

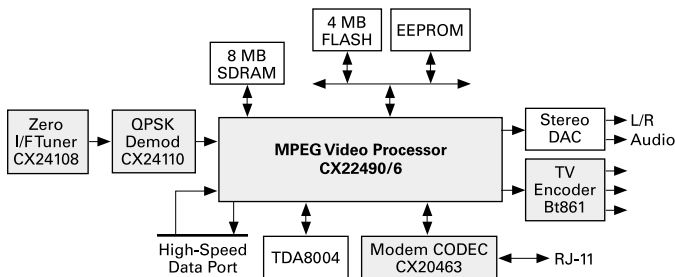


# Interactive TV Decoders

## CX22490/22496

### Single-Chip Interactive TV Solutions

Conexant's interactive TV decoder products provide complete system solutions for the core electronics of high-performance set top boxes deployed in digital satellite, cable or terrestrial TV networks. The CX22490 and CX22496 offer an advanced, embedded 32-bit RISC CPU, an MPEG-2 audio/video decoder and 2D graphics performance. This combination enables consumer electronics manufacturers to build low-cost digital TV set top boxes to support a wide range of advanced, interactive, consumer entertainment services.



**CX22490/22496-based set top box system**

The CX22490 and CX22491 combine an MP@ML MPEG-2 video decoder, a digital audio decoder, a programmable MPEG-2/DVB/ATSC/DSS transport stream demultiplexer, a high-speed 2D graphics rendering engine, and an advanced display compositing engine with a high-performance, embedded 32-bit 175 MIPS ARM940T RISC processor and integrated peripheral I/O ports. These second-generation interactive TV decoders share a common core feature set. The CX22490 adds USB and IDE multiword DMA support to the core features, while the CX22496 adds NDS CA hardware support.



### Distinguishing Features

- MPEG-2 A/V decoding, Dolby Digital decoding
- Dedicated RISC-based transport stream processor
- High-performance 32-bit 175 MIPS integrated CPU (ARM940T)
- High-performance 2D graphics rendering acceleration
- Multiplane video/graphics compositing and display engine
- High-performance unified memory controller architecture
- Full suite of set top peripheral I/O interface controllers

# Interactive TV Decoders

## CX22490/22496

### Fast CPU and Graphics

The CX22490/22496's powerful 32-bit RISC processor and advanced video/graphics display controller provide a platform ideally suited to support Internet access and interactive multimedia applications. The CPU core easily handles computationally intensive host signal processing tasks for Internet applications, such as codecs for streaming audio, Internet telephony, speech and video. Additionally, the CX22490/22496 provides ample CPU processing power to support implementation of a complete, low-speed modem datapump and controller in software.

### Low-Cost ICs for Entry-Level Interactive TV

Conexant's interactive TV decoders feature all the major subsystems required to implement the core system and decoder electronics of a digital interactive TV set top box. This includes an MPEG-2 A/V decoder (Dolby Digital audio is optional), a 32-bit RISC CPU, a 2D graphics accelerator, a video/graphics display compositing controller and a set of peripheral I/O ports for set top box front and back panel connectors. For a complete system hardware design, you only need to add a TV encoder, tuner/demodulator, modem codec, audio DAC, SDRAM and flash memory ICs.

This high level of system-on-chip integration delivers the low-cost system bill of materials sought after by mainstream digital, multichannel TV operators. At the same time, our ICs offer an advanced hardware capability for entry-level interactive or enhanced TV.

Entry-level interactive TV lets viewers do more than just watch programs. It upgrades the TV's user navigation interface from a simple Electronic Program Guide (EPG) to a more sophisticated application for both digital TV programming and enhanced information services. The services typically offered include local news and weather, interactive advertising and simple games.

An enhanced TV set top box requires more memory than a basic box for TV viewing. Conexant's interactive TV decoders feature an innovative, unified memory architecture that reduces memory costs by servicing all system requirements in a single, flexible, external 4 MB SDRAM buffer. System hardware costs are further minimized by implementing analog modem return path functionality in software running on the 175 MIPS embedded ARM940T CPU. This embedded CPU offers ample resources to power a 2,400-baud software modem datapump and controller, in addition to servicing all interactive TV system requirements.

### Expandable to Advanced Interactive Set Top Box Platform

Moving beyond the entry level, many operators are offering a "walled garden" suite of truly interactive online applications accessible through the TV. They deliver services using both the digital broadcast stream and an analog telco modem, typically V.34 or V.90. Interactive applications for this class of platform include banking and shopping from home, and possibly limited Internet access and e-mail



capabilities. Conexant's interactive TV decoders offer CPU and graphics performance ideally suited for such mid-range interactive TV set top boxes, in which a system can be implemented using 8 MB or 16 MB of SDRAM, depending on the functionality desired. Conexant's powerful video/graphics display compositing engine supports up to six independent image planes to enable the rich visual interface required for simultaneous TV viewing and application interaction. In addition, Conexant's 2D graphics rendering engine can composite an unlimited number of graphics planes with transparency into a single displayable OSD plane.

More advanced interactive systems on high-bandwidth cable networks go even further. They offer full Internet access, including Web browsing, e-mail and chat applications. Conexant's architecture scales up to satisfy the requirements of this computer-centric set top box model with a high-performance, 133 MHz, 32-bit SDRAM memory controller and a 160 MHz, 32-bit CPU providing 160 MIPS dedicated to OS and application execution.

A high-performance 2D graphics rendering engine accelerates 8/16/32bpp graphics screen updates to support multiple overlapping graphics screen surfaces. The display-compositing engine enables picture-in-graphics, flicker filtering, alpha blending and other effects. The CX22490 supports direct attachment to an IDE hard disk drive for video pause and Web-browser caching applications.

## What is an Interactive TV Decoder?

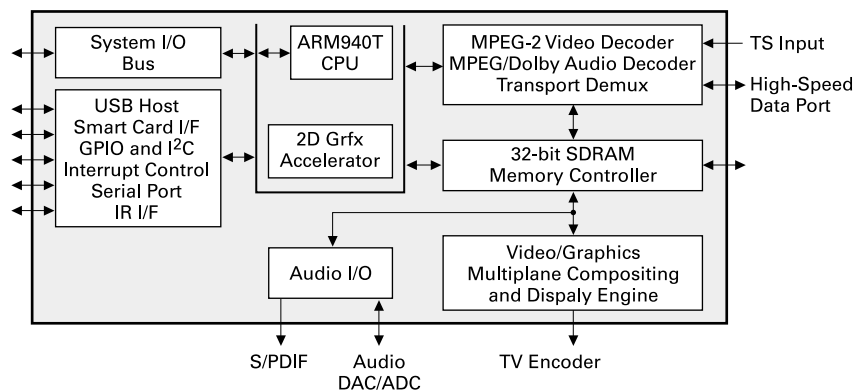
An interactive TV decoder is a device that enables a set top box connected to a digital TV network, to deliver both digital TV programming and information services to a TV set. The basic functions performed by an interactive TV decoder include identifying and filtering specific programs embedded in a compressed digital TV data stream, and decompressing the video and audio data associated with the selected program. This generates the TV program's picture and sound. An interactive TV decoder can also identify and filter information sent in the digital TV data stream. Data pertaining to interactive applications is processed by the interactive TV decoder's embedded CPU under OS control, and generates a graphical user interface that can be navigated using the set top box's remote control unit.

The interactive TV decoder's graphics-controller function allows both the TV picture and application user interface graphics to be presented as a single image on the TV, using a variety of video/graphics image scaling, filtering and blending techniques. The interactive TV decoder must also provide a return channel data communications mechanism to allow the application to interact with the broadcast data source. This is typically done via a telco or cable modem. Finally, the interactive TV decoder should be able to decrypt TV program and application content which has been encrypted by the service provider to protect against unauthorized access to services. Support for this kind of conditional-access system is usually implemented via smart card technology, combined with an embedded decryption circuit.

## Full-Featured Development Platform

These ICs are packaged in a fully-engineered interactive TV decoder development system that runs on third-party interactive middleware/RTOS platforms and provides complete set top box functionality. The initial platform comes equipped with fully-integrated OpenTV, pSOS and

VxWorks runtime and driver software components. The development platform set-top box hardware has a modular design, allowing OEMs to configure the system with their choice of tuner/demodulator, analog modem, TV encoder, audio DAC and SDRAM buffer size.



**CX22490/22496 block diagram**

## Product Features

- MPEG-2 MP@ML video decoder supporting NTSC and PAL CCIR601 image resolution
- MPEG-1/MPEG-2 audio decoder and Dolby Digital (AC3)
- MPEG-2/DVB/ATSC/DSS transport stream demultiplexing
- Integrated DVB common descrambler
- NDS conditional access embedded in the CX22496
- 160 MHz 175 MIPS 32-bit ARM940T CPU
- Advanced 2D graphics rendering for bitblt, textblt, line draw and color expansion acceleration
- Unified memory architecture supporting 32-bit, 133 MHz SDRAM
- MPEG picture and still plane upscaling and downscaling
- Multiplane video/graphics image compositing with color key or 256-level alpha blending
- Video-picture-in-graphics and video-picture-in-video-picture support
- Flicker filtering, aspect ratio conversion and hardware cursor
- 4/8/16/32-bit RGB/YCrCb graphics
- PCM audio mix and playback
  - USB 1.1 OHCI host controller (CX22490 only)
  - IDE multiword DMA support (CX22490 only)
- Serial, I²C and GPIO ports
- Bi-directional IR controller and dual smart card controllers

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