

Apple IIc Plus

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The **Apple IIc Plus** was the sixth and final model in the Apple II line of personal computers, produced by Apple Computer. The "*Plus*" in the name was a reference to the additional features it offered over the original portable Apple IIc, such as greater storage capacity (a built-in 3.5" floppy drive replacing the classic 5.25"), increased processing speed, and a general standardization of the system components. In a notable change of direction, the Apple IIc Plus, for the most part, did not introduce new technology or any further evolutionary contributions to the Apple II series, instead merely integrating existing peripherals into the original Apple IIc design. The development of the 8-bit machine was criticized by quarters more interested in the significantly more advanced 16-bit Apple IIGS.



Apple IIc Plus

Manufacturer	Apple Computer
Introduced	September 1988
Discontinued	November 1990
Price	675 USD
CPU	65C02, 4 MHz
RAM	128 KB (up to 1.125 MB),
OS	ProDOS

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History

The Apple IIc Plus was introduced on September 16th, 1988 at the AppleFest conference in San Francisco, with less fanfare than the Apple IIc had received four years earlier. Described as a "turbocharged version of the IIc with a high-capacity 3½ disk drive" by one magazine review of the time, some users were disappointed. Many IIc users already had add-ons giving them something rather close to what the new model offered.

Before the official release of the machine, it had been rumored to be a slotless version of the Apple IIGS squeezed into the portable case of the Apple IIc. Apple employee John Arkley, one of the engineers working on the Apple IIc Plus project, had devised rudimentary plans for an enhanced Apple IIGS motherboard that would fit in the IIc case, and petitioned management for the go ahead with such a project. The idea was rejected.

When the project started the original plan was to just replace the 5.25" floppy drive with a 3.5", without modifying the IIc design. Other features, consequently, were added as the project progressed. It is believed the Apple IIc Plus design, and its existence at all, was influenced by a third party Apple IIc compatible known as the Laser 128. It is not coincidence that the Apple IIc Plus is very similar in design to the Laser 128EX/2 model, released shortly before the Apple IIc Plus. As fully backwards compatible, the Apple IIc Plus replaced the Apple IIc.

Codenames for the machine while under development included: Raisin, Pizza, Adam Ant.

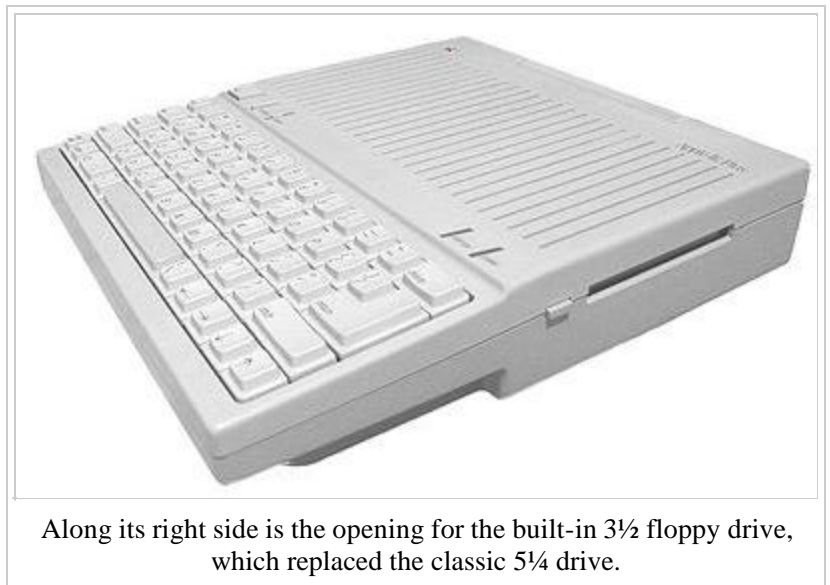
Overview of new features

Three major new features

Although there were several changes present, the Apple IIc Plus mainly comprised three new features. The first and most noticeable feature was the replacement of the 5¼" floppy drive with the new 3½" drive. Beside offering nearly six times the storage capacity (800 KB), the new drive had a much faster seek time (three times faster) and button-activated motorized ejection. To accommodate the increased data flow of the new drive, specialized chip circuitry called The MIG, short for "Magic Interface Glue", was designed and added to the motherboard along with a dedicated 2 KB static RAM buffer (the MIG chip is the only exception to there being no new technological developments present in the machine). The second most important feature was a faster 65C02 processor, running at 4 MHz. In actuality an Apple II accelerator product called the *Zip Chip* was licensed through third party developer Zip Technologies and added to the IIc Plus, however instead of the all-in-one tall chip design, Apple engineers broke out the design into its core components and integrated them into the motherboard (a 4 MHz CPU, 8 KB of combined static RAM cache, and logic). Of interesting note is CPU acceleration was a last minute feature added, which in turn made the specialized circuitry for the use of a 3.5 drive completely unnecessary as the machine was now fast enough to handle the data flow; that circuitry was left in place and put into operation nonetheless. By default the machine ran at 4 MHz, but holding down the 'ESC' key during a cold or warm boot disabled the acceleration so it could run at a standard 1 MHz operation—necessary for older software that depended on timing, especially games. The third major change was the internalization of the power supply into the Apple IIc Plus's case, utilizing a new miniature design from Sony (gone was the infamous "brick on a leash" external supply).

A new look and minor changes

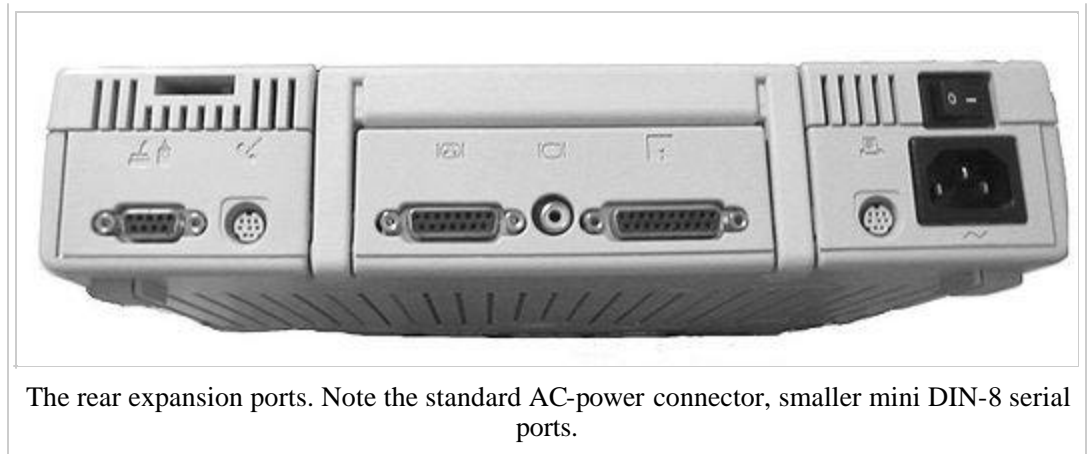
Cosmetic changes were apparent as well. The keyboard layout and style now mirrored that of the Apple IIGS and Macintosh, including an enlarged "Return" key and updated modifier keys (Open and Solid Apple being replaced by "Command" and "Option"). Above the keyboard, the little used "40/80" switch was replaced by a sliding volume control (gone was the left side volume-control dial, and as a cost-cutting measure, the audio headphone jack disappeared with it). The case housing and keyboard had been changed to the light-grey Apple platinum color, creating a seamless blend between keyboard and case, making them appear almost as one. The machine, a half pound lighter than the original IIc, weighed in at 7 pounds (3.2 kg).



Along its right side is the opening for the built-in 3½ floppy drive, which replaced the classic 5¼ drive.

In the rear of the machine the most obvious change was a 3-prong AC plug connector and power switch where the voltage converter had once been, an Apple security port at the far left corner, and the standardization of the serial port connectors (changed from DIN-5 to mini DIN-8, but still providing an identical signal). All the same built-in Apple II peripheral equivalents and port functionality of the IIc remained, with the one exception being the floppy port. Whereas the previous IIc could only support one external 5.25 floppy drive and (in later models) "intelligent" storage devices such as the UniDisk 3.5, the Apple IIc Plus offered backwards port compatibility and more. Support for the external Apple 3.5 Drive used by the Apple IIGS and Macintosh was now present, and up to two external 5.25 floppy drives could be added as well.

Internally, the new motherboard sported a pin connector for an internal modem; however no products ever supported it. The same memory expansion socket introduced on late model IIc's was present, although it was not compatible with memory cards designed for the previous system.



The rear expansion ports. Note the standard AC-power connector, smaller mini DIN-8 serial ports.

The ROM firmware (now labeled revision "5", following on the sequence from the original IIc) remained the same size, as did RAM, meaning the machine continued to ship with only 128 KB of memory.

Negative aspects

The most criticized aspect of the Apple IIc Plus, even among collectors today, is the lack of an internal 5.25 drive. The reason for this is the vast majority of software for the 8-bit Apple II series shipped on 5.25 disks (often hardcoded for the medium) making the machine of limited use unless an external 5.25 drive is added.

Another unpopular change was the removal of the voltage converter. While it made the IIc Plus a more integrated one-piece unit for desktop use, the negative aspect was the loss of the ability to operate the machine from a battery source. This in turn eroded the portability aspect of the IIc series, rooting it further to a desktop-only environment. The removal of the audio-out jack used for headphones or a speaker was another feature users missed.

Technical specifications

Microprocessor

- 65C02 running at either 1 MHz or 4 MHz (user selectable)
- 8 KB SRAM cache (16 KB physical installed; 8 KB for TAG/DATA)
- 8-bit data bus

Memory

- 128 KB RAM built-in
- 32 KB ROM built-in
- Expandable from 128 KB to 1.125 MB RAM

Video

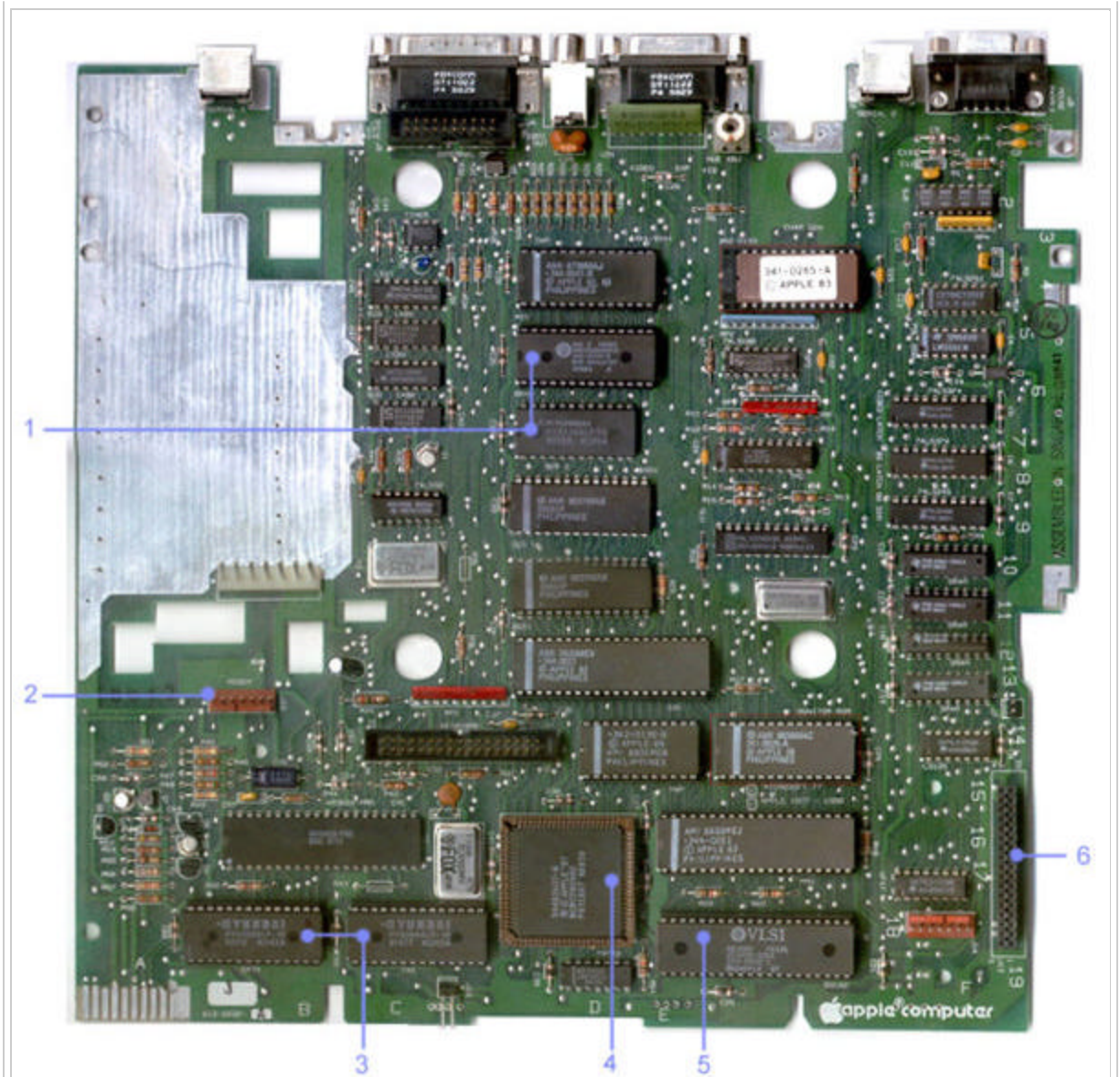
- 40 and 80 columns text, with 24 lines¹
- Low-Resolution: 40×48 (16 colors)
- High-Resolution: 280×192 (6 colors) *
- Double-Low-Resolution: 80×48 (16 colors)
- Double-High-Resolution: 560×192 (16 colors) *

**effectively
140×192 in
color, due to
pixel
placement
restrictions*

*Text can be
mixed with
graphic
modes,
replacing
either bottom
8 or 32 lines,
depending on
video mode*

Audio

- Built-in



The IIC Plus motherboard, normally inaccessible in the closed system. Note the MIG and its 2 KB SRAM (1), the internal modem connector (2), Dual 8 KB cache for CPU (3), accelerator ASIC (4), 4 MHz 65C02 (5), and memory expansion connector (6).

speaker; 1-bit toggling

- User adjustable volume (manual sliding switch)

Built-in storage

- Internal 3.5 floppy drive
- 800 KB, double-sided
- Motorized ejection/auto-injection

Internal connectors

- IIC Plus Memory Expansion Card connector (34-pin)
- Internal modem

Specialized chip controllers

- IWM (Integrated Wozniak Machine) for floppy drives
- MIG (Magic Interface Glue) with 2 KB SRAM, for "dumb" 3.5 drive support
- Dual 6551 ACIA chips for serial I/O

External connectors

- Joystick/Mouse (DE-9)
- Printer, serial-1 (mini DIN-8)
- modem, serial-2 (mini DIN-8)
- Video Expansion Port (D-15)
- Floppy drive SmartPort (D-19)
- NTSC composite video output (RCA connector)

Notes of interest

No new revisions

The Apple IIc Plus had a relatively short product life span, produced for only two years (it was officially discontinued November 1990). During that time there were no changes or revisions made to the machine, not even to the firmware, despite the presence of bugs such as the inability to recognize single-sided 400 KB diskettes. The only ROM produced for the machine was identified as version '5', following the numbering sequence from previous Apple IIc computers before it.

No international versions

There were also no international versions of the Apple IIc Plus produced, so the keyboard, unlike the original IIc, was only manufactured with English-American printed keycaps and the 'Keyboard' switch was utilized solely for changing between QWERTY and DVORAK layout (not localized language text video). Consequently, the Apple IIc Plus was only sold in the United States--not even Canadian Apple dealers were authorized to distribute or sell it.

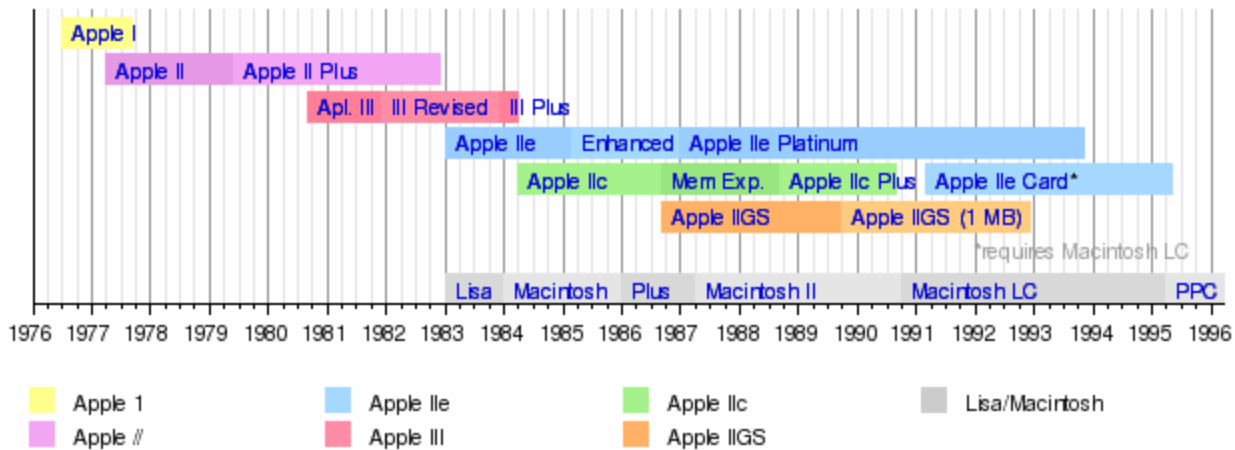
End of the line

Although it wasn't intended to be, fate would have it that the Apple IIc Plus would be the last new Apple II model. Although even back in 1988, before this was known, the Apple IIc Plus could be seen as signaling the beginning of the end for the Apple II series, or at the very least a hint at the direction Apple Computer was taking with the line. In releasing the IIc Plus, Apple management essentially made a statement the Apple IIGS was no longer considered a top priority, and if anything, giving it a back seat when it was the only possible future for the evolution and continued success of the Apple II line. That in turn signified the Apple II line as a whole, despite its promise and potential, was no longer being considered important at Apple headquarters. Consequentially, from this point forward the Apple II was milked for financial gain as much as possible, yet at the same time a cap was placed on its evolution and advancement so it wouldn't overshadow and compete with the Macintosh, the company's then new focus and chosen future.

Further proof of this was a year after the release of the oddly out of place and retro design Apple IIc Plus, only a minor maintenance release of the Apple IIGS was introduced (mainly boasting more RAM and improved firmware) rather than any of the desperately needed hardware changes required to keep the machine viable. Prototypes of more advanced Apple II's (namely in the form of a new IIGS) were delayed and eventually cancelled as the company decided what to do with its Apple II product line. The end result was to allow it to slowly fade out into obscurity due to a lack of development or support.

Timeline of Apple II family models

See also: *Timeline of Apple II family*



See also: *Timeline of Macintosh models and Timeline of Apple products*

See also

- Apple II Family
- Apple III
- Apple II Plus
- Apple IIe
- Apple IIc
- Apple IIGS
- List of Apple II games
- Apple II peripheral cards
- Publications/Periodicals devoted to the Apple II
- ReactiveMicro.com – The last remaining Apple II hardware production company (cloned items)

References

External links

- A2Central.com – Apple II news and downloads
- Steven Weyhrich's Apple II History
- Apple II at the Open Directory Project
- Apple II expansion cards
- Applefritter has an Apple II forum
- PCB pictures of the Apple II
- Apple2clones has information on Apple II clones
- ReactiveMicro.com - The last remaining Apple II hardware production company (cloned items)

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