

8. [ADSP-21161 SIMD SHARC DSP - The 32-bit Processor of Choice for Present and Future Audio DSP](#)
[Appendix - References](#)
[Glossary for some Common A/D and D/A audio converter](#)

0. Overview

Since the introduction of the compact disc in the early 1980s, digital technology has become the standard for the recording and storage of high-fidelity audio. It is not difficult to see why. Digital signals are robust. Digital signals can be transmitted and copied without distortion. Digital signals can be played back without degrading the carrier. Who would want to go back to scraping a needle along a vinyl groove now?

Another advantage of digital audio signals is the ease with which they can be manipulated. Digital Signal Processing (DSP) technology has advanced to such an extent that almost any audio product, from a mobile phone to a professional mixing console, contains a DSP chip. Once again the reasons for the success of DSP are simple: stability, reliability, enhanced performance and programmability. Signal processing functions can be implemented for a fraction of the cost, and in a fraction of the space required by analog circuitry, as well as providing functionality that simply couldn't be done in analog. In fact, so ubiquitous has it now become that, for many people, the word "digital" has become synonymous with "high quality".

The ever-increasing performance and falling cost of DSP hardware have generated new applications and new markets for digital audio in both the consumer and professional audio sectors. Digital Versatile Disk (DVD) and digital surround sound in the home, digital radio and hands-free cellular phones in the car are just a few of the DSP-based technologies which have appeared in the last few years. The demands on the quality, speed and flexibility of DSP has also increased as more functionality is added to DSP products: a DSP might now be required for mixing, equalization, dynamic range compression and data decompression, all in one product, implemented on one chip.

16-bit, 44.1 kHz PCM digital audio continues to be the standard for high quality audio in most current applications such as CD, DAT, and high-quality PC audio. Recent technological developments and improved knowledge of human hearing, however, have created a demand for greater data word lengths. Analog-to-digital converters now available support 18-, 20-, and 24-bits and are capable of exceeding the 96dB dynamic range available using 16-bit data words. Many recording studios now routinely master their recordings using 20- or 24-bit recorders. These technological developments are beginning to make their way into the consumer and "prosumer" audio applications. The most obvious consumer audio impact is DVD which is capable of carrying audio with up to 24-bit resolution at sample rates well above 48 kHz. Another example is a 16-channel digital home studio recorder, capable of sampling at a 96 kHz sample rate with 24-bit resolution. In fact, three trends can be identified which have influenced the current generation of digital audio formats which are set to replace CD digital audio. These can be summarized as follows:

- Higher resolution - either 20- or 24-bits per data word
- Higher sampling frequency - typically 96 kHz and 192 kHz
- More audio channels for a more realistic "3D" sound experience

Low-cost, higher-performance digital signal processors are now appearing on the market to satisfy the high dynamic range requirements for processing or synthesizing audio signals. How many bits are required for processing audio signals? Is it 16, 20, 24, or 32 bits? Does the audio application require fixed-point or floating-point arithmetic? What undesirable side effects of quantization should the audio designer look out for?