H.32x VideoPhone

VIDEOPHONE, VIDEOCONFERENCING AND MULTIMEDIA

OVERVIEW

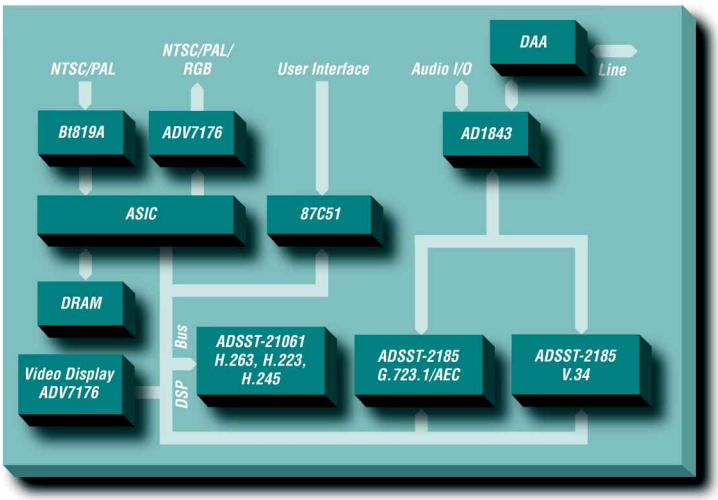
The H.32x VideoPhone reference design delivers videophone, videoconferencing and multimedia capabilities to any set-top box or telephone over analog POTS telephone lines. The H.32x VideoPhone performs all video compression and decompression and system control functions on its included SHARC® floating-point 32-bit digital signal processor (DSP), all audio compression and decompression on its included fixed-point DSP, and V.34 modem communications on a second fixed-point DSP.

The reference design includes a board, software modules and development tools to enable designers (as part of its chipset software, which consists of standards-compliant audio, video, telephony and system control algorithms) to add videophone capabilities to any telephone or television. The H.32x VideoPhone provides advantages that proprietary, ASIC-based systems cannot match.

The H.32x VideoPhone performs the audio and video compression and decompression, acoustic echo cancellation, standards-compliant processing of audio, video and telephony algorithms and programmable multimedia support for MPEG I and II Audio Layers I and II, Dolby Digital (AC-3) and high-end audio and system control functions. The hardware components consist of Analog Devices' DSPs and media codecs for real-time application implementation.

HIGHLIGHTS

- Compliance with H.324 for POTS Videoconferencing
- Supports H.223 Mux/Demux, H.245 Control Protocol
- Supports G.723.1 at 6.3/ 5.3 Kbps
- Includes 100 ms of Acoustic Echo Cancellation
- Supports H.263 for up to 4CIF Resolution
- Built-in V.34 Datapump
- Optional Data Port
- Programmable Support for MPEG I and II Audio, Dolby™ Digital and High-End Audio for Multimedia Applications



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VideoPhone, Videoconfe

The H.32x VideoPhone design complies with the H.324 standard for POTS videoconferencing over analog telephone lines. The H.32x VideoPhone architecture includes a high degree of hardware and software integration to reduce system cost as well as a reprogrammable media and communications architecture that can be upgraded to newer design implementations in the future.

H.263 Video Codec

The input video signal is digitized and converted to 4:2:2 YCbCr format by the video decoder. The Video I/O processor transfers the image into the DRAM using its internal DMA channel.

Frame acquisition is under the control of the video codec, which determines whether or not a frame is to be acquired. Frames can be captured in either 4CIF (still image mode only), CIF or QCIF formats for H.263 encoding. The codec can dynamically switch between any of these formats.

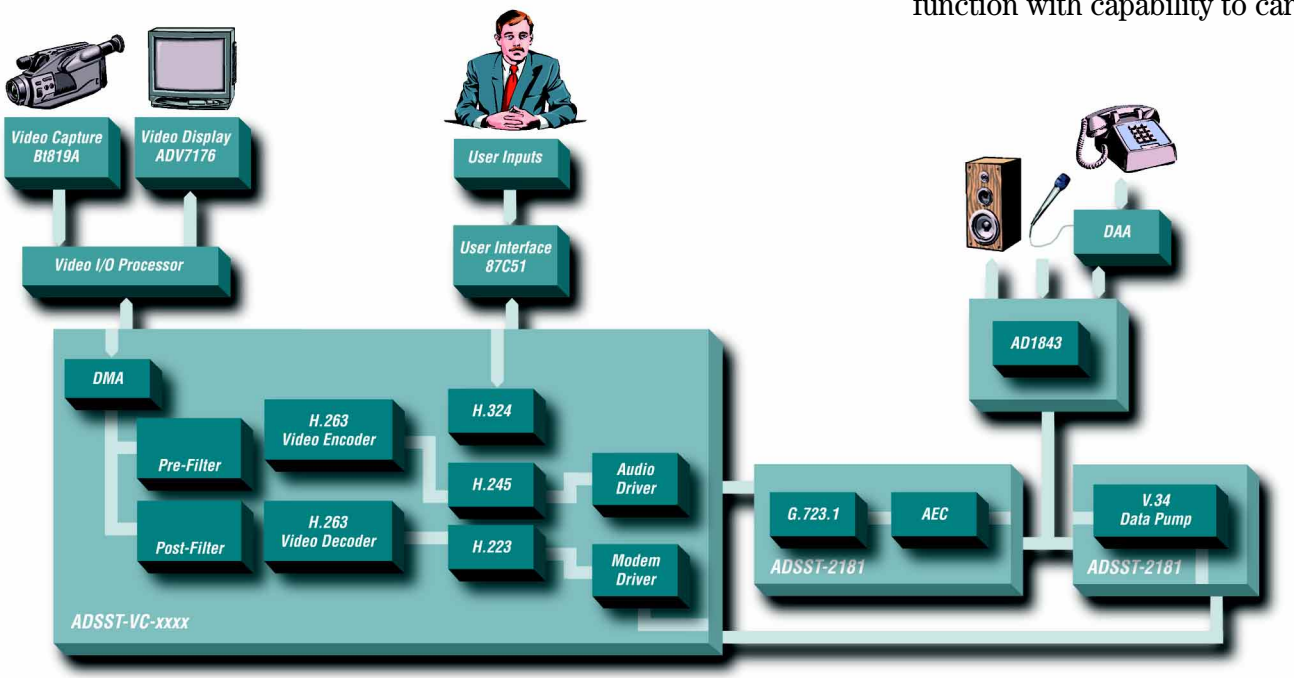
The H.263 encoder transfers a frame, on a macroblock-by-macroblock basis, using one of the on-chip DMA channels into the internal memory before processing. The encoder section includes dynamically selectable temporal and spatial filters to enhance the performance of the codec.

The codec also includes an optimized motion detection and estimation algorithm that achieves an optimum compromise between computational complexity and performance.

At the output of the decoder, the reconstructed video is transferred to the Video I/O processor using one of the on-chip DMA channels. The Video I/O processor then scales up the image before outputting to NTSC/PAL encoder device. The decoder section includes dynamically selectable post filters to reduce artifacts due to blocking and "mosquito" effects.

G.723.1 Audio Codec

Of the two ADSP-2185 DSPs, one implements the G.723.1 audio codec and acoustic echo cancellation. The G.723.1 implementation includes a Voice Activity Detection (VAD) module that enables silence suppression and comfort noise insertion. The echo cancellation module is a scaleable function with capability to cancel



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acoustically coupled echoes with up to 400 ms of delay.

Protocols

H.223 and H.245 are the ITU standards for multiplexing and handshake protocols meant to be used in an H.324 system. In addition to supporting audio and video channels, the implementation also supports a data channel that can be used for a variety of custom applications. In remote security/monitoring applications, this channel can be used for secure communications by using an encryption standard over it. The channel can also be used for remote software upgrade. Since the data channel is part of H.324, software upgrades can be obtained directly from other users of similar equipment, without having to call a dedicated server. In addition to the protocols, the design also incorporates an HDLC interface with the modem.

V.34 Data Pump

The second ADSP-2181 implements the V.34 data pump. A single, dual-channel codec – the AD1843 is used in a TDM mode as the analog front end interface for speech as well as modem signals. The design includes the DAA circuitry for direct phone line connection.

Telephony Functions

The design also supports most telephony functions like Speakerphone and Caller ID. This enables design of products that can be used as normal telephones with CID, Speakerphone and digital answering machine features. If the caller has an H.324 videophone, the call can then be switched into an audio and video call.

The design also supports DTMF encode and decode functions, enabling the design of products that do not need any extra hardware like keypads to implement user interface. A regular telephone can be connected directly to the unit and its keypad can be used for user interface. These functions also enable the implementation of video mail features.

User Interface

A glueless 8-bit microcontroller interface is included in the design to implement a flexible user interface and text/display control. The architecture enables OEMs to easily customize the man/machine interface. For example, a remote control interface could substitute the keypad interface and new fonts/scripts could be added to enhance text/menu display. The design also includes an optional Data Port to increase connectivity to the outside world. This functionality, for example, enables users to dump a high resolution image, that has been received or simply grabbed, to a computer hard disk.

By incorporating data channel support, the multiplex layer enables transmission of data along with audio and video, enabling only authorized users to call into the remote unit, through the use of a password, when the VideoPhone is used in a security/monitoring application. To accommodate changes in standards (H.320, for example, was approved in the late 1980's, but is still being tweaked) as well as future applications not yet written software updates must be handled remotely. The H.32x VideoPhone accommodates future software with an API that uses the data channel to exchange information, two FLASH memories and a design that transfers information simultaneously with audio and video calls. The telephone connection to the H.32x VideoPhone uses the existing telephone keypad as the user interface to enable OEM customization.

The design supports an easy to use API to control the videophone module. All useful parameters that control the video, audio, modem and data channel can be controlled and monitored through this interface. OEMs can develop software upgrade utilities by using the flash management and upgrade utility functions, which are accessible through the API.

H.32x VideoPhone

H.32x VideoPhone Specifications

FUNCTIONAL SPECIFICATIONS

System Control

- H.223 for Multiplex and Demultiplex
- H.245 for Control Protocol
- Remote Software Upgrade
- Data Channel

Video Codec

H.263, Source Formats: SQCIF, QCIF, CIF and 4CIF

Performance:

SQCIF: 20 fps
QCIF: 15 fps
CIF: 5 fps
4CIF: Still Images

- Motion Estimation
- Half-Pixel Interpolation
- Optional Error Correction
- Dynamically selectable pre- and post-filters

Audio Codec

- G.723.1 @ 5.3/6.3 Kbps
- Voice Activity Detection
- Optional Post-Filter

Acoustic Echo Cancellation

100 ms

Communications

V.34 Data Pump (33.6 Kbps)

Telephony

- Speakerphone
- Caller ID
- DTMF Encode/Decode
- Telephone Interface

Application Areas

- Set-Top Videoconferencing
- Telephone Videoconferenciing
- Security/Surveillance
- Distance Learning
- Video Mail
- Telemedicine

HARDWARE SPECIFICATIONS

Processing Engines

- ADSP-21061 @ 40 MIPS for Video Codec and System Control
- ADSP-2181 @ 33 MHz for Audio Codec and Acoustic Echo Cancellation
- ADSP-2181 @ 33 MHz for V.34 Data Pump

External Memory

Up to 512 k/256 k × 32, 50 = 60 ns DRAM
5 Cycles Page Miss
2 Cycles Page Hit
Refresh: CAS before RAS
64 k × 48 SRAM
0 Wait States

ADSP-2181 Interface

- 16-Bit IDMA Port Access
- Core Access or DMA Access
- 2 Cycle Index Address Write
- 2 Cycle Data Read/Write
- Synchronous Serial Interface to ADSP-21061
- Interrupt Driven Communications

Video Display

Encoder: ADV7176
Output: NTSC/PAL/RGB/S-Video/YUV
Input: CCIR-601/656 16-Bit
Programmable Luma Filters
Square Pixel Support
Interlaced/Noninterlaced Operation
Master/Slave Operations Supported
Full Screen, Half Screen, Quarter Screen

Audio I/O

Controller: AD1843 SoundComm
Inputs: Microphone – 1 Channel for Dynamic or Condenser Microphone
Outputs:
Speaker – 1 W @ 8 Ohms
Modem Support V.32 bis, V.34
Sampling Rates: 4 KHz to 54 KHz
Gain: Programmable
Attenuation: Programmable
Mute: Programmable
Host Interface: TDM Serial Master Mode to SPORT of ADSP-2181

Video Capture

Input: PAL/NTSC Composite
Video 1: RCA Phono Input
Scaling – Horizontal: 6 TAP Interpolation
Scaling – Vertical: 2 TAP Interpolation
Picture Control: Programmable Brightness, Contrast, Hue, Saturation, Luma Decimation Filter
Control Interface: I²C®

Ordering Information

Designers of products using this reference design and software must order the product under the product line ADSST-VC-xxxx and will be required to sign a license agreement.

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