Apple II
Technical Notes

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Developer Technical Support

Apple IIGS
#23:   Toolbox Use of DOC RAM

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This Technical Note explains why you must be careful about which values you store in the first page of the Ensoniq Digital Oscillator Chip (DOC) RAM when using Note Synthesizer and MIDI Tool Sets on the Apple IIGS.

The Apple IIGS Note Synthesizer uses an oscillator as a free-running timer to clock the update of waveform envelopes when the DOC sounds notes. To act as a timer, the oscillator "plays" the contents of bytes $00 – $FF in DOC RAM at zero volume. Once it scans through the entire "waveform buffer," the oscillator generates an interrupt, which the appropriate Note Synthesizer routines service.

When using the Note Synthesizer or the Note Sequencer without the MIDI Tool Set, there is no need to avoid using DOC RAM locations $00 – $FF for general waveform storage. More than one oscillator can play from the same waveform buffer at the same time, so the function of the timer oscillator does not affect normal use of the DOC for sound generation purposes in any way. However, you should not fill the first page of DOC RAM with waveforms that are delimited by zero bytes (as is sometimes appropriate in special situations, discussion of which is beyond the scope of this Note). The presence of zero bytes in the first page of DOC RAM

can cause serious system performance degradation and can even cause the system to hang. In particular, it is always inappropriate to store arbitrary, non-waveform data in the first page of DOC RAM since such data often includes zero bytes (which would be corrupted were you to remove or modify them).

The Apple IIGS MIDI Tool Set also uses bytes $00 – $FF of DOC RAM for timing purposes, but it uses a different oscillator than the Note Synthesizer. If you want MIDI time stamping, you may <u>not</u> use the first page (bytes $00 – $FF) of DOC RAM for your own purposes since the MIDI Tool Set uses the contents of those bytes for time-stamping purposes.

You may use the MIDI, Note Synthesizer, and Note Sequencer Tool Sets together, but you must not use bytes $00 – $FF of DOC RAM for any purpose if using MIDI time stamping, nor store zero bytes in this area when using the Note Synthesizer. You might consider it appropriate to avoid using the first page of DOC RAM, if possible, to facilitate adding MIDI support to your application at a later date.