MPEG-2 Audio/Video CODEC
Perfect for Consumer Entertainment Applications

CS92288 Features

- Single-chip, real time MPEG-2 audio/video CODEC with system mux/demux and OSD
- Supports real time MPEG-1, MPEG-2 MP@ML, SP@ML, and MP@LL encoding and decoding
- Support for constant and one-pass variable bit rate
  - IPB-pictures, CBR or VBR to 15 Mbps
  - I-pictures only to 30 Mbps
- Supports Transport, Program, and Elementary streams
- Support for real time encoding and decoding of two-channel digital audio in either Dolby Digital or MPEG audio (Layer I, II, and III - MP3)
- Programmable system mux/demux supports VCD, SVCD, and DVD encoding and decoding
- 8-bit OSD support (2-b text, 2-b to 8-b graphics)
- Supports multiple resolutions and scan rates
- Low external memory, e.g., NTSC:
  - 8 Mbytes for full D1 (720) NTSC/PAL pictures
- Intel/Motorola 16-bit host interface
- Generic 8-bit interface for glueless to multiple devices such as the Philips 7146 PCI Bridge, Philips TriMedia, and USB controllers
- Integrated programmable video pre- & post-processors
- Integrated I2S interface
- 1.00 watts at 108 MHz average power consumption
- 272 BGA package

CS92288 is a single-chip, real time MPEG-2 audio/video encoder/decoder (CODEC) with an integrated system multiplexor/demultiplexor and on-screen display (OSD) feature. CS92288 CODEC encodes and decodes both ISO/IEC 13818 Main Level @ Main Profile (ML@MP), Simple Profile @ Main Level (SP@ML), Main Profile @ Low Level (MP@LL), and ISO/IEC 11172 (MPEG-1) video bitstreams as well as MPEG audio and Dolby Digital (AC-3).

By integrating advanced MPEG-2 features, such as support for both frame and field prediction, and proprietary rate control algorithms, CS92288 provides unique video quality at both low and high bit rates.

Our CS92288-based reference designs allow fast time-to-market introduction of affordable, high-quality, digital A/V products, for consumer, PC, and Internet applications.
Technical Overview

CS92288 combines a programmable RISC core, programmable DSP core, and dedicated processing units organized as a process pipeline. The RISC core supports system mux and demux requirements for a variety of system applications, including VCD, SVCD, and DVD. The DSP supports dual-channel Dolby Digital encoding and MPEG (all layers) audio encoding and decoding. It is powerful enough to support additional audio formats, such as DTS or Dolby Pro Logic. Integrated I²S support allows for a glueless interface to A/D and D/A converters.

Format Support

CS92288 supports all the requirements of the VCD and Super VCD specifications. This includes MPEG-1 and MPEG-2 encoding and decoding at 1/2 (VCD), 2/3 (SVCD), or full D1 (DVD) resolutions, MPEG audio encoding and decoding, and an OSD. In addition, CS92288 supports audio/video encoding and decoding at full D1 resolution using either the Dolby Digital (AC-3) or MPEG audio specifications.

MPEG Video

CS92288 provides application program control over a large number of encoding parameters such as I, P, B-picture cadence, GOP structure, and decoder buffer sizes.

Internal rate control provides a high degree of flexibility in relation to the output bit rate, including the ability to generate variable bit rate compressed video stream in one pass. This makes it suitable for storage sensitive applications such as digital camcorders and removable storage media.

Pre- and post-processing support includes pre- and post-filtering, temporal filtering, telecine (3:2 pulldown), inverse telecine, plus up and down chroma conversions.

Audio

CS92288 supports MPEG-1 and MPEG-2 (all layers), Dolby Digital, and MP3; however, additional audio compression and decompression algorithms can be supported via firmware upgrades.

Input/Output

CS92288 can input or output MPEG-compliant program streams or audio and video elementary streams. Transport stream generation and decoding is also available via optional firmware upgrade.

Interfaces

CS92288 includes a 64-bit SDRAM memory interface, video, and audio interfaces (with I²S), a 16-bit/8-bit Motorola/Intel host interface, a serial EPROM/Flash memory interface, and JTAG.

CS92288 is the best MPEG solution because ...

Superior Video Quality

A patented motion search engine allows CS92288 to yield better video quality than other MPEG encoders, even when these encoders apply wider search ranges. For TV interlaced signals, CS92288 is one of few consumer-grade MPEG codecs that support motion estimation using frame, 16x8, and field prediction. Other encoders support only frame prediction. Our support for advanced modes in motion estimation, combined with our proprietary rate-control algorithms lends to a unique level of video quality at both low and high bit rates.

Superior Audio Features

Cirrus Logic is a leader in digital audio and CS92288 is no exception. A programmable DSP supports Dolby Digital and all MPEG audio formats, including MP3.

Superior Support

Cirrus Logic provides proven CS92288-based reference designs for affordable, high-quality, digital A/V products for consumer, PC, and Internet applications.
**System Design Examples**

**DVD Player/PVR Reference Design**

CS92288 is an ideal single-chip solution for a variety of MPEG-2 based applications such as DVD recorders, set-top boxes with recording capability, or USB-based digital video recorders. The DVD Player/PVR Reference design combines a standard DVD decoder chip with the CS92288 for full-duplex DVD recording and playback functionality. This design enables new classes of consumer devices, such as DVD players with time-shift capabilities or DVD-Recordable VHS replacement systems. CS92288's MP3 CODEC capability can further enhance these devices by adding additional audio functionality.

**USB-DVR Reference Design**

The USB-DVR CS92288 Reference Design is a USB peripheral that makes it easy to capture and playback audio, video, and television signals on Microsoft Windows-based personal computers equipped with USB ports. The USB-DVR design can output MPEG video to either the computer display or a standard NTSC/PAL video monitor. The main hardware components of the USB-DVR board are: a NTSC/PAL TV/FM tuner, the CS4954/5 NTSC/PAL video encoder from Cirrus Logic, a video decoder, CS92288 audio/video CODEC, a Cypress EZ-USB FXTM USB controller, audio A/D and D/A converters, an analog audio multiplexor, and an IR sensor for optional remote control.

**Harmony Reference Design**

The Harmony™ reference design is a platform that enables fast development of cost effective consumer products that combine DVD playback with digital audio/video MPEG recording on a set-top box or other PCI-based products. Examples include: Advanced set-top boxes with Personal Video Recorders (PVRs) and home media servers with recordable DVD and audio-CD.
Video Features

- NTSC: (720-D1, 704-D1, 640-VGA, 544, 480-2/3D1, 352-1/2D1) x 480, or 352 x 240 (CIF), or 176 x 112 (QCIF) at 30 or 29.97 Hz
- PAL: (720-D1, 704-D1, 640-VGA, 544, 480-2/3D1, 352-1/2D1) x 576, or 352 x 288 (CIF/SIF), or 176 x 144 (QCIF) at 25 Hz
- Film: (720-D1, 704-D1, 640-VGA, 544, 480-2/3D1, 352-1/2D1) x 480, or 352 x 240 (CIF), or 176 x 144 (QCIF) at 24 Hz
- ITU-R 656 or ITU-R 601
- Digital loopback
- Proprietary high performance motion estimation
  - Half-pel accuracy
  - Programmable search range
  - H search range - 63.5, 31.5, 15.5, 7.5 pel/frame
  - V search range - 31.5, 15.5, 7.5 pel/frame
  - Field, 16 x 8, and frame-mode prediction
- Programmable encoding parameters
  - IBBP, IBP, I, P, I GOP structures
  - User defined quantization matrices
  - Encoding time
  - Average bit rate
  - Active picture area selection
  - VBR and CBR
- Pre- and post-processing
  - Horizontal and vertical cropping
  - Horizontal and vertical scaling

Audio Features

- Programmable, 24-bit, digital signal processor
- Input/Output sampling rates: 32, 44.1, 48, and 96KHz
- Data resolution up to 24 bits/sample
- Two channel audio encoding or decoding in either MPEG (all layers) or Dolby Digital (AC-3)
- Supports stereo, joint stereo, or two mono channels
- 5.1 channels audio decoding (downmixed to two channels)
- Support for new audio algorithms via firmware

System Processor Features

- Based on powerful embedded ARC core
- System multiplexer and demultiplexer
- Programmable, supports encoding and decoding of DVD, VCD, SVCD, Elementary, Program, and Transport streams formats
- Programmable DMA transfer size
- Trick Play: fast and slow play forward, fast play backward