MultiMediaCard

In consumer electronics, the **MultiMediaCard** (**MMC**) is a memory-card standard used for solid-state storage. Unveiled in 1997 by SanDisk and Siemens AG,[1] MMC is based on a surface-contact low pin-count serial interface using a single memory stack substrate assembly, and is therefore much smaller than earlier systems based on high pin-count parallel interfaces using traditional surface-mount assembly such as CompactFlash. Both products were initially introduced using SanDisk NOR-based flash technology. MMC is about the size of a postage stamp: 24 mm × 32 mm × 1.4 mm. MMC originally used a 1-bit serial interface, but newer versions of the specification allow transfers of 4 or 8 bits at a time. MMC can be used in many devices that can use Secure Digital (SD) cards.

Typically, an MMC operates as a storage medium for a portable device, in a form that can easily be removed for access by a PC. For example, a digital camera would use an MMC for storing image files. Via an MMC reader (typically a small box that connects via USB or some other serial connection, although some can be found integrated into the computer itself), a user could transfer pictures taken with the digital camera to his or her computer. Modern computers, both laptops and desktops, often have SD slots, which can additionally read MMCs if the operating system drivers can.

MMCs are available in sizes up to and including 512 GB. They are used in almost every context in which memory cards are used, like cellular phones, digital audio players, digital cameras and PDAs. Since the introduction of SD cards, few companies build MMC slots into their devices (an exception is some mobile devices like the Nokia 9300 communicator in 2004, where the smaller size of the MMC is a benefit), but the slightly thinner, pin-compatible MMCs can be used in almost any device that can use SD cards if the software/firmware on the device is capable.

While few companies build MMC slots into devices as of 2018 (SD cards are more common), the embedded MMC (eMMC) is still widely used in consumer electronics as a primary means of integrated storage in portable devices. It provides a low-cost flash-memory system with a built-in controller that can reside inside an Android or Windows phone or in a low-cost PC and can appear to its host as a bootable device, in lieu of a more expensive form of solid-state storage, such as a traditional solid-state drive.

MultiMediaCard



32 MB MMCplus card

Media type	Memory card
Capacity	Up to 512 GB
Developed by	JEDEC
Dimensions	Standard: 32 × 24 × 1.4 mm
Weight	Standard: ~2.0 g
Usage	Portable devices
Extended to	Secure Digital (SD)

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Open standard

This technology is a standard available to any company wanting to develop products based on it. There is no royalty charged for devices which host an MMC. A membership with the MMC Association must be purchased in order to manufacture the cards themselves.

As of July 2009, the latest specifications version 4.4 (dated March 2009) can be requested from the MMCA, and after registering with MMCA, can be downloaded free of charge. Older versions of the standard, as well as some optional enhancements to the standard such as MiCard and SecureMMC, must be purchased separately.

A highly detailed version is available on-line[2] that contains material information for writing an MMC driver.

As of 23 September 2008, the MMCA group has turned over (https://web.archive.org/web/20080923015503/http://www.mmca.org/compliance/buy_spec/mmc_spec_v4_3/) all specifications to the JEDEC organization (http://www.jedec.org) including embedded MMC (e-MMC) and miCARD assets. JEDEC is an organization devoted to standards for the solid-state industry.

As of February 2015, the latest specifications version 5.1 can be requested from JEDEC, and after registering with JEDEC, can be downloaded free-of-charge. Older versions of the standard, as well as some optional enhancements to the standard such as MiCard and SecureMMC, must be purchased separately.



Top of four types of MMC cards (clockwise from left): MMC, RS-MMC, MMCplus, MMCmobile, metal extender

Variants

RS-MMC

In 2004, the **Reduced-Size MultiMediaCard** (**RS-MMC**) was introduced as a smaller form factor of the MMC, about half the size: 24 mm × 18 mm × 1.4 mm. The RS-MMC uses a simple mechanical adapter to elongate the card so it can be used in any MMC (or SD) slot. RS-MMCs are currently available in sizes up to and including 2 GB.

The modern continuation of an MS-MMC is commonly known as **MiniDrive (MD-MMC)**. A MiniDrive is generally a microSD card adapter in the RS-MMC form factor. This allows a user to take advantage of the wider range of modern MMCs available[3] to exceed the historic 2 GB limitations of older chip technology.

Implementations of RS-MMCs include Nokia and Siemens, who used RS-MMC in their Series 60 Symbian smartphones, the Nokia 770 Internet Tablet, and generations 65 and 75 (Siemens). However, since 2006 all of Nokia's new devices with card slots have used miniSD or microSD cards, with the company dropping support for the MMC standard in its products. Siemens exited the mobile phone business completely in 2006. Siemens continue to use MMC for some PLC storage leveraging MD-MMC advances.



Bottom of the same four cards

DV-MMC

The Dual-Voltage MultimediaCard (**DV-MMC**) is one of the first acceptable changes in MMC was the introduction of dual-voltage cards that can operate at 1.8 V in addition to 3.3 V. Running at lower voltages reduces the card's energy consumption, which is important in mobile devices. However, simple dual-voltage parts quickly went out of production in favour of MMCplus and MMCmobile which offer capabilities in addition to dual-voltage capability.

MMCplus and MMCmobile

The version 4.x of the MMC standard, introduced in 2005, brought in two very significant changes to compete against SD cards: ability to run at higher speeds (26 MHz and 52 MHz) than the original MMC (20 MHz) or SD (25 MHz, 50 MHz) and a four- or eight-bit-wide data bus.

Version 4.x full-size cards and reduced-size cards can be marketed as **MMCplus** and **MMCmobile** respectively.

Version 4.x cards are fully backward compatible with existing readers but require updated hardware/software to use their new capabilities; even though the four-bit-wide bus and high-speed modes of operation are deliberately electrically compatible with SD, the initialization protocol is different, so firmware/software updates are required to use these features in an SD reader.

MMCmicro

MMCmicro is a micro-size version of MMC. With dimensions of 14 mm × 12 mm × 1.1 mm, it is even smaller and thinner than RS-MMC. Like MMCmobile, MMCmicro allows dual voltage, is backward compatible with MMC, and can be used in full-size MMC and SD slots with a mechanical adapter. MMCmicro cards have the high-speed and four-bit-bus features of the 4.x spec but not the eight-bit bus, due to the absence of the extra pins.[4]

It was formerly known as *S-card* when introduced by Samsung on 13 December 2004. It was later adapted and introduced in 2005 by the MultiMediaCard Association (MMCA) as the third form factor memory card in the *MultiMediaCard* family.[5]

MMCmicro appears very similar to microSD but the two formats are not physically compatible and have incompatible pinouts.



MMCmicro

MiCard

The **MiCard** is a backward-compatible extension of the MMC standard with a theoretical maximum size of 2048 GB (2 TB) announced on 2 June 2007. The card is composed of two detachable parts, much like a microSD card with an SD adapter. The small memory card fits directly in a USB port while it also has MMC-compatible electrical contacts, which with an included electromechanical adapter fits in traditional MMC and SD card readers. To date, only one manufacturer (Pretec) has produced cards in this format.[6]

Developed by Industrial Technology Research Institute of Taiwan, at the time of the announcement twelve Taiwanese companies (including ADATA Technology, Asustek, BenQ, Carry Computer Eng. Co., C-One Technology, DBTel, Power Digital Card Co., and RICHIP) had signed on to manufacture the new memory card. However, as of June 2011 none of the listed companies had released any such cards, and nor had any further announcements been made about plans for the format.

The card was announced to be available starting in the third quarter of 2007. It was expected to save the 12 Taiwanese companies who planned to manufacture the product and related hardware up to US$40 million in licensing fees, that presumably would otherwise be paid to owners of competing flash memory formats. The initial card was to have a capacity of 8 GB, while the standard would allow sizes up to 2048 GB. It was stated to have data transfer speeds of 480 Mbit/s (60 Mbyte/s), with plans to increase data throughput over time.

SecureMMC

An additional, optional, part of the MMC 4.x specification is a DRM mechanism intended to enable MMC to compete with SD or Memory Stick in this area. Very little information is known about how SecureMMC works or how its DRM characteristics compare with its competitors.

eMMC

The eMMC (embedded MMC[7]) architecture puts the MMC components (flash memory plus controller) into a small ball grid array (BGA) IC package for use in circuit boards as an embedded non-volatile memory system. eMMC exists in 100, 153, 169 ball packages and is based on an 8-bit parallel interface.[8] This is noticeably different from other versions of MMC as this is not a removable card, but rather a permanent attachment to the circuit board. In the event of an issue stemming from either the memory or its controller, the entire PCB (Printed Circuit Board) would need to be replaced. eMMC also does not support the SPI bus protocol.

Almost all mobile phones and tablets used this form of flash for main storage up to 2016. In 2016 UFS started to take control of the market. The latest version of the eMMC standard (JESD84-B51 (http://www.jedec.org/standards-documents/results/jesd84-b51)) by JEDEC is version 5.1 released February 2015, with speeds rivaling discrete SATA-based SSDs (400 MB/s).[9]

eMMC KLMAG2GE4A-A002 inside the Samsung Galaxy Tab 2 10.1.

Others

Seagate, Hitachi and others are in the process of releasing SFF hard disk drives with an interface called CE-ATA. This interface is electrically and physically compatible with MMC specification. However, the command structure has been expanded to allow the host controller to issue ATA commands to control the hard disk drive.

Table

Comparison of technical features of MMC and SD card variants

Type	MMC	RS-MMC	MMCplus	MMCmobile	SecureMMC	SDIO	SD	miniSD	microSD
SD-socket compatible	Yes	Extender	Yes	Extender	Yes	Yes	Yes	Adapter	Adapter
Pins	7	7	13	13	7	9	9	11	8
Width	24 mm	24 mm	24 mm	24 mm	24 mm	24 mm	24 mm	20 mm	11 mm
Length	32 mm	18 mm	32 mm	18 mm	32 mm	32 mm+	32 mm	21.5 mm	15 mm
Thickness	1.4 mm	1.4 mm	1.4 mm	1.4 mm	1.4 mm	2.1 mm	2.1 mm (most) 1.4 mm (rare)	1.4 mm	1 mm
1-bit SPI-bus mode	Optional	Optional	Optional	Optional	Yes	Yes	Yes	Yes	Yes
Max SPI bus clock	20 MHz	20 MHz	52 MHz	52 MHz	20 MHz	50 MHz	25 MHz	50 MHz	50 MHz
1-bit MMC/SD bus mode	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4-bit MMC/SD bus mode	No	No	Yes	Yes	No	Optional	Yes	Yes	Yes
8-bit MMC bus mode	No	No	Yes	Yes	No	No	No	No	No
DDR mode	No	No	Yes	Yes	Unknown	Unknown	Unknown	Unknown	Unknown
Max MMC/SD bus clock	20 MHz	20 MHz	52 MHz	52 MHz	20 MHz?	50 MHz	208 MHz	208 MHz	208 MHz
Max MMC/SD transfer rate	20 Mbit/s	20 Mbit/s	832 Mbit/s	832 Mbit/s	20 Mbit/s?	200 Mbit/s	832 Mbit/s	832 Mbit/s	832 Mbit/s
Interrupts	No	No	No	No	No	Optional	No	No	No
DRM support	No	No	No	No	Yes	N/A	Yes	Yes	Yes
User encrypt	No	No	No	No	Yes	No	No	No	No
Simplified spec.	Yes	Yes	No	No	Unknown	Yes	Yes	No	No
Membership cost	JEDEC: US$4,400/yr, optional					SD Card Association: US$2,000/year, general; US$4,500/year, executive			
Specification cost	Free				Unknown	Simplified: free. Full: membership, or US$1,000/year to R&D non-members			
Host license	No	No	No	No	No	US$1,000/year, excepting SPI-mode only use			
Card royalties	Yes	Yes	Yes	Yes	Yes	Yes, US$1,000/year	Yes	Yes	Yes
Open-source compatible	Yes	Yes	Unknown	Unknown	Unknown	Yes	Yes	Yes	Yes
Nominal voltage	3.3 V	3.3 V	3.3 V[10][11]	1.8 V/3.3 V	1.8 V/3.3 V	3.3 V	3.3 V (SDSC), 1.8/3.3 V (SDHC & SDXC)	3.3 V (miniSD), 1.8/3.3 V (miniSDHC)	3.3 V (SDSC), 1.8/3.3 V (microSDHC & microSDXC)
Max capacity	128 GB	2 GB	128 GB?	2 GB	128 GB?	?	2 GB (SD), 32 GB (SDHC), 512 GB (SDXC), 2 TB (SDXC, theoretical)	2 GB (miniSD), 16 GB (miniSDHC)	2 GB (microSD), 32 GB (microSDHC), 512 GB (microSDXC), 2 TB (microSDXC, theoretical)
Type	**MMC**	**RS-MMC**	**MMCplus**	**MMCmobile**	**SecureMMC**	**SDIO**	**SD**	**miniSD**	**microSD**

- Table data compiled from MMC, SD, and SDIO specifications from SD Association and JEDEC web sites. Data for other card variations are interpolated.

References

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External links

Organizations

- JEDEC (http://www.jedec.org/) - Solid State Technology Association

Specifications

- eMMC (Embedded MMC) Standard MMCA 4.4 (JESD84-A44)(March 2009) (http://www.jedec.org/sites/default/files/docs/JESD84-A44.pdf) (registration required)
- MMCplus 13 Pin Full Size MultiMediaCard (MMC) Outline (MO-277A) (http://www.jedec.org/sites/default/files/docs/MO-277A.pdf) (registration required)
- MMCmobile 13 Pin Reduced Size MultiMediaCard (MMC) Outline (MO-278A) (http://www.jedec.org/sites/default/files/docs/MO-278A.pdf) (registration required)
- MMCmicro 10 Pin Micro Size MultiMediaCard (MMC) Outline (MO-279A) (http://www.jedec.org/sites/default/files/docs/MO-279A.pdf) (registration required)

Other

- Sandisk OEM Manual for MMC and RS-MMC (PDF) (http://www.sandisk.com/Assets/File/OEM/Manuals/ProdManRS-MMCv1_3.pdf)
- KingMax MMC technical document (PDF) (https://web.archive.org/web/20071010143502/http://www.kingmaxdigi.com/product/MMC.pdf)
- MMC pinout (tech.) (http://www.hardwarebook.info/MMC)
- MMCplus pinout (tech.) (http://www.hardwarebook.info/MMCplus)

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