

H.324 VidComTM

VIDEOPHONE, VIDEO COMMUNICATIONS, AND MULTIMEDIA



OVERVIEW

The H.324 VidCom reference design delivers videophone, video communications, and multimedia capabilities to any set-top box or telephone over analog POTS telephone lines. The H.324 VidCom 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.

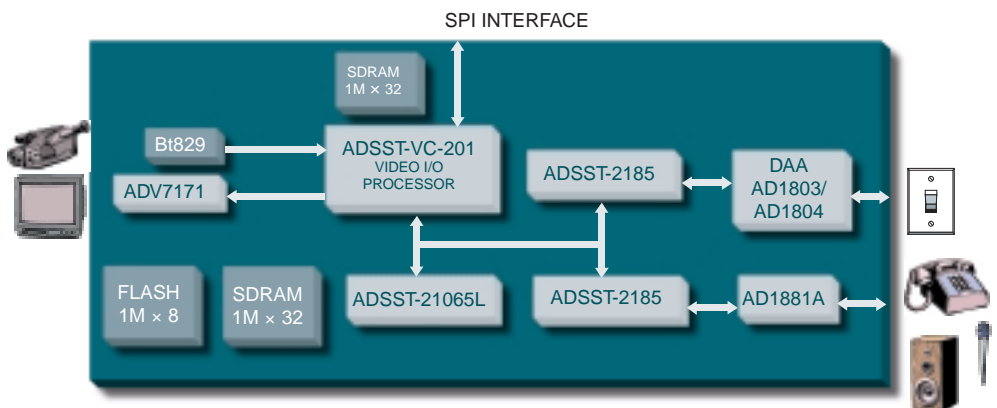
The reference design includes a board, software modules and development tools to enable designers (as part of its chipset software, which consists of standards-compliant audio, video, telephony and system control algorithms) to add videophone capabilities to any telephone or television. The H.324 VidCom provides advantages that proprietary, ASIC-based systems cannot match.

The H.324 VidCom 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 MPEG1, MPEG2, and MP3 Audio Layers I and II, Dolby[®] Digital and high-end audio and system control functions. The hardware components consist of Analog Devices' DSPs and media codecs for real-time application implementation.

The H.324 VidCom design complies with the H.324 standard for POTS video communications over analog telephone lines. The H.324 VidCom 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.

HIGHLIGHTS

- Compliance with H.324 for POTS Video Communications
- Supports H.223 Mux/Demux, H.245 Control Protocol
- Supports ITU Standard 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
- Support for MPEG1 and MPEG2 Audio, Dolby[®] Digital and High-End Audio for Multimedia Applications, browser, email, and audio/video mail
- Supports high-resolution graphics (1024x768) with video overlay and chroma keying



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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 SDRAM 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.

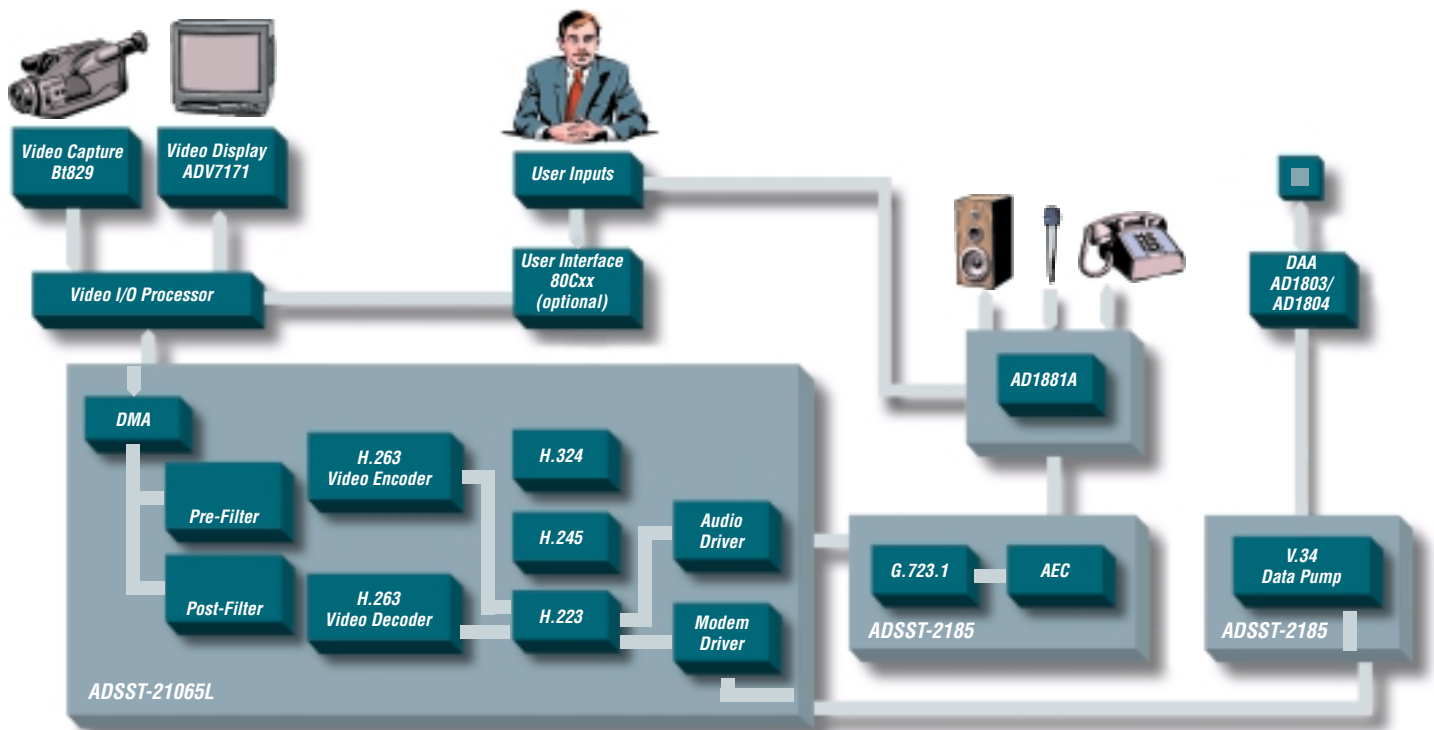
The codec also includes an optimized motion detection and estimation algorithm that achieves an optimum compromise between computational complexity and performance.

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 ITU standard 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 acoustically-coupled echoes with up to 400 ms of delay.



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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 upgrades. 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-2185 implements the V.34 data pump. The AD1803 codec is used as the analog front end interface for the modem signals. The design includes the DAA circuitry for direct phone line connection.

Telephony Functions

The design also supports most telephony functions such as 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

The H.324 VidCom software architecture enables OEMs to easily customize the man/machine interface. All the different modules in the videophone can be controlled through a flexible API by an OEM application that runs above the API. A sample application is provided as part of the design.

The ADSST-21065L runs the software to render the high resolution graphics and the built-in anti-aliased English fonts on the display device. All the graphics and font display functions can be accessed via the APIs. A very flexible and easy-to-customize navigation module is also included for OEMs to design and implement a user interface "tree." Other language fonts can also be supported.

Local user inputs can be fed into the system via either, or a combination of, two mechanisms. Any micro-controller can be interfaced to an alphanumeric keypad (or any other input mechanism) and connected to the system via the SPI bus and/or the built-in DTMF decoder running an ADSST-2185 can be used to detect inputs fed through the phone keypad. In

either of the two cases, only the key press is transmitted to the ADSST-21065L which takes care of interpreting and implementing the action. A sample application running on the micro-controller along with the reference schematic (using 8-bit micro-controller), is also provided as part of the package. Using the data channel and/or the H.245 messaging feature the system can respond to remote user inputs as well.

API Functions

A flexible and easy-to-use set of API functions are part of the software to enable OEMs to customize the system and its man/machine interface. Through the APIs the application can configure the various settings of the audio, video, and other system related parameters. For example, the audio APIs allow the application to control the input and output levels, while the video APIs allow control over brightness, contrast, resolution, quality, etc.

At a system level, password controlled access to a remote unit (for remote surveillance) can be provided. Cameras can be controlled remotely for Pan, Tilt, and Zoom (PTZ) functions and four cameras can be viewed simultaneously on a single display device. OEMs can also develop applications to facilitate remote software upgrades via the flash management APIs.

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H.324 VidCom 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
- Call Progress Tone Detection

Application Areas

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

HARDWARE SPECIFICATIONS

Processing Engines

- ADSP-2105L @ 60 MIPS for Video Codec and System Control
- ADSP-2185 @ 52 MIPS for Audio Codec and Acoustic Echo Cancellation
- ADSP-2185 @ 52 MIPS for V.34 Data Pump

External Memory

Flash: 1Mx8

SDRAM (Local): 1Mx32

SDRAM (Frame): 1Mx32

Video Display

Encoder: ADV7171

Output: NTSC/PAL/RGB/S-Video/YUV

Input: CCIR-601/656 8-Bit

Programmable Luma Filters

Square Pixel Support

Interlaced/Noninterlaced Operation

Master/Slave Operations Supported

Full Screen, Half Screen, Quarter Screen

Audio I/O

Controller: AD1881A SoundComm

Inputs: Microphone – 1 Channel for Dynamic or Condenser Microphone

Outputs:

Speaker – 1 W @ 8 Ω

Sampling Rates: 4 kHz to 54 kHz

Gain: Programmable

Attenuation: Programmable

Mute: Programmable

Host Interface: TDM Serial Master Mode to SPORT of ADSP-2185

Video Capture

Input: PAL/NTSC Composite with up to four cameras

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[®]

Solid-State DAA

- AC'97 or DSP Style Serial Interface
- Supports all Modem/Fax Standards up to V.90
- Software Programmable DAA Compliant with U.S. and International PTT Standards

Ordering Information

Designers of products using this reference design and software must order the product under the product line ADSST-VC-4200 and will be required to sign a license agreement.



<http://www.analog.com/solutions>

SHARC is a registered trademark of Analog Devices, Inc.; Dolby is a trademark of Dolby Laboratories Licensing Corporation;

I²C is a registered trademark of Philips Corporation.

EUROPE HEADQUARTERS

Am Westpark 1-3
D-81373 München, Germany
Tel: 089/76 903-0; Fax: 089/76 903-157

JAPAN HEADQUARTERS

New Pier Takeshiba, South Tower Building
1-16-1 Kaigan, Minato-ku, Tokyo 105-6891, Japan
Tel: (3) 5402-8200; Fax: (3) 5402-1063

SOUTHEAST ASIA HEADQUARTERS

4501 Nat West Tower, Times Square
Causeway Bay, Hong Kong, PRC
Tel: (2) 506-9336; Fax: (2) 506-4755

WORLDWIDE HEADQUARTERS

One Technology Way, P.O. Box 9106
Norwood, MA 02062-9106, U.S.A.
Tel: 781-461-3483, 800-262-5643 (U.S.A. only);
Fax: 781-461-4360
email: systems.solutions@analog.com
Worldwide Website:
<http://www.analog.com/solutions>

