1980
Single-chip digital signal processor (NEC)
~ Integrated Circuit ~

As the semiconductor technology advanced, resulting in the advancement of operation speed and integration, signal processors capable of processing the voice band became realized. NEC was ahead of industry to develop and manufacture the digital signal processor, µPD7720, that integrated most of the functions necessary for signal processing. Until this time, in order to perform digital signal processing, it was necessary to assemble separate discrete components such as a high-speed multiplier and a high-speed memory. Especially, a multiplier which multiplied 16 bits in 200ns consumed nearly 10 watts of electric power, and the price was tens of thousands of yen and it was not possible to adopt it for consumer appliances.

This processor could process all 16-bit operations including 16-bit multiplication in 250ns, and reduced the power consumption of the entire processor including ROM and RAM to 1W or less. Also, it adopted an architecture that could directly calculate numerical data expressed in complement of 2.

In general, digital signal processing requires (1) multiplication of data and coefficients, (2) accumulation of multiplication results, and (3) movement of data storage addresses in every sampling period. For example, in order to maintain the quality of a voice telephone, it is necessary to sample the signal every 125µs and finish the operation within this time. In this signal processing processor, various techniques for high speed processing were devised, such as adoption of a high-speed parallel multiplication circuit adopting a secondary booth algorithm as a multiplier, transfer of data and coefficients to a multiplier by a separate bus at the same time, simultaneous processing of multiplication and accumulation, special address circuit for data movement. Also, for applications requiring high reliability, resetting is applied every sampling period in one clock cycle, so it could be applied to applications in which the processors should not freeze.

A general-purpose PCM codec was easily connected to the input and output, so that a signal processing system of the telephone voice band could be easily constructed.

Fig. One-chip Digital Signal Processor µPD7720
(By courtesy of Renesas Electronics)

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