NTT Develops High-quality MPEG-2 Codec LSI for Embedding in Consumer-oriented Interactive Video Communication Systems

–High-quality codec processing (up to 720/30P) on a single chip enables superior picture quality in home audio/video and mobile systems–

NTT has developed LSI technology for implementing consumer-oriented codec[*1] LSIs (development code: ISIL) that offer high picture quality exceeding that of standard TVs[*2]. Using this new technology, NTT is able to achieve simultaneous processing (full duplex[*3]) for encoding and decoding (compression and decompression) of high-quality progressively scanned pictures at 480/60P in conformance with MPEG-2[*4] standards. In the past, this level of processing required the use of several specialized chips. NTT's single-chip design is unprecedented anywhere in the world. In the case of half-duplex[*3] processing —that is, processing of only encoding or decoding— the new chip can handle high-quality pictures up to 720/30P.

The recently developed chip achieves both high performance and flexibility to accommodate video formats for a variety of applications, as well as video communication systems. The chip's design aims for low cost and low power consumption (less than 1.5 W), making it ideal for a wide range of consumer systems. It can be embedded in home digital video cameras, interactive video communication terminals, and mobile codec systems, contributing to the progress of a high-quality video environment that offers picture quality surpassing that of standard TVs. This will in turn promote the development of diverse and interactive consumer-oriented contents, and enable a rapid acceleration in the establishment of a high-quality visual communication society.

Background to development

For some time now, NTT Cyberspace Laboratories have been working on the development of a chip (called SuperENC) that enables encoding of standard TV signals, as well as a very small MPEG-2 encoder PC card with this SuperENC, which is only the size of a business card. The goal of these development activities is to provide high-quality video communication and other services that make use of broadband networks.

With the arrival of the "true era of broadband," there has been a growing need for MPEG-2 codec LSIs that offer high quality exceeding even that of standard TVs. These LSIs must also be inexpensive, operate with low power consumption, and allow integration into a variety of consumer-oriented systems, so as to promote the creation and distribution of high-quality video contents.

Keys to related technologies

(1) Full-duplex codec processing of 480/60P on a single chip (Fig. 1)

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*1 Codec (coder and decoder): A codec contains the functions of both an encoder (to compress video and audio data into a specified stream) and a decoder (to decompress that video and audio data from the stream). Because digital video and audio use huge volumes of data, it is important to use an appropriate codec when compressing data.

*2 High picture quality exceeding that of standard TV: Refers to video formats that improve the quality of video. Conventional formats for standard TV use an interlacing of 480 active scanning lines (480I) at a frame rate of 30 frames per second. In contrast, these methods utilize a progressive scanning format that achieves smoother moving pictures by either doubling the frame rate to 60 frames per second (480/60P) or increasing the number of effective scanning lines by 50% (720/30P).

*3 Full duplex, half duplex: Simultaneous execution of encoding (compression) and decoding (decompression) processing to enable both one-way and interactive applications. Half-duplex refers to one-way applications using only one of these processes.

*4 MPEG-2 (Moving Picture Experts Group-2): MPEG is an international standard related to the compression of video signals. MPEG-2 is a standard encoding method for high-quality video, including HDTV and other TV images, and is also used for DVD and digital TV broadcasting.

A huge amount of calculation is required in both the encoder and decoder in order to execute full-duplex processing of 480/60P. To achieve this on a single chip, NTT embedded in the chip an encoder core[*5] and a decoder core[*5] that operate independently, and developed a dual memory scheme for supplying data to each of these cores independently at high speeds. This facilitates simultaneous operation of the encoder and decoder, supporting a broader range of applications that include not only one-way communications but also interactive communications. The 30 million transistors required for these types of applications have been integrated into the same single chip using commercial 0.13-µm CMOS technology[*6].

(2) Hardware and software co-design ensures lower power consumption and lower cost, and enables easy integration in various codec systems (Fig. 2).

Establishing an optimum balance of roles between hardware and software components, this LSI executes codec processing for high quality exceeding that of standard TV with a power consumption of less than 1.5 W. Besides handling the standard TV format (480I)[*2], it copes flexibly with the high-quality video standards of 480/60P and 720/30P formats. Furthermore, because the chip features a built-in audio encoder/decoder and multiplexer/demultiplexer[*7], it can be easily incorporated into a variety of high-quality mobile codec systems by adding simple AD/DA converters[*8], stream I/O circuits, or other simple external circuits, for use in a wide range of consumer applications.

Future developments

In keeping with the rapidly advancing broadband era, from spring 2003 NTT will incorporate this ISIL
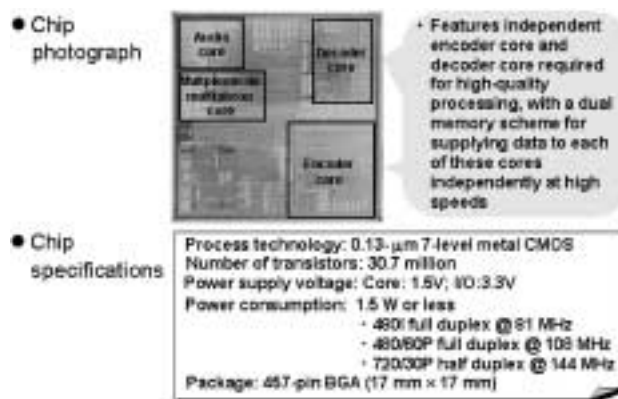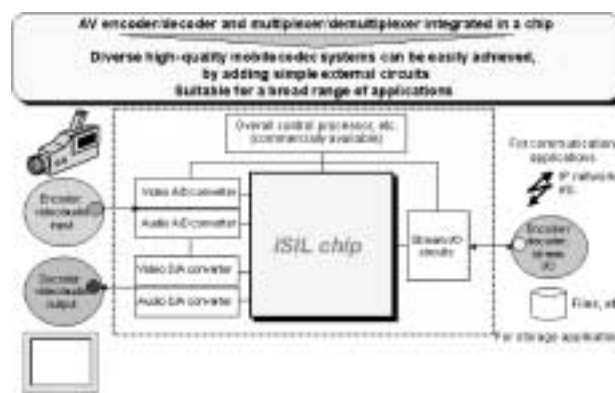

Fig. 1.   Outline of the ISIL chip.

Fig. 2.   Typical codec system configuration using the ISIL chip.

chip into a variety of ubiquitous mobile codec systems, including consumer-oriented video cameras and video communication terminals. It will promote the commercialization of these devices, aiming to promote and popularize applications such as TV phones and teleconferencing using high-quality pictures surpassing that of standard TV, thus contributing to the expansion of optical fiber networks. This chip will be marketed by NTT Electronics Corp. under the name SuperENC-III. In order to develop diverse services in the future using optical networks, NTT will continue its efforts to achieve further miniaturization and greater quality in the ISIL chip, and to develop next-generation codec technologies to accommodate a wide range of new functions.

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*5 Encoder core, decoder core: These are the basic components used in MPEG-2 video encoding and decoding processing; they compress or decompress video signals on the LSI chip.

*6 0.13-µm CMOS: CMOS (Complementary Metal Oxide Semiconductor) is a method of fabricating semiconductors that exhibit high speed and low power consumption. Nearly all current semiconductors, from CPUs to memory chips, are manufactured using the CMOS process. The value of 0.13 µm, which represents the minimum circuit width, is the most advanced commercially available process technology for mass production.

*7 Multiplexer/demultiplexer: A multiplexer is a device that combines compressed video and audio data into one output stream (transport stream or program stream) in conformance with the MPEG-2 standard. The demultiplexer executes the reverse process.

*8 AD/DA converter: A device that converts analog signals into digital ones and vice versa.