AMD

AmMCL00XA

2 or 4 Megabyte 3.0 Volt-only Flash Miniature Card

DISTINCTIVE CHARACTERISTICS

- **2 or 4 Mbytes of addressable Flash memory**
- **2.7 V to 3.6 V, single power supply operation**
  - — Write and read voltage: 3.0 V –10/+20%
  - — No additional supply current required for V_{PP}
- **Fast access time**
  - — 150 ns maximum access time
- **CMOS low power consumption**
  - — Typical active read current: 35 mA (word mode)
  - — Typical active erase/write current: 40 mA (word mode)
  - — Typical standby current: 10 µA (4 Mbyte); 5 µA (2 Mbyte)
- **High write endurance**
  - — Guaranteed minimum 100,000 write/erase cycles per card
  - — More than 1,000,000 cycles per card typical
- **Uniform sector architecture**
  - — 64K byte individually useable sectors
  - — Erase Suspend/Resume increases system level performance
  - — BUSY# and RESET# signals
- **Zero data retention power**
  - — No power required to retain data
- **Available in industrial temperature grade (–40°C to +85°C)**
- **Miniature Card standard form factor**
  - — True interchangeability
  - — 60-pad elastomeric connector
  - — Supports multiple technologies
  - — Sonic welded stainless steel case
  - — PCMCIA Type II adapter available
  - — Selectable byte- or word-wide configuration
  - — Small Form Factor (38 mm x 33 mm x 3.5 mm)
- **60 connection bus**
  - — 16-bit data bus
  - — 25-bit address bus
  - — Easy system integration
  - — Low cost implementation
  - — Low cost cards
- **Consumer-friendly mechanicals**
  - — User can easily insert and remove card, upgrade memory, and add applications
- **Voltage level keying**
  - — Does not allow a 3 V card to plug into a 5 V system and vice versa
  - — Single power supply design
  - — System does not need a separate program voltage supply; only one is necessary to read and write

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GENERAL DESCRIPTION

The Miniature Card is an expansion card that provides a low cost, low power, high-performance, small form factor solution for data and file storage to the portable, handheld market, which includes audio, digital film, wireless, and PDA (Portable Digital Assistant) applications.

Miniature cards can be easily "snapped" into the back of an electronic system and can be readily removed and replaced by end users. AMD's 3 V Flash Miniature Cards are manufactured using AMD's industry leading 3.0 volt-only, single-power-supply Am29LV081 Flash Memory device, ensuring high reliability and excellent performance. The Miniature Card is less than 30% of the size of a PCMCIA memory card. Applications include digital voice recorders, pocket PCs and intelligent organizers, smart cellular telephones, voice and data messaging pagers, digital still cameras and portable instrumentation equipment.

The Miniature Card specification will be defined by PCMCIA as of October 1997. The participating association members include major Flash memory vendors and leading consumer electronics OEMs. The goal of the Miniature Card specification is to promote an open, interoperable small-form-factor memory card standard. For more information on the Miniature Card specification, visit the PCMCIA web site at http://www.pc-card.com.

AMD Flash Miniature Cards can be read in either a byte-wide or word-wide mode, which allows for flexible integration into various system platforms. Compatibility is assured at the hardware interface and software interchange specification.

The Miniature Card is also designed with low-cost and rugged handling in mind. The card contains virtually no control logic, which keeps cost and power consumption to a minimum. The Miniature Card is packaged in a sonic welded, stainless steel case that guarantees durability, provides good ESD protection and ease of handling.

The Miniature Card has extensive third-party support, including socket and connector solutions, software support from the major FTL software vendors, and PCMCIA adapter solutions and programmer support.

AMD's Miniature Flash cards can be used for both code and data storage. Since fast random access is possible, code can be directly executed from the card, reducing the amount of system RAM required. In addition. AMD's Flash technology offers unsurpassed endurance, data retention and reliability, eliminating the need for complex error correction and defect management hardware and software. Each Flash sector provides a minimum of 100,000 cycles, and a typical card life of one million or more cycles.

For more information, please contact your local AMD sales office or visit our Web site at http://www.amd.com/html/products/nvd/nvd.html.

DEFINITIONS

Table 1 lists the terms and definitions that may be used in conjunction with Miniature Card specifications.

Table 1. Miniature Card Definitions

Term	Meaning
AIS	Acronym for Attribute Information Structure. AIS is a Miniature Card specification for storing Miniature Card attribute information.
ESD	Acronym for Electrostatic Discharge. ESD is part of the Miniature Card physical test.
FAT	Acronym for File Allocation Table. Using an FAT is a common method for managing files in a DOS-based system.
Flash	A type of non-volatile memory that is both readable and writeable, but requires the media to be erased before it is rewritten.
Host	Any system that incorporates a Miniature Card socket.
Insertion, Cold	*User Perception:* Insertion of the Miniature Card when the host is off. *Host State:* The host would be either off or in sleep mode, no bus activity is occurring, the host is non-operational by the user. The user inserts the Miniature Card and then presses a button to turn the host on before the system is operational.
Insertion, Hot	*User Perception:* Insertion of a Miniature Card when the host is running. *Host State:* The host would be in running mode, bus activity is occurring, the host is operational by the user. The user inserts the card, the host recognizes it, and the host continues to be operational. Note: Hot insertion may require buffering on the host system for proper operation.

Table 1. Miniature Card Definitions (Continued)

Term	Meaning
Insertion, Pseudo Hot	*User Perception:* Insertion of a Miniature Card when the host is running. *Host State:* The host would be in running mode, bus activity is occurring, the host is operational by the user. The user inserts the card, the host immediately powers off before the Miniature Card makes contact with the host's internal bus. The user would then need to press a button to turn the host on for it to become operational.
Interface Signals	Miniature Card signals that make connection through the 60-pad connector area.
JEDEC	Acronym for Joint Electronic Device Engineering Council.
Miniature Card Backside	The side of the Miniature Card that contains the latching mechanism. The backside is opposite the frontside.
Miniature Card Bottomside	The side of the Miniature Card that contains the interface signals. The bottomside is opposite the topside.
Miniature Card Frontside	The side of the Miniature Card that contains power, insertion, ground, voltage keys, and alignment notch. The frontside is opposite the backside.
Miniature Card Topside	The side of the Miniature Card that contains the Miniature Card label. The topside is opposite the bottomside.
PC Card	A memory or I/O card compatible with the PC Card Standard.
PC Card Adapter	The hardware that connects the Miniature Card 60 contact bus to the PC Card 68 pin bus. This hardware can be mechanically implemented by following the PC Card Type II specification.
Power/Insertion Signals	The three signals on the frontside of the Miniature Card that provide ground, power and early detection of insertion.
Pull-Ups	Resistors used to ensure that signals do not float when no device is driving them.
Removal, Cold	*User Perception:* Removal of a Miniature Card when the host is off. *Host State:* The host would either be off or in sleep mode, no bus activity is occurring, the host is non-operational by the user. User would turn off the host, then remove the Miniature Card and then press a button to turn the host on for it to become operational again.
Removal, Hot	*User Perception:* Removal of the Miniature Card when the host is running. *Host State:* The host would be in running mode, bus activity is occurring, the host is operational by the user. User removes the card, the host recognizes the event, and the host continues to be operational.
Removal, Pseudo Hot	*User Perception:* Removal of the Miniature Card when the host is running. *Host State:* The host would be in running mode, bus activity is occurring, the host is operational by the user. User removes the card, the host recognizes the event, the host immediately powers off before the Miniature Card removes contact with the host's internal bus. The user would then need to press a button to turn the host on for it to be operational again.
Sector	Usually 64 KBytes. In word mode, a sector is 64 Kwords.
Tuple	An element of the PC Card Standard CIS that provides card attribute information, and a link to the next tuple in a string of tuples.
User Insertable	All Miniature Cards should be inserted into the host by the user without the need for any special tools.
User Removable	This type of Miniature Card can be removed by the user without the need for any special tools. It contains programs and data that users may want to switch often. The use of this type of card is similar to a floppy disk.
User Non-Removable	This type of Miniature Card must be removed by the user with a special tool. It contains memory upgrades or boot program that users switches only when they require an upgrade. The use of this type of card is similar to a SIMM memory expansion or boot hard disk.
XIP	Acronym for eXecute-In-Place, which refers to code that executes directly from a Miniature Card.

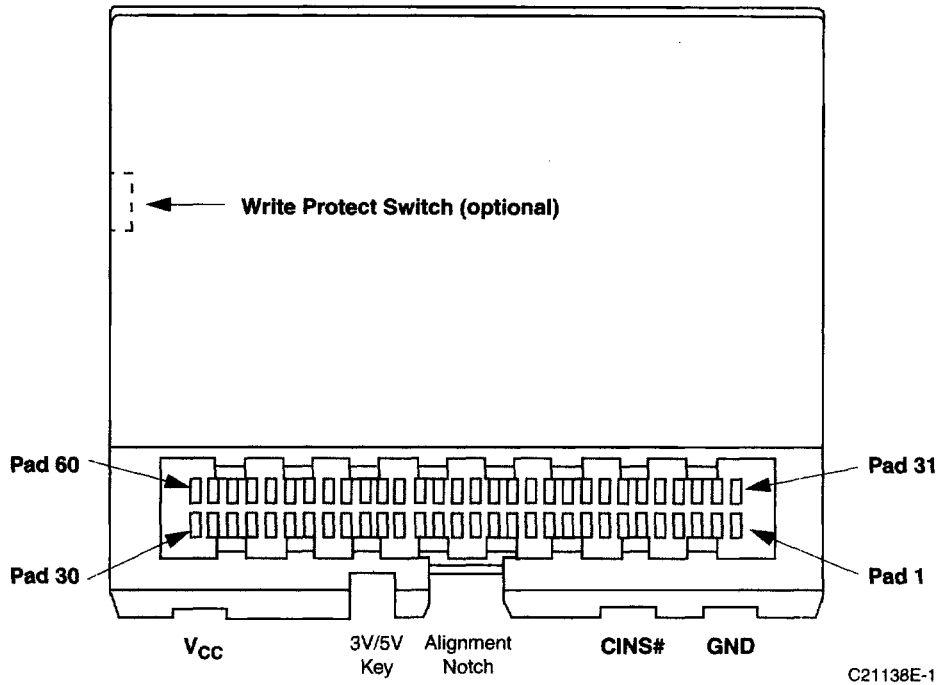


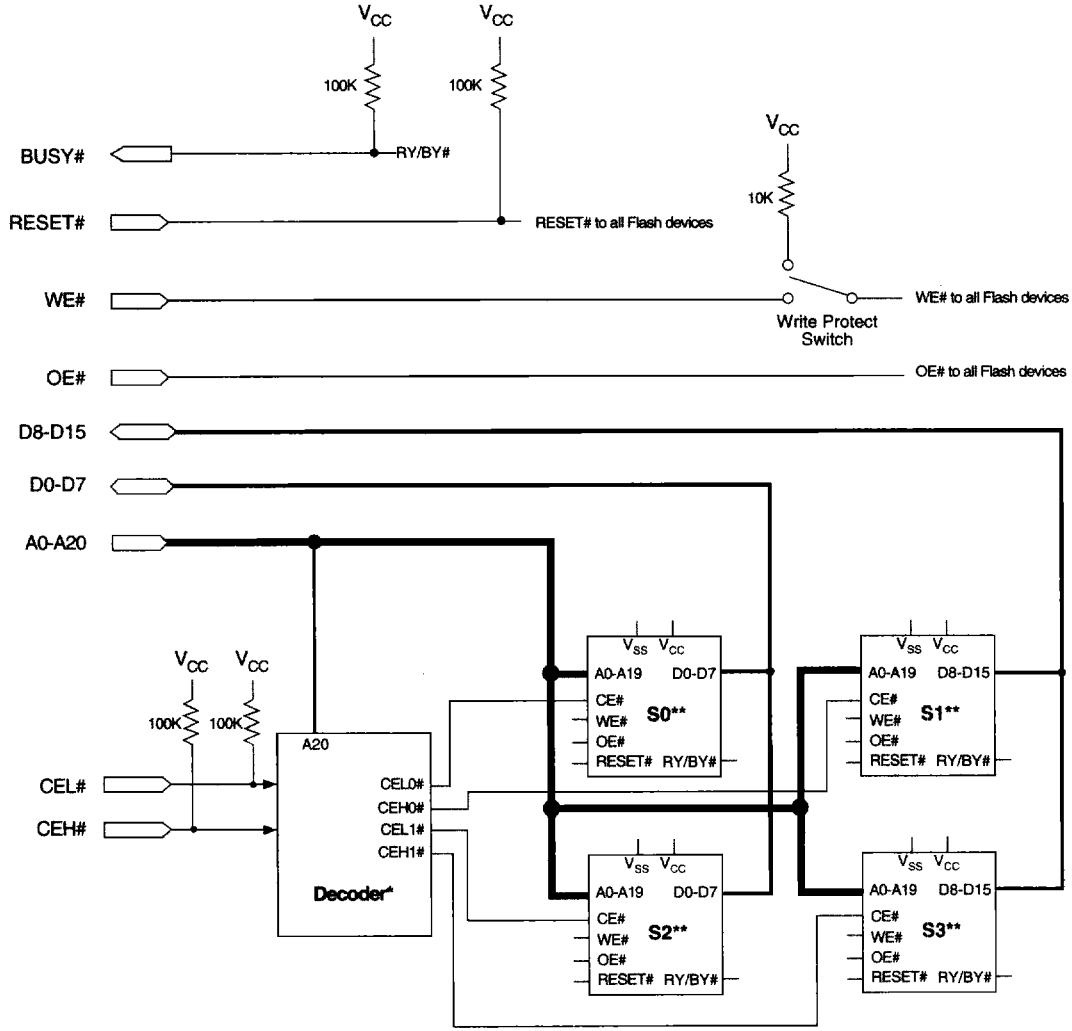
Figure 1. Miniature Card Connector (Card Bottom View)

Note: *Refer to the Physical Dimensions section for more information. Also refer to the MCIF specification for detailed mechanical information, available on the Web at http://www.mcif.org.*

Table 2. AMD Flash Miniature Cards and Flash Devices

Family Part Number	Density	No. of Flash Devices	AMD Flash Memory
AmMCL002AWP	2 Mbyte	2	Am29LV081
AmMCL004AWP	4 Mbyte	4	Am29LV081

BLOCK DIAGRAM



C21138E-2

* *4 Mbyte card only. Not used on 2 Mbyte card.*

** *2 Mbyte card: Two Am29LV081 devices, S0 and S1*
4 Mbyte card: Four Am29LV081 devices, S0...S3

Note: *On the 2 Mbyte card, A20–A24 are not connected. On the 4 Mbyte card, A21–A24 are not connected. Connections not shown in this diagram are* ***not connected*** *internally.*

MINIATURE CARD PAD ASSIGNMENTS

A0–A24

Address A0 to A24 are the address bus lines that can address up to 32 Mwords (64 Mbytes). The address lines are word addressed. The Miniature Card specification does not require the Miniature Card to decode the upper address lines. A 2 Mbyte Miniature Card that does not decode the upper address lines would repeat its address space every 2 Mbytes. Address 0h would access the same physical location as 200000h, 400000h, 600000h, etc. On the 2 Mbyte cards, A20–A24 are not connected. On the 4 Mbyte cards, A21–A24 are not connected.

D0–D15

Data lines D0 through D15 constitute the data bus. The data bus is composed of two bytes; the low byte is D0–D7 and the high byte is D8–D15. These lines are tristated when OE# is high.

OE#

OE# indicates to the card that the current bus cycle is a read cycle. The output enable access time (t_{OE}) is the delay from the falling edge of OE# to valid data at the output pins (assuming the addresses have been stable for at least $t_{ACC} - t_{OE}$ time).

WE#

WE# indicates to the card that the current bus cycle is a write cycle. The falling edge of WE# (or CE#), whichever occurs later, latches address information and the rising edge of WE# (or CE#), whichever occurs first latches data/command information.

VS1#

Voltage Sense 1 signal. This signal is grounded.

VS2#

Voltage Sense 2 signal. This signal is left open or not connected.

CEL#

CEL# enables the low byte of the data bus (D0–D7) on the card.

CEH#

CEH# enables the high byte of the data bus (D8–D15) on the card.

RESET#

RESET# controls card initialization. When RESET# transitions from a low state to a high state, the Miniature Card resets to the Read state after a maximum delay of 20 µs.

BUSY#

BUSY# is a signal generated by the card to indicate the status of operations within the Miniature Card. When BUSY# is high, the Miniature Card is ready to accept the next command from the host. When BUSY# is low, the Miniature Card is busy and unable to accept most data operations from the host. In Flash Miniature Cards the BUSY# signal is tied to the components' RY/BY# signal.

CD#

CD# is a grounded interface signal. After a Miniature Card has been inserted, CD# will be forced low. The card detect signal is located in the center of the second row of interface signals, and should be one of the last interface signals to connect to the host. Do not confuse CD# with CINS#.

CINS#

CINS# is a grounded signal on the front of the Miniature Card that is used for early detection of a card insertion. CINS# makes contact on the host when the front of the card is inserted into the socket, before the interface signals connect.

BS8#

The BS8# (Bus size 8) signal indicates to the Miniature Card that the host has an 8-bit bus. AMD Flash Miniature Cards ignore this signal (no internal connection). An 8-bit host must connect its D0–D7 data lines to D8–D15 on the Miniature Card to retrieve the upper (odd) byte.

GND

Ground

V_{CC}

Vcc is used to supply power to the card.

NC

No connect

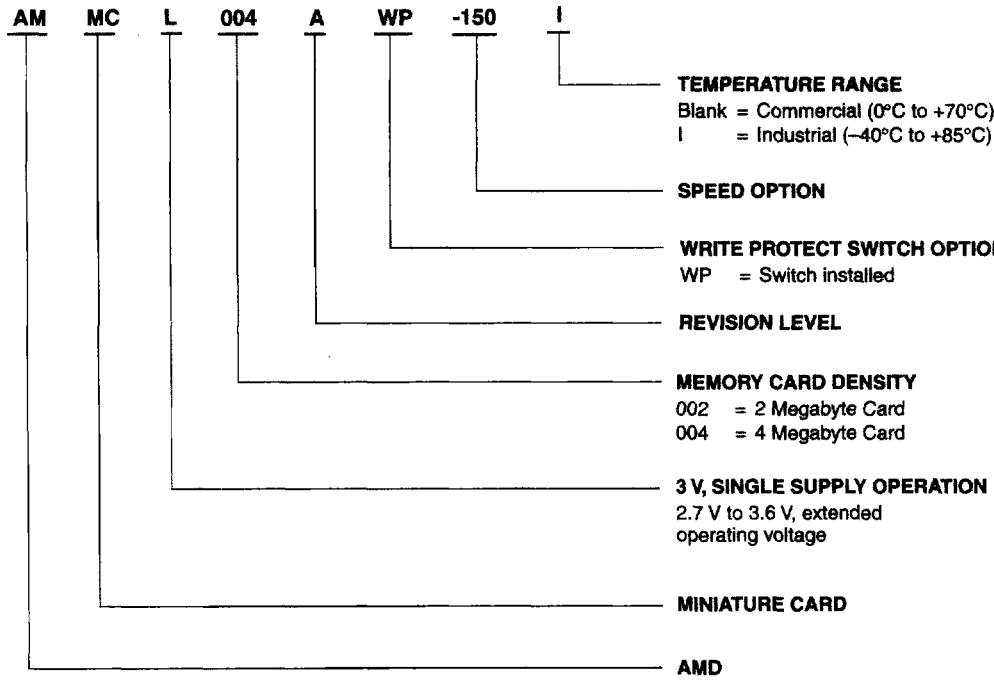
RFU

Reserved for future use

ORDERING INFORMATION

Standard Products

AMD standard products are available in several packages and operating ranges. The order number (Valid Combination) is formed by a combination of the following:



REVISION HISTORY FOR AMMCL00XA

Distinctive Characteristics

Added industrial temperature bullet. Revised low power consumption specifications. Deleted "Small Form Factor" bullets.

General Description

Revised text to indicate that the Miniature Card specification will be defined by PCMCIA. Deleted references to the elastomeric connector.

Table 2, AMD Flash Miniature Cards and Flash Devices

Added WP as part of required base part number.

Miniature Card Pad Assignments

BUSY#: Revised to indicate that the Miniature Card cannot accept most operations when BUSY# is low. CD#: Deleted last sentence.

Ordering Information

Added Industrial temperature range. Deleted NP option from part number. Added WP as part of required base part number.

Figure 2, Host/Card Address Assignments

Labeled host bus in drawing. Deleted NC callouts in drawing.

Tables 5–9, Command Definitions

Revised for easier reference: removed "H" designators from table (now indicated in notes), removed 4-cycle Reset/Read command, separated Read and Reset commands, moved RA, RW, RD, PA, PW, PD, X, SA definitions to legend. Moved Erase Suspend and Erase Resume definitions from table to notes.

Operating Ranges

Added industrial temperature range.

AC Characteristics, Write Operations

Deleted t_{ELQV}, t_{AVQV}, t_{GLQV}, t_{ELQX}, t_{EHQZ}, t_{GLQX}, t_{GHQZ}, t_{AXQX}, t_{WHGL}, t_{GLQNZ}

Embedded Erase Algorithm

Removed last paragraph.

Absolute Maximum Ratings

Revised storage and ambient temperature ratings.

Operating Ranges

Added industrial temperature range.

DC Characteristics

Revised I_{CC} specifications. Added frequency specification to Note 2.

AC Characteristics, Write (Erase/Program) Operations

Deleted t_{ELQV}, t_{AVQV}, t_{GLQV}, t_{ELQX}, t_{EHOZ}, t_{GLOX}, t_{GHQZ}, $t_{AXQ}X$, t_{WHGL}, t_{GLQNZ}.

Table 19, AMD Compatibility Data

Added two tuples of data to list, covering addresses 100h–10Bh.