

Bt835

Digital Video Decoder

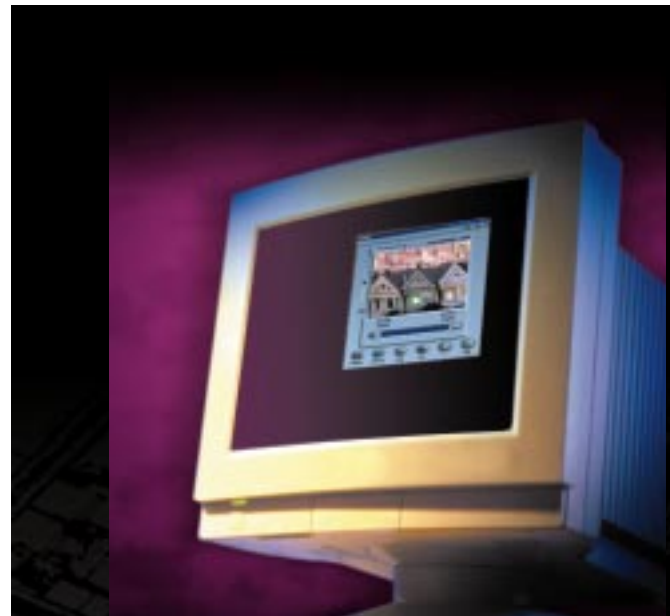
Integrated VideoStream III
Video Capture Processor for TV/VCR
Analog Input and VBI Data Decoding

Conexant's Bt835 video capture processor is a single-chip decoding and filtered scaling solution for analog NTSC/PAL/SECAM base-band signals from TV tuners, VCRs, cameras, and other sources of composite or Y/C video. The Bt835 is the first video capture solution for low-cost PC video/graphics systems to deliver total integration of the video digitization, synchronization, 2H adaptive Y/C separation, scaling and VBI data passthrough functions. Using mixed signal and DSP circuitry, the Bt835 converts an analog composite video waveform into a scaled digital video stream while supporting a variety of video formats, resolutions and frame rates.

Optimized for PC Video Capture

The Bt835 provides the most cost-effective, high-quality video input solution for low cost PC multimedia subsystems, which integrate both graphics acceleration and video capabilities on one add-in card or the PC motherboard itself.

The Bt835 minimizes the cost of the video capture function integration in a number of ways. First, recognizing that YCrCb to RGB color space conversion is now a standard feature of multimedia controllers for acceleration of digital video playback, the Bt835 avoids redundant functionality and allows the downstream controller to perform this task.



Distinguishing Features

- Single-chip composite/S-video NTSC/PAL/SECAM to YCrCb digitizer
- On-chip Ultralock™
- Square pixel and CCIR601 resolution for NTSC, PAL (B, D, G, H, I, M, N, N combination, OO) and SECAM
- 2H adaptive comb filtering (NTSC)
- Single crystal for all video formats



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Secondly, the Bt835 integrates a multi-tap filtered video downscaler, which enables the video controller to accept a high-quality user scaled image with no further video processing. Finally, the Bt835 minimizes the number of interface pins required by a downstream multimedia controller — keeping package costs to a minimum.

Analog Video Input Interface

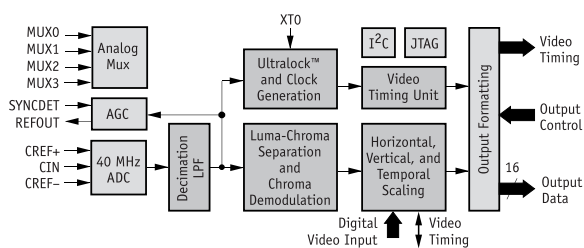
The Bt835 supports composite and S-video sources in NTSC, PAL and SECAM video formats. Four composite, or three composite and one S-video sources are selected through an on-chip 4:1 analog multiplexer. The Bt835 integrates two flash Analog-to-Digital Converters (ADCs) which provide high-performance 8x oversampling of the NTSC/PAL color subcarrier. Oversampling of the analog signal enables simple external anti-aliasing filters to be implemented (if required) and enhances digital filtering performance on-chip.

Clock generation is provided by a low-cost crystal. The Bt835 needs only one 14.318 MHz crystal for NTSC, PAL and SECAM operation. The onboard PLL multiplies this frequency to 28.64 MHz for NTSC and 35.48 MHz for PAL/SECAM, for 8x Fsc sampling of the baseband video signal. The fixed, integral relationship between the subcarrier frequency (Fsc) and the

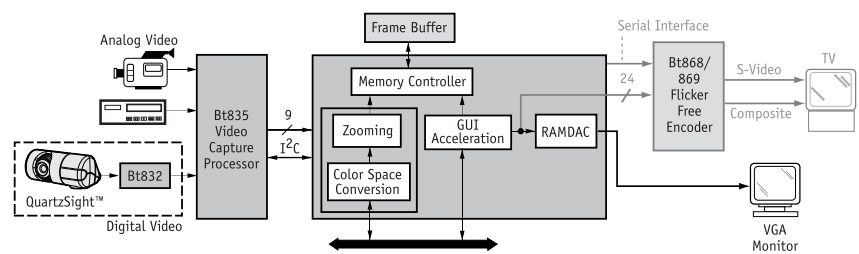
sample rate optimizes the performance of the downstream Y/C separation and minimizes the cost of implementation. The Bt835 also incorporates auto-format detect capability through which it can sense the presence of an NTSC or PAL video source on the input after power up and configure itself accordingly for correct decoding of the video.

Ultralock™

Employing Conexant patented Ultralock technique, the Bt835 achieves both horizontal and subcarrier synchronization to the incoming analog video signal. It will always generate the required number of pixels per line from an analog source in which the line length can vary by as much as a few microseconds. Ultralock's digital locking circuitry enables the Bt835 to quickly and accurately lock on to video signals, regardless of their source. Since the technique is completely digital, Ultralock can recognize unstable signals caused by VCR headswitches or any other deviation and adapt the locking mechanism to accommodate the source. Ultralock uses non-linear techniques that are difficult, if not impossible, to implement in genlock systems. Unlike linear techniques, it adapts the locking mechanism automatically. This removes the requirement to reset the locking range of the genlock circuit, which other video decoding technologies impose to accommodate the type of source being used in a particular system setup.



Bt835 block diagram



Video/graphics system



Digital Video Output Interface

The output pixel port of the Bt835 can be configured in a variety of flexible formats to support many different system implementations. The video pixels are delivered as a continuous video stream running at a 4x Fsc rate which is synchronous to the ADC sample clock. Both YCrCb and YUV 4:2:2 pixels can be provided over an 8- or 16-bit data bus. Three clock signals are provided for the system interface: CLK x 1 and CLK x 2, which operate at 4x Fsc and 8x Fsc respectively; and QCLK, which can be configured to be a pixel load clock for a downstream video controller. Both data and clock operate at 2x the video pixel rate when the pixel port is configured in an 8-bit-wide mode. The Bt835 also has the capability of embedding the video control signals in the digital pixel stream in either ViP mode or ByteStream mode. The video field/frame synchronization signals and others are coded into the pixel data stream using out-of-range luminance and chrominance data values. This feature eliminates the requirement for the downstream video controller to allocate pins to receive video control signals from the Bt835.

The Bt835 features a digital video input interface where any digital video stream from sources such as a MPEG-II decoder or a digital camera with 8-bit YCrCb outputs can take advantage of the Bt835's sophisticated video scaler and color control circuitry. CCIR656 inputs and 8-bit YCrCb data with external syncs are supported.

Vertical Blanking Interval Data Capture

The Bt835 provides a complete solution for capturing and decoding Vertical Blanking Interval (VBI) data by operating in a VBI line output mode, in which the VBI data is only captured during select lines. This mode of operation enables the concurrent capturing of VBI lines which contain ancillary data and the processing of normal video image data.

In addition, the Bt835 supports a VBI frame output mode, in which every line in the video frame is treated as if it were VBI line data. This mode of operation is designed for use with still frame capture/processing applications.

What is a Video Decoder?

A video decoder is a chip that allows live video from a television broadcast, a video tape or a camera to be brought into a PC or a settop box. To accomplish this, the chip must first track the video signal, digitize it, separate out the brightness and color information from the signal, and send the digital ones and zeros representing the video signal to the PC's video subsystem. Once captured, the digital bits representing the video image can be manipulated for many exciting video-related applications. These include: Microsoft's WebTV™ for Windows, which allows users to watch the news on their PCs while working in other applications; editing camcorder tapes; receiving broadcast data, such as stock pricing; recording sequences of video for playback at a later time; sending video email; and many other possible applications, limited only by the user's imagination.

With the increasing popularity of video-based applications, and the affordable cost of video decoders, many graphics add-in board companies are adding video decoders to their 2D/3D boards, offering an array of exciting features and applications to their products. Because all 2D/3D graphics controllers support an interface for a video decoder, more and more PCs are expected to offer video capture features by taking advantage of Conexant's performance-leading video decoders.

Scaling

The Bt835 integrates a high-quality comprehensive scaler for image downsizing. The scaling factor is selectable to be arbitrary and independent in X and Y dimensions with minimum scaling factors of 0.071 in X and Y. This enables full-resolution video to be reduced to any size down to icon resolution. The video can be optionally band-limited using a digital low-pass filter prior to scaling to minimize aliasing artifacts induced by the scaling process. Horizontal scaling is implemented through a six-tap 32-phase interpolation filter. Vertical scaling is performed with a multi-tap eight-phase interpolation filter. In addition to scaling, the video image may be cropped to an arbitrarily sized window.

Y/C Separation

Y/C separation involves extracting the luminance (Y) and the chrominance (C) components from the composite information. This is followed by quadrature demodulation to generate the baseband components (I and Q for NTSC or U and V for PAL) from the chrominance signal. The Bt835 implements an adaptive 2H comb filter to separate the chrominance from the luminance while maintaining full vertical resolution and eliminating “hanging dots” for the best possible NTSC Y/C separation. For PAL/SECAM video, the Bt835 uses a notch/chroma comb filter. The Bt835 also provides hue, saturation, brightness and contrast controls — providing end users with the flexibility to adjust the decoded image’s appearance.

Host Interface

Bt835 register access is implemented using I²C, which is a serial two-wire interface (one data pin and one clock pin). The Bt835 behaves as an I²C slave with a data transfer rate of 100 Kbps.

Product Features

- Single-chip composite/S-video NTSC/PAL/SECAM to YCrCb digitizer
- On-chip Ultralock™
- Square pixel and CCIR601 resolution for NTSC, PAL (B, D, G, H, I, M, N, N combination, OO) and SECAM
- 2H adaptive comb filtering (NTSC)
- Single crystal for all video formats
- High quality horizontal and vertical filtered scaling
- Closed caption decoding
- Vertical blanking interval data passthrough
- Programmable temporal decimation for a reduced frame-rate video sequence
- Programmable hue, brightness, saturation, and contrast
- 8x Fsc sampling to simplify external analog filtering
- Two-wire I²C bus interface

- 8- or 16-bit pixel interface
- YCrCb (4:2:2) output format
- Software selectable four-input analog mux
- 8 fully programmable GPIO pins
- Auto NTSC/PAL format detect
- Automatic gain control
- User programmable peaking filter
- 3.3V I/O mode
- IEEE 1149.1 (JTAG) interface
- 100-pin PQFP package

Applications

- Multimedia
- Image processing
- Desktop video
- Video phone
- Personal video conferencing
- Interactive video

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