Digital PC to TV Encoder with Macrovision™

General Description

The Chrontel CH7005 is designed to provide the highest quality TV-output possible from a single chip TV encoder. It provides a universal digital input port which allows it to accept pixel data from a wide variety of digital input sources and converts this data directly into an NTSC or PAL TV signal in composite, S-Video, and SCART output formats.

Using Chrontel's TrueScale™ technology, the scaling and deflickering engine in the CH7005 supports full vertical and horizontal underscan capability and operates in 5 different resolutions, including 640x480 and 800x600. Combined with a digital NTSC/PAL encoder with a 9-bit DAC interface, a new adaptive 4-line and 5-line flicker filter, a high accuracy, low-jitter phase-locked loop, and a universal digital input interface, the CH7005 provides the highest quality TV-output solution for a variety of different graphics controllers.

A new universal digital interface, along with full programmability make the CH7005 ideal for system-level PC solutions. All features are software programmable through a standard I^2C port, to enable a complete PC solution using a TV as a primary display device.

Architectural Overview

The CH7005 is a complete TV output subsystem which uses both hardware and software elements to produce the best possible TV image from a digital input source. This process includes a standard conversion from RGB to YUV color space, converting from a non-interlaced to an interlaced frame sequence, and encoding the pixel stream into an NTSC or PAL compliant format. Creating an optimum computer-generated image on a TV screen involves a highly sophisticated process of scaling, deflickering, and filtering. This process results in a compatible TV output that displays a sharp image of the right size and minimal artifacts from the conversion process.

As a key part of the overall system solution, the CH7005 software establishes the correct framework for the digital input signal to enable this process. The software programs the various timing parameters of the VGA controller to create an output signal that will be compatible with the chosen resolution, operating mode, and TV format. By performing these adjustments in software, the CH7005 can render a superior TV image with the added cost of a full frame buffer memory - a component that is normally used to implement features such as scaling and full synchronization.

The CH7005 universal digital input interface accepts digital RGB (15, 16, or 24-bit) or YCrCb (CCIR601 or 656) inputs, which are latched in synchronization with the pixel clock. The digital input can be in 8-, 12-, or 16-bit multiplexed or non-multiplexed format. These inputs are then color-space converted into YUV (unless already input as YUV data) in 4:2:2 format, encoded into luminance (Y) and color-difference (U, V) signals and stored in an internal line buffer memory. The scan-rate converter transforms the VGA horizontal scan-rate to either NTSC or PAL scan rates, the vertical flicker filter eliminates flicker at the output, and the underscan scaling reduces the size of the displayed image to fit onto a TV screen. The resulting YUV signals are filtered through digital filters to minimize aliasing problems. The digital encoder receives the filtered signals and transforms them to composite, S-Video, or SCART outputs using three 9-bit, output DACs.

The CH7005 allows an NTSC or PAL sub-carrier frequency to be accurately generated from a 14.31818MHz crystal oscillator, leaving the sub-carrier frequency independent of the sampling rate. This feature is a significant benefit since even a ± 0.01% sub-carrier variation may be enough to cause some televisions to lose color lock.

In addition, the CH7005 has the capability to genlock the color burst signal to the graphics horizontal sync frequency, which enables a fully synchronous system between the graphics controller and the television. When genlocked, the CH7005 can also stop the “dot crawl” motion (for composite mode operation in NTSC modes) to eliminate the annoyance of moving borders.

The flicker filter in the CH7005 uses an adaptive filter algorithm for implementing flicker reduction with selections of high, medium, and low flicker content for both luma and chroma channels. In addition, a proprietary text enhancement circuit incorporates additional filtering for enhancing the readability of text.

Worldwide TV Support

The CH7005 supports the following TV formats including NTSC-M (North America, Taiwan), NTSC-EIA (Japan), PAL-B, D, G, H, I (Asia, Europe), PAL-M (Brazil), and PAL-combination N (Argentina). In addition, with Macrovision 7.X support, the CH7005 makes the ideal PC-to-TV encoder for PC-DVD to TV applications.

Product Features

- Universal digital interface accepts YCrCb (CCIR 601 or 656) or RGB (15/16 or 24-bit) video data in both non-interlaced and interlaced formats
- Supports Macrovision 7.X anti-copy protection for PC-DVD to TV applications
- Designed specifically for graphics controllers that require a blank output for TV-Out (i.e. the Intel740*)
- +3.3V I^2C operation
- Function compatible with the CH7004
- Enhanced text sharpness with adaptive 4-line and 5-line flicker filtering
- Enhanced dot crawl control and area reduction
- Supports NTSC, NTSC-EIA (Japan), and PAL (B, D, G, H, I, M, and N) TV formats
- Supports 5 different input resolutions - 512x384, 720x400, 640x400, 640x480, and 800x600
- Provides Composite, S-Video, and SCART TV outputs
- Master or slave mode operation
- Fully programmable through I^2C port
- Auto detection of TV presence
- Supports VBI pass-through
- Programmable power management modes
- 9-bit video DAC outputs
- Complete Windows and DOS driver software
- Available in 44-pin PLCC and 44-pin TQFP packages

Applications

TV-Out for Desktop PCs
TV-Out for Notebook PCs
TV-Out for PDA-type devices
TV-Out for 3D PC Gaming
Internet set-top boxes