VisionSpectrum™ 7500 (VDP-7500)

Digital Display and Video Processor

VisionSpectrum™

OVERVIEW

The VDP-7500 is part of the LSI Logic VisionSpectrum™ Display Processor (VDP) family, which contains the best-in-class, high-performance video and display processors suitable for Digital CRTs, LCDs, Plasmas, and Front- and Rear-Projection TVs.

VDP-7500 is designed for use in mainstream display products. VDP-7500 supports worldwide Standard Definition and High Definition baseband inputs and performs advanced video processing to enable the best viewing experience on any flat-panel display.

VDP-7500 utilizes LSI Logic's industry-leading ClearView™ technology to provide optimum picture quality and innovative features enabling manufacturers to differentiate their products.

ClearView technology combines state-of-the-art proprietary Pixel Enhancement, 3D Motion Adaptive Deinterlacing with Jaggie Edge Reduction, Advanced 3D Noise Reduction including built-in Digital 3D Comb filter for NTSC and PAL modes - all of which work together to produce a superior picture. VDP-7500 architecture also integrates many other display display processing functions such as up/down scaling, PIP/POP, contrast/color enhancements and edge enhancements making it one of the most feature-rich yet cost-effective display processing solutions available in the market today.

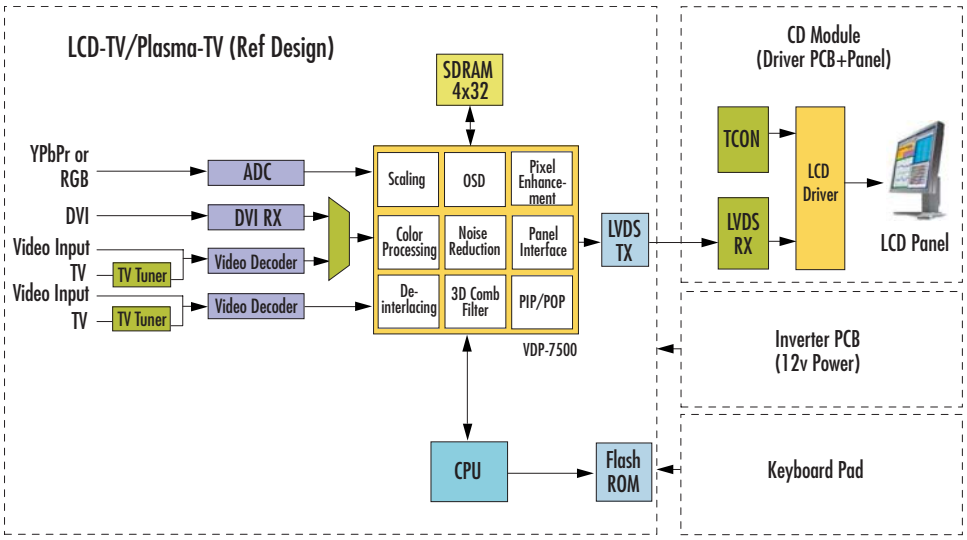

Figure 1. Reference design using VDP-7500 digital display processor.

PROCESSOR FEATURES

- Accepts SDTV, HDTV, and PC inputs
- ClearView™ Super3D™ built-in digital 3D comb filter for NTSC/PAL
- ClearView™ 3D Motion Adaptive Deinterlacing
- ClearView 3D Motion Adaptive Noise Reduction
- ClearView™ Proprietary Pixel Enhancement Technology
- Non-linear Scaling Engine
- Customizable Software and Reference Design Available
- Enables Cost-Effective Designs with Quick Time-to-Market

LSI LOGIC

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CLEARVIEW™ IMAGE PROCESSING TECHNOLOGY

Watching noisy video or improperly scaled and deinterlaced video can ruin the viewing experience especially on larger displays where every artifact is magnified. LSI Logic's industry-leading ClearView technology provides a powerful combination of digital 3D comb filtering for NTSC/PAL, advanced motion-adaptive 3D deinterlacing, 3D Noise Reduction and Pixel Enhancement to produce a visually superior picture on almost any flat panel display.

ClearView Super3D Comb Filter

The 3D adaptive digital temporal comb filter provides reduction of cross color and cross luma interference resulting from combining the Y(luma) and C(Chroma) in NTSC/PAL composite signals. Having this built-in eliminates the need for an expensive external 3D Comb filter in many cases thereby saving cost. It also provides significant improvement in the quality of S-Video input signals where the orginal source contained YC interference noise (something which external 3D Comb solutions don't handle)

ClearView Deinterlacing

3D Motion Adaptive Video Deinterlacer

The ClearView 3D Motion Adaptive Deinterlacer uses motion detection and sophisticated 3D Interpolation and 3D Jaggie Edge Reduction techniques to reduce artifacts and jagged edges during the deinterlacing process, resulting in a much more appealing picture. It is a software-programmable engine that easily allows fine-tuning the picture quality based on panel characteristics.

Example of improved picture using ClearView™ Deinterlacing.

Advanced Film Mode Recovery with Pattern Breakdown Detection and Correction

The built-in Auto Film Mode detection ensures proper recognition and handling of a 3:2 (NTSC) or 2:2 (PAL) pull down sequence in TV-adapted film material during the deinterlacing process. It uses pattern recognition to reconstruct the original progressive frames rather than interpolate the missing pixels. It also detects and corrects a breakdown in the pull-down pattern or fields mismatched during the editing process, which would normally result in undesirable artifacts in the final displayed output.

Example of ClearView™ intelligent Noise Reduction.

ClearView Noise Reduction

3D Motion Adaptive Noise Reduction

The 3D Noise Reduction Engine reduces random noise in the picture by using pixel-level motion detection algorithms. This results in a much cleaner image especially in the case of high noise still images.

ClearView Pixel Enhancement

ClearView Pixel Enhancement technology provides yet another level of picture quality improvement. Its proprietary text edge detection and smoothing algorithm results in clearer character boundaries and is a key differentiating feature for LCD/Plasma panel manufacturers. When applying the enhancements to images, the picture becomes brilliant and live even on lower-resolution display panels.

ClearView™ Pixel Enhancement results in crisper picture.

OTHER KEY FEATURES

Superior Scaling Engine

The scaling engine in the VDP-7500 processor is an independent horizontal and vertical scaler capable of 4 segment non-linear horizontal scaling. It supports high-quality up/down scaling, frame rate up/down conversion, 4:3/16:9 aspect ratio conversion and an independent PIP scaling engine to allow maximum flexibility.

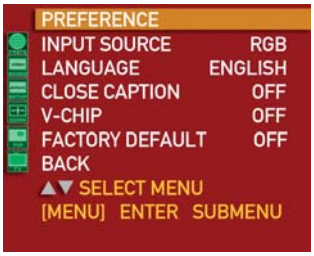
Example of main and PIP scaling for SXGA display.

On Screen Display (OSD)

The on-chip OSD is a powerful and unique font-based image processing engine supporting a 2 layer OSD. Creating OSD type images using a font mode as opposed to the more common graphics mode requires much less display memory and places less burden on the system processor. This enables support for multiple display pages with very fast page updates. The OSD engine is also equipped with all the necessary functions to support Closed Captioning (CC) and V-Chip.

Key features of the OSD engine:

- Bit-mapped OSD
- Font table supports up to 256 fonts
- Programmable display rows and columns, up to 1K display characters
- Programmable character cell resolution, up to 32 pixels x 64 pixels
- Programmable horizontal and vertical display position
- Uses up to 32 entries true color palette table to program foreground and background colors of characters
- Provides 8 separate levels of alpha blending for foreground and background



Example of VDP-7500 on-chip OSD menu.

PIP/POP

The easy-to-program on-chip Picture-in-Picture (PIP) and Picture-on-Picture (POP) engine can support simultaneous display of up to 9/16 PIP windows. It supports fast page switching and includes the following programmable features: "Split-screen" mode, POP display, one selectable PIP window for highlight, "Zoom-in" window for user to zoom the main screen, PIP window in PC mode, and deinterlace mode in PIP display image.

Example of simultaneous display of 9 independent PIP windows.

Flexible I/O

The processor provides very flexible system configuration for connecting multiple devices on the system board without glue logic as shown in the Reference Design Block Diagram (figure 1). It has independent inputs for the main picture and PIP allowing the PIP to display an independent video input from what the main screen is displaying. Its progressive output port supports a glueless interface to most common DAC devices for analog output and LVDS/DVI panel transmitters.

VDP-7500 is also designed to support advanced computer displays. Some of the key embedded functions include input windowing adjustment, auto window-size detection, auto clock-phase adjustment and input timing-mode detection to meet the demanding requirements of today's computer display systems.

External CPU Interface

Since most of the complicated and time-critical functions are implemented using register-level programmable engines within the processor, VDP-7500 can be easily programmed using a low-cost 8051-like micro controller. Having the CPU external also allows for added system design flexibility.

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Summary of Specifications

Input Features

- Flexible single/dual-pixel mode input for PC and HDTV
- Two ITU-R BT656 YCbCr inputs for interfacing gluelessly to NTSC/PAL/SECAM video decoders
- SD/HD Progressive and Interlaced video - 480i, 480p, 576i, 720p, 1080i
- UXGA @60Hz or SXGA @85Hz input - 160MHz input pixel clock input in dual channel mode
- Built-in programmable color space converters
- Auto detection of input format (graphics, video, film, HD)
- Auto-clock phase adjustment and input timing detection for PC mode

Output Features

- 4:4:4 (YCbCr or RGB) and 4:2:2 YCbCr 6/8/10-bit pixel output
- Supports up to 1400x1280 panel resolution
- Composite SYNC output
- Gamma Correction

ClearView Processing

- Super3D™: Built-in 3D Adaptive Digital Comb Filter for NTSC/PAL
- 3D Motion Adaptive De-interlacer, Jaggie Edge Reduction
- 3D Noise Reduction
- Built-in Digital 3D Temporal YC Comb filter for NTSC and PAL
- Auto Film Mode detection with inverse 3:2 NTSC/2:2 PAL pull-down
- Film pattern breakdown detection and correction
- Proprietary Pixel Enhancement technology
- Programmable Color Transient Improvement (CTI)
- Programmable Luma Transient Improvement (LTI)
- Skin/Flesh tone correction
- RGB color enhancement
- Programmable Hue, saturation, brightness, and non-linear contrast

Superior Scaling Engine

- High quality up/down scaling
- Non linear scaling
- 4:3 image display on 16:9 output and aspect ratio conversion
- Scaling output up to 1400x1280 resolution
- Frame rate conversion

PIP and POP

- Simultaneous display of 9/16 windows for channel scanning
- Second scaling engine for PIP
- Flexible PIP/POP windows size and position with swappable POP
- Changeable PIP/POP border color
- Tearless PIP/POP display

On Screen Display (OSD)

- Bit-mapped OSD
- Multiple font tables (each can support 256 Fonts)
- User programmable fonts with multi-color characters
- Changeable aspect ratio of fonts
- Blending, blinking, transparency and underline for each character
- 32 true color font OSD image support
- Multiple display pages with very fast page switching
- Very low memory requirement for each display page
- Embedded closed-caption decoder and V-chip support

External Host Interface

- Supports low-cost 8051-like 8-bit interface to internal registers

Package

- 256-Pin PBGA

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