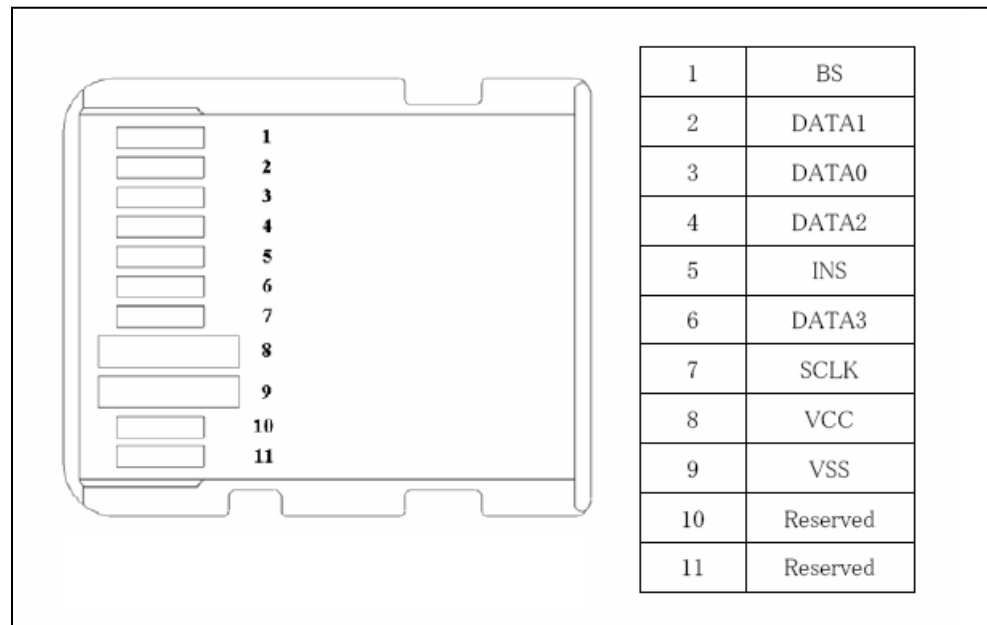
The Memory Stick M2 complies with the *Memory Stick M2 Format Specification* (Ref. 1) and *Memory Stick M2 Media Format Specification* (Ref. 2).   Refer to the formal specifications for further details.

5   Card Capacities and User Areas

The Memory Stick M2 uses a portion of its memory for system and security (MG-R) and the remainder for the user. Table 5-1 defines the user area available in any of the SanDisk MS PRO, PRO Duo and M2 products.

Table 5-1   User Areas

Card Capacity*	Total # of bytes	User Area (KB)
32 MB	32, 768,000	29,750
64 MB	65, 536,000	60,375
128 MB	131,072,000	121,625
256 MB	262,144,000	237,875
512 MB	524,288,000	468,625
1 GB	1,048,576,000	950,625
2 GB	2,097,152,000	1,950,625
4 GB	4,194,304,000	3,908,625

* 1 megabyte (MB) = 1 million bytes; 1 gigabyte (GB) = 1 billion bytes. Some of the listed capacity is used for formatting and other functions and therefore is not available for data storage.

6   Reliability Test Standards

6.1   Test Environment

Reliability tests shown in Table 6-4 should be performed under the conditions listed in Table 6-1 unless otherwise specified.

Table 6-1   Operating Environment

Temperature	15° C ~ 35° C
Atmospheric Pressure	86kPa ~ 106 kPa
Humidity	25% ~ 85%

To obtain reproducible results, tests must use the parameters shown in Table 6-2.

Table 6-2   Operating Environment for Reproducible Experiment

Temperature	23°C ± 3°C
Atmospheric Pressure	86kPa ~ 106 kPa
Humidity	50% ± 10%

The conditions listed in Table 6-3 should be used for tests performed in a storage environment.

Table 6-3   Storage Environment

Temperature	-40°C ~ 85°C
Humidity	95% or less; saturated state

6.2   Test and Performance Standards

The tests summarized in Table 6-4 are required for product qualification and adherence to the *Memory Stick Micro Format Specification* (Ref. 3). Specific test conditions are detailed and maintained in the *Memory Stick Micro Media Format Specification* (Ref. 4).

Table 6-4   Test Description Summary

Test	Description
Irregular Insertion	Confirmation of media withstanding incorrect insertion
Vibration	Confirmation of media withstanding 16.1[m/s] (1.64G) vibration
Shock	Confirmation of media withstanding 150G, 200G shock.
Bend	Confirmation of media withstanding mechanical bending
Drop	Confirmation of media withstanding drop impact
Torque	Confirmation of media withstanding mechanical torque of the package
Case Pressing	Confirmation of media withstanding pressure applied to the product case
Storage Test High/Low Temperature and Humidity	Confirmation of media withstanding exposure to high temperature (100°C) and low temperature (-40°C) storage environment
Operational Test High/Low Temperature	Confirmation of media withstanding exposure to high temperature (+85°C) and low temperature (-25°C) storage environment
Operational Test at High Humidity	Confirmation of media withstanding exposure to high temperature (+85°C) and low temperature (-25°C) storage environment
Thermal Shock	Confirmation of media withstanding non-operational thermal shock (-40°C to 80°C)
Electrostatic Discharge	Confirmation of media withstanding +/-10kV discharge

7   Card Marking Method

Figure 7-1 illustrates the SanDisk marking method for cards.

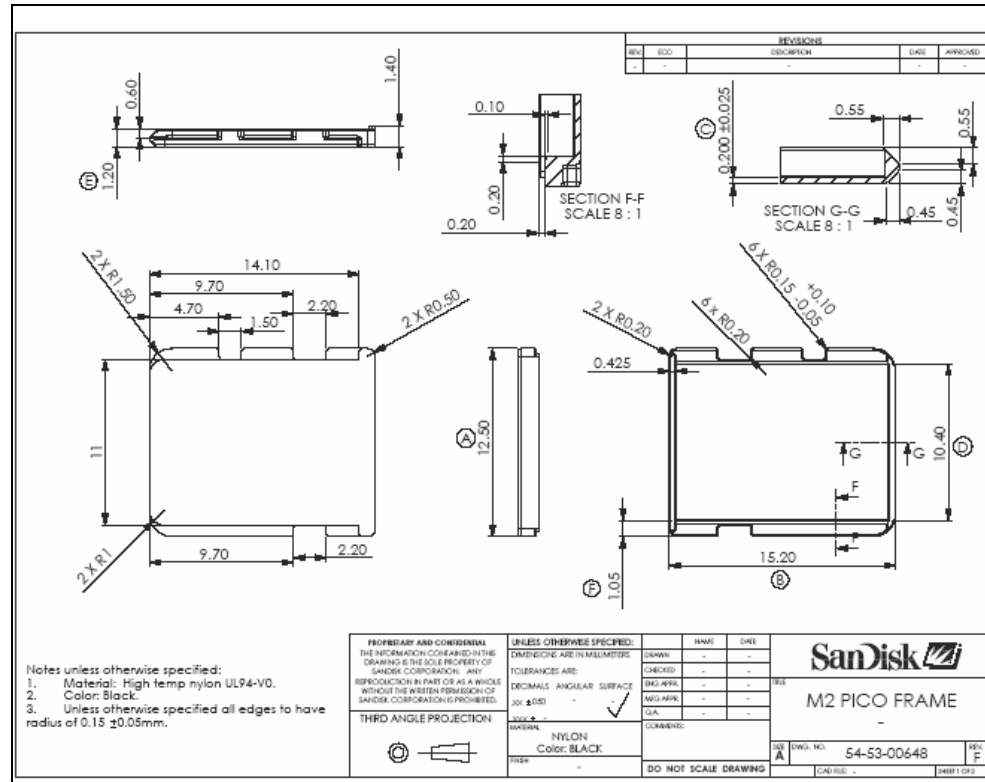**Figure 7-1   Card Marking Method**
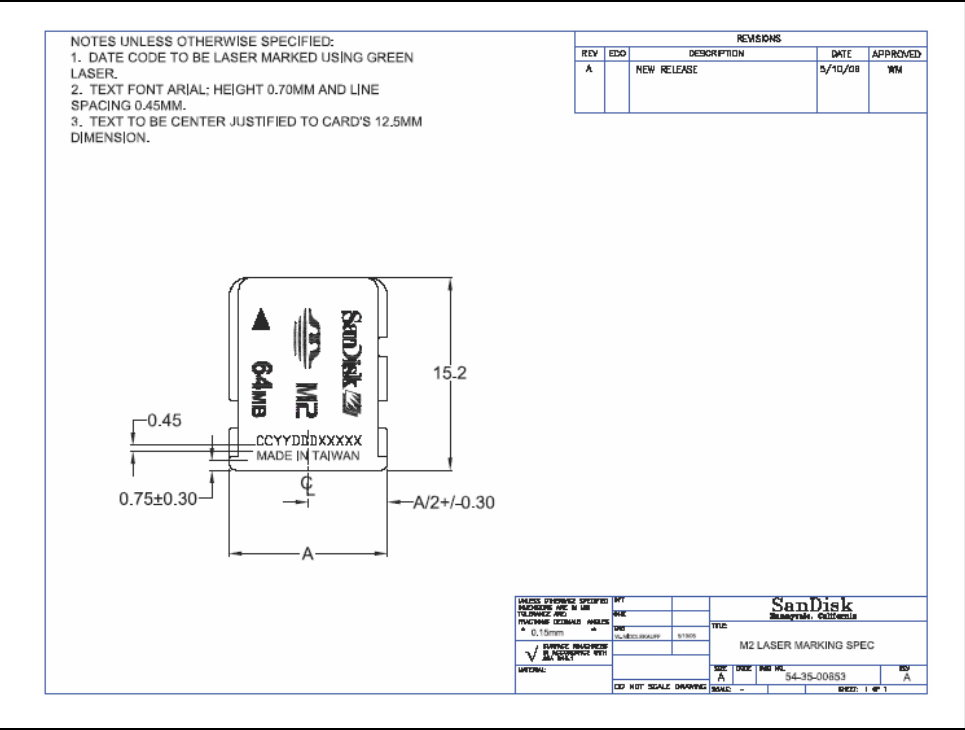
8   Packages

8.1   Package Dimensions

Figure 8-1 illustrates package dimensions for the Memory Stick M2. Specific dimensions and tolerance are set forth and maintained in the *Memory Stick Micro Media Format Specification* [Ref. 4].

Figure 8-1   Memory Stick Micro M2 Dimensions

Appendix A   Ordering Information

A.1   Memory Stick Micro (M2)

To order SanDisk products directly from SanDisk, call (408) 801-1000.

Part Number	Capacity*
SDMSM2-64	64 MB
SDMSM2-128	128 MB
SDMSM2-256	256 MB
SDMSM2-512	512 MB
SDMSM2-1024	1 GB
SDMSM2-2048	2 GB
SDMSM2-4096	**4 GB****

* 1 megabyte (MB) = 1 million bytes; 1 gigabyte (GB) = 1 billion bytes.
Some of the listed capacity is used for formatting and other functions
and therefore is not available for data storage.

** **Available in 2007**

Appendix B   Limited Warranty

I. WARRANTY STATEMENT

SanDisk warrants its products to be free of any defects in materials or workmanship that would prevent them from functioning properly for one year from the date of purchase. This express warranty is extended by SanDisk Corporation.

II. GENERAL PROVISIONS

This warranty sets forth the full extent of SanDisk's responsibilities regarding the SanDisk SD Card. In satisfaction of its obligations hereunder, SanDisk, at its sole option, will repair, replace or refund the purchase price of the product.

NOTWITHSTANDING ANYTHING ELSE IN THIS LIMITED WARRANTY OR OTHERWISE, THE EXPRESS WARRANTIES AND OBLIGATIONS OF SELLER AS SET FORTH IN THIS LIMITED WARRANTY, ARE IN LIEU OF, AND BUYER EXPRESSLY WAIVES ALL OTHER OBLIGATIONS, GUARANTIES AND WARRANTIES OF ANY KIND, WHETHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR INFRINGEMENT, TOGETHER WITH ANY LIABILITY OF SELLER UNDER ANY CONTRACT, NEGLIGENCE, STRICT LIABILITY OR OTHER LEGAL OR EQUITABLE THEORY FOR LOSS OF USE, REVENUE, OR PROFIT OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION PHYSICAL INJURY OR DEATH, PROPERTY DAMAGE, LOST DATA, OR COSTS OF PROCUREMENT OF SUBSTITUTE GOODS, TECHNOLOGY OR SERVICES. IN NO EVENT SHALL THE SELLER BE LIABLE FOR DAMAGES IN EXCESS OF THE PURCHASE PRICE OF THE PRODUCT, ARISING OUT OF THE USE OR INABILITY TO USE SUCH PRODUCT, TO THE FULL EXTENT SUCH MAY BE DISCLAIMED BY LAW.

SanDisk's products are not warranted to operate without failure. Accordingly, in any use of products in life support systems or other applications where failure could cause injury or loss of life, the products should only be incorporated in systems designed with appropriate redundancy, fault tolerant or back-up features.

III. WHAT THIS WARRANTY COVERS

For products found to be defective within one year of purchase, SanDisk will have the option of repairing or replacing the defective product, if the following conditions are met:

A. A warranty registration card for each defective product was submitted and is on file at SanDisk. If not, a warranty registration card must accompany each returned defective product. This card is included in each product's original retail package.

B. The defective product is returned to SanDisk for failure analysis as soon as possible after the failure occurs.

C. An incident card filled out by the user, explaining the conditions of usage and the nature of the failure, accompanies each returned defective product.

D. No evidence is found of abuse or operation of products not in accordance with the published specifications, or of exceeding storage or maximum ratings or operating conditions.

All failing products returned to SanDisk under the provisions of this limited warranty shall be tested to the product's functional and performance specifications. Upon confirmation of failure, each product will be analyzed, by whatever means necessary, to determine the root cause of failure. If the

root cause of failure is found to be not covered by the above provisions, then the product will be returned to the customer with a report indicating why the failure was not covered under the warranty.

This warranty does not cover defects, malfunctions, performance failures or damages to the unit resulting from use in other than its normal and customary manner, misuse, accident or neglect; or improper alterations or repairs.

SanDisk reserves the right to repair or replace, at its discretion, any product returned by its customers, even if such product is not covered under warranty, but is under no obligation to do so.

SanDisk may, at its discretion, ship repaired or rebuilt products identified in the same way as new products, provided such cards meet or exceed the same published specifications as new products. Concurrently, SanDisk also reserves the right to market any products, whether new, repaired, or rebuilt, under different specifications and product designations if such products do not meet the original product's specifications.

IV. RECEIVING WARRANTY SERVICE

According to SanDisk's warranty procedure, defective product should be returned only with prior authorization from SanDisk Corporation. Please contact SanDisk's OEM Support department at 866-436-6073 with the following information: product model number and description, serial numbers, nature of defect, conditions of use, proof of purchase and purchase date. If approved, SanDisk will issue a Return Material Authorization or Product Repair Authorization number and provide a shipping address where the defective product can be returned.

V. STATE LAW RIGHTS

SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, OR LIMITATION ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU. This warranty gives you specific rights and you may also have other rights that vary from state to state.

Appendix C   Disclaimer of Liability

C.1   SanDisk Corporation Policy

SanDisk Corporation general policy does not recommend the use of its products in life support applications wherein a failure or malfunction of the product may directly threaten life or injury. Accordingly, in any use of products in life support systems or other applications where failure could cause damage, injury or loss of life, the products should only be incorporated in systems designed with appropriate redundancy, fault tolerant or back-up features.

SanDisk shall not be liable for any loss, injury or damage caused by use of the Products in any of the following applications:

−   Special applications such as military related equipment, nuclear reactor control, and aerospace

−   Control devices for automotive vehicles, train, ship and traffic equipment

−   Safety system for disaster prevention and crime prevention

−   Medical-related equipment including medical measurement device