New Technical Notes

Macintosh ®

Developer Support

HW 33 - Composite SIMMs Not Supported

Hardware

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This Technical Note discusses composite SIMMs and why they shouldn't be used on Macintosh computers.

Introduction

It is possible to create a large memory SIMM by using banks of many smaller DRAM chips along with additional circuitry to fool the Macintosh memory controller circuitry. Such a SIMM is called a composite SIMM.

The problem is that composite SIMMs can cause random memory failures due to higher electrical currents, a higher amount of system noise, and the added timing overhead (delay) caused by the additional circuitry.

The memory timing on Macintosh CPUs is often carefully adjusted to get the maximum performance from the DRAMs. There is little or no margin for extra loads on the address and control lines. There are a number of issues with composite SIMMs, including increased loading on all lines (including the data bus), timing specification violations, and possible physical problems.

Apple has identified a couple of problems with using composite SIMMs on selected Macintosh computer models. Due to the nature of these problems, Apple does not recommend the use of composite SIMMs in any Macintosh computer.

Definition

A composite SIMM is defined as a SIMM made up of banks of many smaller DRAM devices, with additional bank-controlling circuitry and perhaps buffers for the address and control signals. A noncomposite SIMM, on the other hand, is organized as a single bank of devices. As an example, a 16 MB composite SIMM would be made up of thirty-two 4-megabit DRAM chips, along with the additional circuitry to control the banks. Conversely, a noncomposite 16 MB SIMM would be made up of eight 16-megabit chips only. Composite SIMMs are made up of more commonly available and less expensive parts, hence the attraction.

Problems

Composite SIMMs pose timing and electrical problems in some Macintosh computers, particularly those optimized for maximum DRAM performance, such as the Macintosh Centris 610, Macintosh Centris 650, Macintosh Quadra 800, and the Macintosh Quadra 900 series.

Composite SIMMs have a larger number of DRAM devices than the SIMMs Apple has tested with. The extra components result in larger peak currents to the devices during read/write accesses and refresh. These larger peak currents subsequently result in added stress to the power system and an overall increase in system noise. The increase in system noise has caused problems on some systems such as the Macintosh Quadra 900 and Macintosh Quadra 950.

The additional circuitry added to composite SIMMs appears to add a slight amount of overhead to the timing of memory accesses. The Macintosh Quadra 800 has very strict timing guidelines (it requires 60-nanosecond DRAM), and is particularly sensitive to this potential problem. These problems may not occur until additional SIMMs are added (for example, two composite SIMMs may work, but four composite SIMMs may cause random failures or the system may not boot). In addition, the larger physical dimensions of the composite SIMMs may make proper installation difficult or impossible.

May Work Under Some Conditions, But…

Composite SIMMs may work under some conditions, but users may experience random failures such as startup failures, system errors, or other strange crashes. The errors can vary with different SIMMs, SIMM configurations, and vendors.

In addition, process variations in chips used in various Macintosh computers (such as memory controllers) can mean one CPU might act a little differently than the same model manufactured at a different time. It’s even possible to see minute variations caused by temperature and supply voltages.

Conclusion

Apple does not support composite SIMMs, nor does it guarantee that they will work in any Macintosh, due to the electrical and timing problems identified with selected Macintosh computers. Apple recommends the use of noncomposite SIMMs because they are less likely to have problems similar to those described in this Technical Note. While presently expensive, it is expected that the cost of 16-megabit chip SIMMs will come down.

Further Reference:

- Developer Notes for individual Macintosh CPU models