

## 5.1. DIGITAL SIGNAL PROCESSORS

### INTRODUCTION:

A digital signal processor (DSP) is a specialized microprocessor chip, with its architecture optimized for the operational needs of digital signal processing. DSPs are fabricated on MOS integrated circuit chips.

### DSP EVOLUTION:

In the late 1970s there were many chips aimed at digital signal processing; however, they are not considered to be digital signal processing owing to either their limited programmability or their lack of hardware features such as hardware multipliers. The first marketed chip to qualify as a programmable DSP was NEC's MPD7720, in 1981. It had a hardware multiplier and adopted the Harvard architecture. Another early DSP was the TMS320C10, marketed by TI in 1982. Figure 3 shows a selective chronological list of DSPs that have been marketed from the early 1980s until now. From a market evolution viewpoint, we can divide the two and a half decades of DSP life span into two phases: a development phase, which lasted until the early 1990s, and a consolidation phase, lasting until now.

A digital signal processor and microcontrollers are microprocessors that are programmed to execute specific tasks or applications as assigned by their user. Though they are different, they both operate by manipulating a device's binary data. DSP is an abbreviation for digital signal processing. It defines any signal processing that is carried out on an information signal or digital signal, and aims at improving or modifying signals. As such, it is branded by the representation of discrete units like discrete frequency, discrete time and discrete domain signals. DSP features include subfields like radar signal processing, communication signal processing, digital image processing and sensor array processing.

Digital Signal Processors (DSPs) are microprocessors with the following characteristics:

a) Real-time digital signal processing capabilities. DSPs typically have to process data in real time, i.e., the correctness of the operation depends heavily on the time when the data processing is completed.

- b) High throughput. DSPs can sustain processing of high-speed streaming data, such as audio and multimedia data processing.
- c) Deterministic operation. The execution time of DSP programs can be foreseen accurately, thus guaranteeing a repeatable, desired performance.
- d) Re-programmability by software.

Different system behaviour might be obtained by re-coding the algorithm executed by the DSP instead of by hardware modifications. DSPs appeared on the market in the early 1980s. Over the last 15 years they have been the key enabling technology for many electronics products in fields such as communication systems, multimedia, automotive, instrumentation and military.

#### **APPLICATIONS:**

DSPs are fabricated on MOS integrated circuit chips. They are widely used in audio signal processing, telecommunications, digital image processing, radar, sonar and speech recognition systems, and in common consumer electronic devices such as mobile phones, disk drives and high-definition television (HDTV) products.