

## High Performance Multimedia Flat Panel Controller

### Features

#### Highly Integrated Design

- 64-bit single-cycle GUI engine
- Embedded 2MB SDRAM frame buffer
- Optional External 2MB SDRAM
- Built-in TrueVideo® processor
- Built-in RAMDAC™ and frequency synthesizer

#### Accelerated Graphics Functions

- 256 Raster Operations (ROPs) for up to 32-bit True Color graphic modes
- Optimized single-cycle engine for: BitBLTs, line drawing, short stroke vectors, rectangle fills, and text transfer
- Linear display memory addressing up to 4GB of memory space
- Two four-color hardware cursors or pop-up icons up to 128x128x2

#### Advanced Power Management

- Supports 0V and 3.3/5V suspend
- 8 GPIO, SMI, and activity detect-pin

#### Mixed Voltage Operation and I/O

- Independent power plane for internal logic, host, memory, panel, and CRT interfaces

#### Simple Bus Interface Support

- PCI rev. 2.1 support with no additional TTL
- VESA DDC, DPMS, and VAFC

#### TrueVideo® Processor

- TrueVideo® scaling support: horizontal/vertical interpolation with proprietary edge recovery scaling and overlay control for 30 fps software MPEG/video CODEC acceleration
- Dual on-chip Color Space Converters (CSC)
- Hardware bilinear H/V interpolated scaling
- Supports DirectDraw™ acceleration for sprites, page flipping, double buffer, and color keying

- Anti-tearing support
- Dual apertures for simultaneous access to graphics and video display memory areas

#### Multiple Display

##### Videoconferencing: Dual Video Windows

- Two independent scalers and CSCs for separate local and remote video window control
- Video data path selection from video port or PCI bus

#### Motion Video Capture

- Glueless interface to MPEG 1, 2, and video decoders
- Supports Zoom Video (ZV port)
- 8/16 pin port for RGB or YUV 4:2:2/4:1:1 video data
- Dual apertures for simultaneous graphics and video access to the display memory areas
- Mixed color depth overlay provides True Color video overlaid on any graphics color depth

#### ClearTV™ Integrated TV Display Support

- 3 line Flicker Removal Filter for flicker-free output to interfaced TV monitors (NTSC/PAL)
- Direct interface to external NTSC/PAL encoder
- Overscan and underscan display to TV
- Simultaneous display (flat panel and TV or CRT)

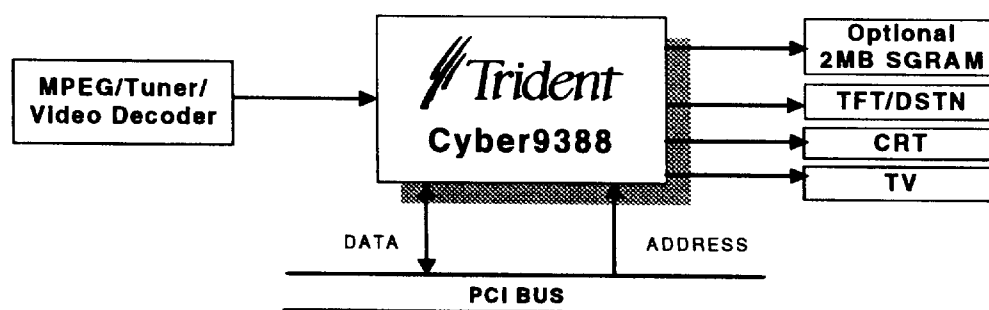
#### Hi-Res and HiRef Display Support

- 16/24-bit interface to color DSTNs up to 1024x768
- 9/12/18/24-bit/analog for TFTs or (9+9)/(12+12)/(18+18) for double pixel/clock TFTs up to 1280x1024
- Supports 85 Hz refresh rate at 3.3V

#### Advanced Flat Panel Image Control

- Frame rate control and spatial dithering for increased color depth
- Auto expansion and centering
- Display up to 1280x1024

Cyber9388 Application Diagram





## Overview

The Cyber9388 with 2MB embedded SDRAM is a fully integrated LCD, CRT, and TV 64-bit, 2D Multimedia Flat Panel Controller for PCI systems. It is a high performance chip, offering high-speed image processing in full compliance and compatibility with IBM VGA and VESA extended VGA. The Cyber9388 has a 32-bit PCI v2.1 local bus interface with Bus Mastering capability.

The Cyber9388's highly innovative design dramatically improves GUI functions and significantly promotes overall system operation. The Cyber9388, equipped with a single-cycle 2D GUI engine, pipelines video and graphics processing architecture in hardware, providing very fast 2D hardware acceleration.

Higher performance is achievable with higher bandwidths due to the high-speed single cycle access to the 2MB embedded SDRAM. Integrated RAMDAC™ can run up to 170Mhz,

Cyber9388's LCD interface provides a flexible environment to manipulate the LCD control. It supports panel interfaces up to 1280x1024 SXGA TFT panels with 12, 18, 24, 12+12, or 18+18-bits or 1024x768 XGA DSTN panels with 16 or 24-bits. In addition to the same simultaneous display supported by the other members of the Cyber LCD controller family, the Cyber9388 is able to provide independent refresh rates for LCD+CRT or LCD+TV simultaneous display.

Cyber9388's Advanced Power Management (APM) provides a flexible solution for low power consumption while extending power management capabilities.

The Cyber9388 supports a 16-bit Zoom Video (ZV) Port that allows direct connection to a PC card. It permits the PC card to write video data (YUV) directly to the VGA chip and overlaid video windows with graphic data on the frame buffer without increasing the data loading on the PCI bus.

To meet the requirements of a PC98 graphics adapter and a multimedia PC, the Cyber9388 supports the planar video format for MPEG-1 and MPEG-2. Also, the dual video playback is capable of overlaying two windows for video conferencing and multimedia displays. The ClearTV™ technology performs "flicker removal" and "scaling," functions that remove the artifacts when VGA signals are transformed to a TV monitor or when the data is sent to a recording device, such as a VCR.

Additionally, the Cyber9388 has such advanced features as: Color Space Conversion (CSC), TrueVideo® scaling, dual video windows, multi-view display, Video Module Interface (VMI), interacts protocol Vertical Blanking Interleave (VBI), an 8-bit DAC, and triple clock synthesizers to allow it to perform at peak levels.

## High Performance 64-bit 2D GUI

The 64-bit graphics engine of the Cyber9388 significantly boosts graphics performance through specialized hardware that accelerates the most frequently used GUI operations and matches the high-speed requirements of CPUs. Functions directly supported in hardware include: BitBLTs, image and text transfer, line draw, short stroke vector draw, rectangle fills, and clipping. The graphics engine supports 256 Raster Operations (ROPs) for up to 32-bit graphic modes. The ROP3 Processor in the Cyber9388 is able to perform Boolean functions, which allow many additional operations, including color expansion alignment and pattern enhancement.

The graphics engine also features linear display memory addressing (up to 4GB of memory space), accelerated color expansion modes for graphics text procession, and memory-mapped I/O registers on the graphics engine for faster access time. Graphic functions are optimized by a 64 bit internal data bus and a four-color hardware cursor/pop-up icon operation up to a 128x128x2 pixel image, which off-loads the CPU.

The hardware cursor mechanism can also be used to display patterns stored in the system memory. This pop-up icon is very useful to instantly display user friendly information through simple hot key operations. This advanced functional combination allows significant performance increases over standard Super VGA designs, providing outstanding graphics acceleration for GUIs such as Microsoft's Windows 95™.

## Highly Integrated RAMDAC™ and Clock Synthesizer

The highly integrated design of the Cyber9388 offers a "no TTL" solution for cost-effective, high performance multimedia subsystem designs for the IBM® PC and compatible notebooks. The embedded SDRAM provides faster data transfer rates for improved system throughput. The highly integrated RAMDAC™ and Clock Synthesizer in the Cyber9388 provides an easy access to the interface and saves spaces.

The integrated triple frequency synthesizer provides a 100 MHz MCLK which supports the high-speed SDRAM and one 170 MHz VCLK, which support refresh rates up to 1280x1024 at 85 Hz.

Video processor features include: on-chip hardware Color Space Conversion (CSC) for faster data conversion "on-the-fly", Horizontal/Vertical (H/V) scaling with interpolation, an edge recovery algorithm, gamma correction, and overlay control with different color depths from graphics. The Cyber9388 also includes a fully integrated GUI accelerator, read cache, and a command FIFO that optimizes memory bandwidth and maximizes graphics performance.



## **Cyber9388™** High Performance Multimedia Flat Panel Controller

### **Product Brief**

#### **TrueVideo® Processor**

The Cyber9388 can provide dual video windows, which display different images from different video sources (from the PCI bus and from the capture port) on the same screen. The video image is stored in the off-screen memory and is retrieved by the Video Display Processing block for TrueVideo® processing.

With the help of DirectDraw™ acceleration for sprites, page flipping, double buffering, and color keying, TrueVideo® processing is performed by utilizing Trident's proprietary edge recovery algorithm for sharper line visibility, de-interlacing, anti-tearing, multitap horizontal filtering, dithering, and scaling operations with bilinear interpolation in both horizontal and vertical directions. The linear scaling permits zooming in/out to any size without restrictions.

In addition, the on-chip hardware Color Space Conversion (CSC) accelerates conversion for 16 bit YUV pixels into linear, true color, 24 bit RGB pixels on the fly. The additional X and Y minifiers are capable of shrinking the video images to any linear fractions; this saves bus bandwidth and memory space. The YUV planar of the Cyber9388 supports a YUV 420 format that can remove redundant video stream decoding procedures. The load of the CPU is reduced while performing SW MPEG or SW videoconferencing. The color and luminance control provided by the Cyber9388 offers color compensations to prevent color distortion for display devices such as a CRT, LCD, or TV with a Gamma correction and hue adjustment control.

The Videoconferencing feature allows remote and local video images to be displayed simultaneously on the same screen. With the support of independent VCLKs for independent refresh rates, the video processor is able to provide multiple view and simultaneous display. This function is also capable of sending local CCD data to the PCI bus via the Bus-Mastering feature.

#### **Motion Video Capture/Overlay Support**

The Cyber9388 has a built-in video capture port and advanced hardware interface logic allowing it to be connected directly to many MPEG and video decoders, such as: the C-Cube CL450/480, SGS 3400/3500, Philips 7110/1, and Brooktree BT819/817. The Video Module Interface (VMI) allows for MPEG compressed data to be transferred to the MPEG decoder through the Cyber9388. The decompressed MPEG data is then transferred back to the graphics controller through the VMI port for real-time display in a window.

A new industry standard is being set for transmission of non-video data over a TV broadcast signal during the dead time called vertical blanking. This technology is also referred to as Intericast. The Cyber9388 has the ability to take the entire video stream over the video port, sending

the visible video stream to the display memory for display in a window, stripping the VBI data from the stream, and then sending this data to the CPU for processing using PCI Bus Mastering.

The Cyber9388 provides a Zoom Video (ZV) port aperture, which connects directly to a PC card. This feature allows the PC card to write directly to the Cyber9388 with video data (YUV) which is overlaid in the video window onto graphic data in the frame buffer without increasing the data transfer loading on the PCI bus.

The Cyber9388 features a Dual Video Overlay. The Video inputs can come from either the PCI bus or the Video Capture Port. Device drivers can use the Cyber9388's PCI Bus Mastering capability to send graphics or decompressed video images to local display memory or to receive live video images from an external video source such as a TV tuner, VCR, or camera. The Bus Mastering can improve the whole system's operation by off-loading CPU tasking on the data transfer to or from the Cyber9388.

#### **Embedded SDRAM**

With 2MB embedded SDRAM, optimized performance can be achieved using programmable timing. The display queue has been increased commensurate with the increase in available bandwidth, optimizing efficiency for the graphic controller. The SDRAM also provides abundant memory bandwidth for a high resolution display and video playback.

SDRAM minimizes chip count, which saves board space and reduces power consumption.

#### **Hi-Res and Hi-Ref Display Support**

The Cyber9388 features versatile display support in the following areas: flat panels, CRTs, TVs, and application display software drivers.

#### **Advanced Flat Panel Image Control**

The Cyber9388 supports TFT or DSTN panels without external glue logic. Full functions are ready for panel interfacing with 12/18/24/36-bit/analog TFT panels or (12+12)/(18+18) double pixel/clock TFTs panels up to 1280x1024-64K color or 16/24-bit DSTN panels up to 1024x768-16M colors with a frame buffer size up to 4M (SDRAM).

The Cyber9388 supports expansion of VGA data for all supported types and resolutions. The Cyber9388 utilizes external LVDS or PanelLink™ technology that enables low voltage, high-speed, low EMI, serial, DC-balanced, differential data transmission. The Cyber9388 employs leading-edge techniques to reduce EMI and to provide scalability and support for notebook LCD displays.



## Cyber9388™

High Performance Multimedia Flat Panel Controller

**Product  
Brief**

### Multiple view/Simultaneous Display and Dual Video Windows for Videoconferencing

The Cyber9388 is capable of providing multiple view and simultaneous displays in 24-bit color with mixed video/graphics on a flat panel and a CRT or on a flat panel and a TV. This feature is an optimal solution for users requiring different images on both displays. The Cyber9388 allows the displays shown on a panel and a CRT or TV at different refresh rates, different resolutions, and different color depth. Therefore, the display on a CRT will not be degraded to accommodate the lower refresh rate of a LCD panel.

The Cyber9388 display enhancements dramatically improve CRT resolution, providing sharp images. These enhancements include support of non-interlaced 1280x1024x64K, 1024x768x16M, 800x600x16M, and 640x480x16M colors for "full spectrum" color. Extended text modes of 80 or 132 columns by 25, 30, 43, or 60 rows provide an extended graphics area frequently used in many spreadsheet and database applications. In addition, extended graphics and text modes are supported by software drivers that provide a "ready-to-go" solution, minimizing the need for additional driver developments.

For videoconferencing, the Cyber9388 supports two independent scalers and CSCs for separate local and remote video window control.

A virtual screen can be created with the Cyber9388. When this function is enabled, a selected portion of a large image can be shown on a smaller display. The image can also be moved either up or down across the whole screen.

The Cyber9388 is able to automatically detect DDC monitors with I<sup>2</sup>C signaling.

### ClearTV™ Output

The Cyber9388 supports a high quality, flicker-free TV display to either the NTSC or PAL standard. To convert the non-interlaced VGA data to an interlaced TV display, the

Cyber9388 employs a 3-line flicker-free TV buffer for flicker reduction by smoothing adjacent lines. This produces a very stable view on a TV screen. ClearTV™ provides the best TV quality in the industry. Composite synchronization (Csync), sub-carrier, and I<sup>2</sup>C signals are provided for connection to standard off-the-shelf TV encoder parts, such as the AD722/4 and Sony CXA series for standard home TV applications.

In order to match different display modes between VGA and TV standards, the Cyber9388 provides overscan, underscan, and automatic aspect adjustment functions or utilities to allow for identical data to be shown on a TV and a LCD panel simultaneously or individually

### Advanced Power Management

The Cyber9388 provides flexible and extensive mobile power management capabilities. The Cyber9388 employs 3.3V voltage operation with independent power planes for Core and Analog, Host, Memory, CRT, and Panel interface. The on-chip LUT/DAC, video clock (VCLK) and memory clock (MCLK), and external crystal input can be powered down through register controls or pins. Power down states include ready, standby, and suspend. Each power state can be activated by hardware pins, hardware timers, or software control bits. Clocks to major functional blocks, such as GE, video, TV-out, etc., can be turned on/off independently.

### Standard Bus Interface

A simple Bus Interface Unit (BIU) provides a low cost, single chip solution for IBM® PC or compatibles on PCI 2.1 Bus systems with speeds up to 66 MHz and Bus Mastering capability.

The Video Module Interface (VMI) is supported for video devices such as MPEG1 and MPEG2. Graphics system throughput is enhanced further by a command FIFO, allowing maximum bus transfer speed for applications, such as Windows™, that directly accesses video memory.

Contact your local Trident representative for:

- Technical Reference Manuals
- Software Programmer's Guides
- Evaluation Kits (Includes documentation plus evaluation board and software)

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