Introduction

Features

❖ High performance GUI accelerator

- Optimized BLT/pattern engine
- Fast CAD & drawing operations
- Color expansion
- Line draw

❖ No-cost motion video™

- Smooth scaled video at 30 fps
- Hardware scaling up to full screen
- YUV to RGB conversion
- Intel/Microsoft DCI support
- Graphics + 24-bit video in 1MB buffer

❖ Integrated DAC and clock generator

- Pixel clock to 135 MHz
- Gamma correction

❖ BetterHalf™ cost-saving technology

❖ VESA® standards support

- Advanced Feature Connector (VAFC)
- Power management (DPMS)
- Bi-directional monitor data (DDC-2B)

❖ High performance host interface

- Glueless PCI 2.0
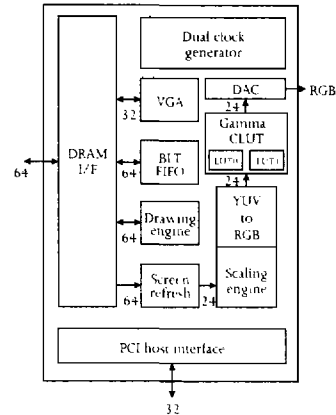- VESA VL-bus
- Efficient memory mapped addressing

❖ Fast 64-bit DRAM interface

- 240MB/second peak bandwidth
- 1MB, 2MB, 4MB standard DRAM
- ×4, ×8, ×16 DRAM support

❖ Programmable resolution to 1600×1200

	256 colors	32K/64K colors	16M colors
1 MB	1152×864	800×600	640×400
1.5 MB	1152×864	800×600	800×600
2 MB	1600×1200	1152×864	800×600

Block diagram

Overview

The ProMotion-6422™ is a highly integrated member of Alliance Semiconductor's ProMotion™ family of high-performance MultiMedia User Interface (MMUI) accelerators. It incorporates a powerful Windows graphical user interface accelerator engine, unique motion video acceleration hardware and a high frequency DAC + clock generator, all in a single integrated 208-pin PQFP package.

The chip's 64-bit internal architecture and memory bus give the 6422 superior performance in a low-cost DRAM-based accelerator. Proprietary BetterHalf™ technology cuts cost by reducing system memory requirements without compromising performance.

The chip's advanced multimedia acceleration engine enables high quality motion video playback at no cost premium over graphics-only solutions. The engine includes an on-chip color space converter to accelerate decompression, and a hardware scaler with proprietary anti-blocking circuitry, to scale continuously from native size up to full screen at full speed. The engine delivers smooth display of motion video data up to 30 fps, at full SIF resolution under DCI and other interfaces. Supported standards include MPEG-1, Video for Windows™, Indeo™, TrueMotion™, and other video applications and codecs.

MMUI

Software drivers

❖ **Microsoft® Windows95™**

❖ **Windows™ 3.X**
- Flat-model optimized drivers
- Switch resolutions on the fly
- Virtual desktop to 1600×1200

❖ **Microsoft DirectDraw™, DCI™ support**

❖ **Codec-neutral, multi-vendor standards**

❖ **Microsoft Video for Windows**

❖ **AutoDesk® ADI for 1AutoCAD®**

❖ **Microstation™**

❖ **WordPerfect® 6.0**

❖ **OS/2™ Warp, 2.11**

❖ **Windows NT™**

❖ **NeXTStep™**

❖ **SCO Open Desktop™**

→ **Complete, high-performance, robust**

Alliance supports the ProMotion family with high-quality flat-model optimized driver software. ProMotion drivers take full advantage of ProMotion-6422 hardware and the latest software technology to accelerate real performance of real applications, from word processing and spreadsheets to the most demanding CAD programs and multimedia software.

The ProMotion driver set accelerates all major operating environments, graphics-intensive software, and motion video applications. With 100% VGA and VESA compatibility, ProMotion controllers can also run standard DOS and VBE-compatible applications directly without driver software.

Source code to ProMotion drivers is available to permit customization and differentiation.

VGA BIOS

❖Industry standard Phoenix® BIOS
❖100% IBM® compatible
❖VESA DPMS power management
❖VESA BIOS extensions

→ **Compatible, user-friendly**

ProMotion-6422 controls an external VGA BIOS ROM for add-in card applications. Binary and source code for the PhoenixView BIOS are available from Alliance.

MMUI

Manufacturing package

❖ **Reference PCB designs**

❖ **OEM software utilities**

❖ **Customer software utilities**

→ **Full customer support**

ProMotion reference designs, OEM tools, and application notes reduce time-to-market. Alliance's OEM support and quality standards, developed over years as a high-volume system supplier to the PC industry, meet the strictest requirements.

No-cost motion video™

❖ Motion video application explosion

- Entertainment
- Education
- Training
- Communications

❖ Specialized requirements

- Color space conversion
- vWindow™ scaling and pixel interpolation
- 3X throughput by offloading CPU

→ **30 fps full-screen, full-motion display**

Today's shift to multimedia user interface has created a need for motion video acceleration, just as the shift from text-based to graphical user interface created a need for GUI acceleration. As new graphics+video systems enter the market, graphics-only displays are going the way of yesterday's text-only terminals.

Motion video playback requires a small set of specialized operations which are CPU-intensive but can be accelerated with dedicated hardware. For a typical stored-video codec, offloading color space conversion and scaling from the host CPU can increase throughput threefold, increasing frame rates and eliminating jerky dropped frames. ProMotion provides this acceleration, along with state of the art graphics performance, at no additional cost above graphics-only solutions.

System block diagram

Host bus: PCI/VL

DRAM
1-2 MB

ProMotion-6422

BIOS ROM
(optional)
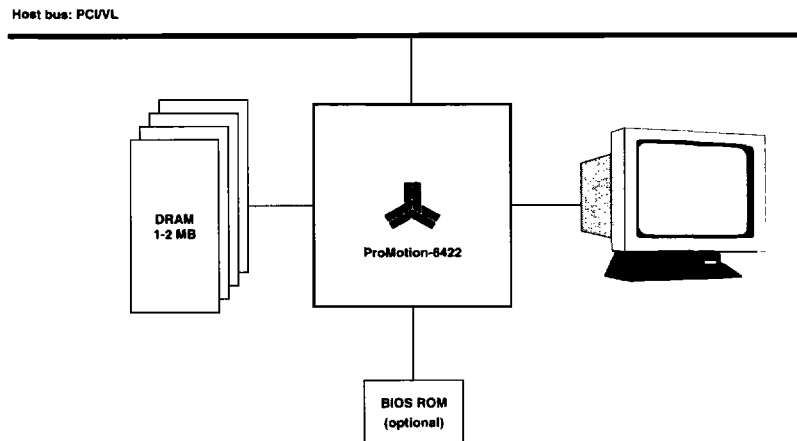
MMUI

Functional description

Graphics accelerator

The ProMotion-6422 integrated MMUI accelerator includes a high performance 64-bit graphics controller designed for demanding truecolor, hi-color, and pseudocolor GUI and CAD applications. A dedicated BLT engine maximizes performance of host-to-screen and screen-to-screen operations. A separate drawing engine efficiently handles pattern fills, text rendering, lines and polygons. Advanced features include:

- Color DitherFill™
- Source and destination transparency
- Line draw
- Strip draw
- Quick-start and auto-update capability
- Linear memory access
- Mono-to-color expansion
- Short-stroke vectors
- Clipping
- Hardware cursor

Motion video accelerator

An on-chip motion video accelerator enables software codecs to achieve 30 fps full-screen playback with no additional hardware. ProMotion-6422 accomplishes this feat by offloading the CPU-intensive tasks of **scaling** and **color space conversion**, and by minimizing the memory bandwidth required for display of decompressed video data.

The chip manages a **hardware motion video window**, the vWindow™, whose data is stored in an off-screen area of the standard frame buffer memory. When displaying the vWindow, the controller stretches by programmable X and Y factors ranging from 1.01 to 255.0. Proprietary interpolation and anti-blocking circuitry enhances the quality of scaled low-resolution images. Motion video data may be in pseudo-color, RGB, or YUV format (4:2:2, 4:1:1, or 4:0:0). ProMotion-6422 converts YUV data to RGB "on the fly" for display in photorealistic color using ProMotion-6422's onboard DAC. ProMotion's advanced architecture permits full 24-bit color for motion video data, even when the graphics desktop uses lower color depth. With ProMotion-6422, a 1MB graphics system can display 8-bit graphics up to 1024×768 resolution, along with 24-bit full-screen motion video.

The ProMotion architecture maximizes motion video performance as well. Because YUV format is more compact than truecolor RGB, and because each motion video frame is sent across the host bus at its unscaled resolution, the host sends a minimum of data across the system bus. Because ProMotion-6422 does scaling on the fly, it reads only the minimum required data from the frame buffer for each screen update, making the best possible use of available bandwidth. ProMotion's innovative architecture removes bandwidth bottlenecks to display multimedia data at its full speed.

VGA controller

A fully register-compatible Super VGA controller in the ProMotion-6422 chip supports all monochrome and 4-bit packed and planar modes. The controller is reverse-compatible to MDA, CGA, and IBM VGA standards. Super VGA modes conform to VESA standards.

VESA No.	Screen format	Display mode
0, 1	360 × 400	text
2, 3	720 × 400	text
4, 5	320 × 200	graphics
6	640 × 200	graphics
7	720 × 400	text
D	320 × 200	graphics
E	640 × 200	graphics
F	640 × 350	graphics
10	640 × 350	graphics
11	640 × 480	graphics
12	640 × 480	graphics
13	320 × 200	graphics

Clock generator and DAC

ProMotion-6422's high-frequency clock generator and integrated palette DAC give high-quality high-resolution display. Table A ProMotion-6422 extended video modes details the resolutions available with standard BIOS and drivers. Figure A, "ProMotion-6422 recommended analog interface," on page 341, displays the analog biasing circuitry.

Gamma correction in 16- and 24-bit modes—including separate gamma tables for desktop and video areas—permits software color matching and brightness/tint control.

Table A. ProMotion-6422 extended video modes

| Display resolution	Bits per pixel	VESA mode	Alliance mode	Mem. req. (MB)	Vert. freq. (Hz)	Horiz. freq. (KHz)	Pixel freq. (MHz)	VCLK freq. (MHz)
640×400	8	100		0.5	70	31.5	25.175	25.175
640×400	15, 16			1.0	70	31.5	25.175	25.175
640×400	24		57	1.0	70	31.5	25.175	25.175
640×480	4			0.5	60	31.5	25.175	25.175
640×480	8	101	95	0.5	60	31.5	25.175	25.175
640×480	15, 16	110, 111	102, 100	1.0	60	31.5	25.175	25.175
640×480	24		39	1.5	60	31.5	25.175	25.175
640×480	8			0.5	67	34.45	28.7	28.7
640×480	4			0.5	72	37.9	31.3	31.3
640×480	8			0.5	72	37.9	31.3	31.3
640×480	15, 16			1.0	72	37.9	31.3	31.3
640×480	24			1.5	72	37.9	31.3	31.3
640×480	4			0.5	75	37.5	31.3	31.3
640×480	8			0.5	75	37.5	31.3	31.3
640×480	15, 16			1.0	75	37.5	31.3	31.3
640×480	24			1.5	75	37.5	31.3	31.3
800×600	4	102		0.5	56	35.2	35.8	35.8
800×600	8	103	92	0.5	56	35.2	35.8	35.8
800×600	15, 16	113, 114	103, 101	1.0	56	35.2	35.8	35.8
800×600	24		38	1.5	56	35.2	35.8	35.8
800×600	4			0.5	60	37.9	40.5	40.5
800×600	8			0.5	60	37.9	40.5	40.5
800×600	15, 16			1.0	60	37.9	40.5	40.5
800×600	24			1.5	60	37.9	40.5	40.5
800×600	8			0.5	64	41.5	44.8	44.8
800×600	15-16			1.0	67	44.75	47	47
800×600	24			1.5	67	44.75	47	47
800×600	4			0.5	72	48.1	50.2	50.2
800×600	8			0.5	72	48.1	50.2	50.2
800×600	15, 16			1.0	72	48.1	50.2	50.2
800×600	24			1.5	72	48.1	50.2	50.2
800×600	4			0.5	75	46.9	50.2	50.2
800×600	8			0.5	75	46.9	50.2	50.2
800×600	15, 16			1.0	75	46.9	50.2	50.2
800×600	24			1.5	75	46.9	50.2	50.2
1024×768	4	104		0.5	60	48.3	64.4	64.4

Table A. ProMotion-6422 extended video modes

Display resolution	Bits per pixel	VESA mode	Alliance mode	Mem. req. (MB)	Vert. freq. (Hz)	Horiz. freq. (KHz)	Pixel freq. (MHz)	VCLK freq. (MHz)
1024×768	8	105	96	1.0	60	48.3	64.4	64.4
1024×768	15, 16	117	47, 97	2.0	60	48.3	64.4	64.4
1024×768	4			0.5	66	53.6	71.4	71.4
1024×768	8			1.0	66	53.6	71.4	71.4
1024×768	15, 16			2.0	66	53.6	71.4	71.4
1024×768	4			0.5	70	56	75.1	75.1
1024×768	8			1.0	70	56	75.1	75.1
1024×768	15, 16			2.0	70	56	75.1	75.1
1024×768	4			0.5	72	58	78.9	78.9
1024×768	8			1.0	72	58	78.9	78.9
1024×768	15, 16			2.0	72	58	78.9	78.9
1024×768	4			0.5	75	60	80.8	80.8
1024×768	8			1.0	75	60	80.8	80.8
1024×768	15, 16			2.0	75	60	80.8	80.8
1152×864	4			0.5	60	54	80.8	80.8
1152×864	8		52	1.0	60	54	80.8	80.8
1152×864	15, 16		53, 54	2.0	60	54	80.8	80.8
1152×864	4			0.5	66	60	96.4	96.4
1152×864	8			1.0	66	60	96.4	96.4
1152×864	15, 16			2.0	66	60	96.4	96.4
1152×864	4			0.5	72	64.9	96.4	96.4
1152×864	8			1.0	72	64.9	96.4	96.4
1152×864	15, 16			2.0	72	64.9	96.4	96.4
1152×864	4			0.5	75	67.5	110	110
1152×864	8			1.0	75	67.5	100.3	100.3
1152×864	15, 16			2.0	75	67.5	100.3	100.3
1280×1024	4	106		1.0	60	64	110	110
1280×1024	8	107	110	1.5	60	64	100.3	100.3
1280×1024	15, 16		49, 111	4.0	60	64	110	110
1280×1024	8			1.5	66	67	129.5	129.5
1280×1024	8			1.5	72	77.4	129.5	129.5
1280×1024	8			1.5	75	80.5	147	147
1600×1200	8		55	2	60	75	160	160
1600×1200	8			2	70	87.5	188	188

Figure A. ProMotion-6422 recommended analog interface
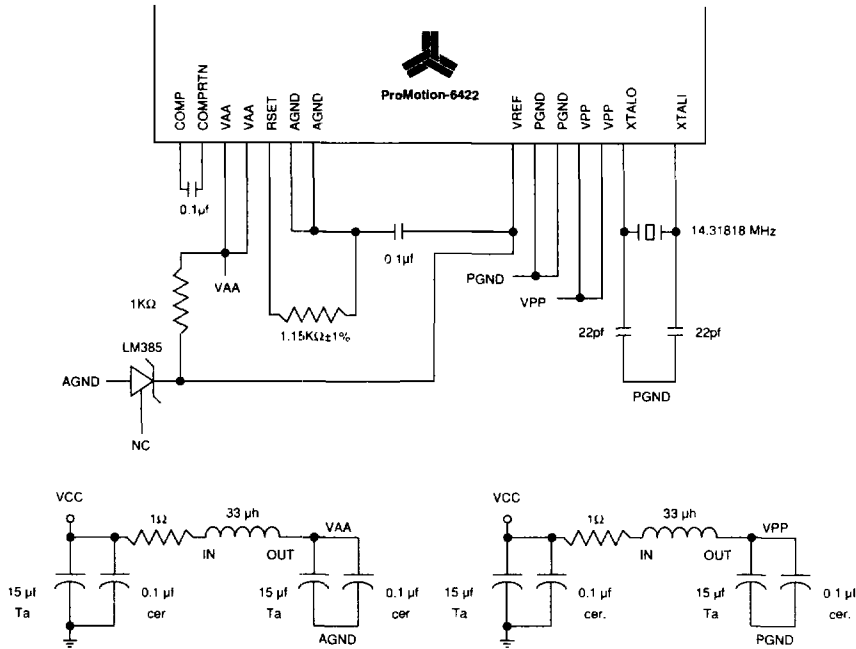
PCI/VL host interface

The ProMotion-6422 interfaces directly to **PCI bus**, or to VESA **VL-bus**. A configuration strap on MD[27] selects host bus type; refer to the ProMotion-6422 Databook. For PCI, a fully glueless interface reduces system cost.

Memory mapped registers make common operations fast. An optimized **command FIFO** further improves performance. Writes to the frame buffer memory and to chip registers are buffered in the FIFO, transparently to software, so the host processor can continue execution.

Figure B. ProMotion-6422 glueless PCI/ROM interface
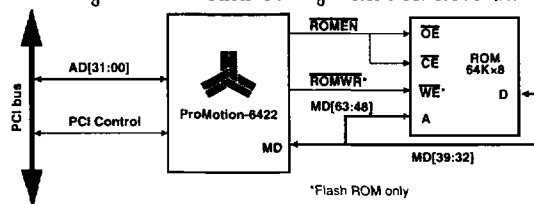
Figure C. ProMotion-6422 VL bus/ROM interface
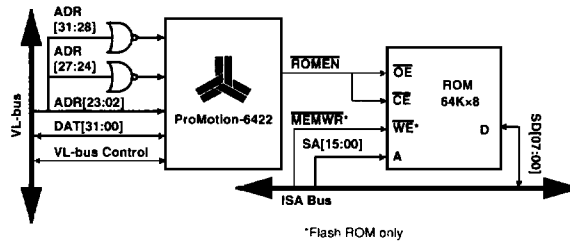
ROM BIOS interface

In PCI mode ProMotion-6422 supports address data and flash write control interface for ROM BIOS as shown in Figure B, "ProMotion-6422 glueless PCI/ROM interface."

In VL-bus mode, ProMotion-6422 decodes VGA BIOS addresses and drives a ROM enable signal. Address and data lines, as well as optional Flash write control, are connected to the ISA bus, as shown in Figure C, "ProMotion-6422 VL bus/ROM interface."

DRAM interface

ProMotion-6422 controls **1, 1.5, 2, or 4 megabytes** of DRAM frame buffer memory. For 1MB, 1.5MB, and 2MB systems 256K×4, ×8, or ×16 parts may be used. For 4MB systems 256K×8 or ×16 may be used. Both dual-CAS and dual-WE organizations are supported; configuration strap MD[29] selects between the two modes.

Programmable memory timing allows ProMotion-6422 to use standard speed DRAM or take advantage of Alliance Semiconductor's industry-leading fast DRAMs and other high-speed DRAMs.

MMUI

Figure D. ProMotion-6422 Memory interface: 1 / 1.5 / 2 MB (default mode/multiple $\overline{CAS}$)
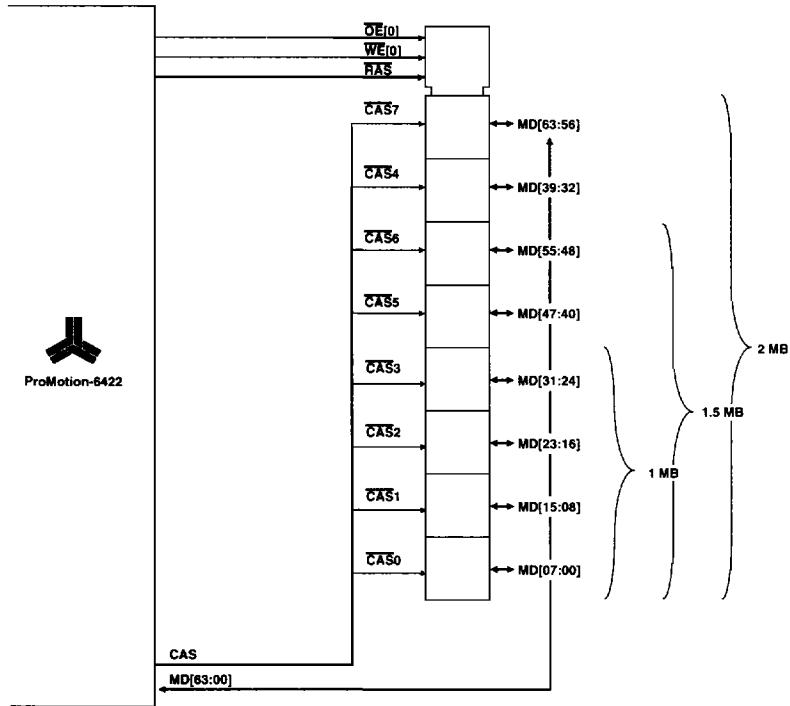
Monitor and feature connector interface

For interoperability with video capture and other multimedia cards, ProMotion-6422 offers two feature connector options, selectable by configuration strap MD[26]. In **VSVPC** mode, ProMotion-6422 connects to an industry-standard 8-bit VGA pass-through connector; refer to Figure E, "ProMotion-6422 glueless VSVPC feature connector: PCI bus," and Figure F, "ProMotion-6422 glueless VSVPC feature connector: VL bus*." In **VAFC** mode, the chip supports the VESA Advanced Feature Connector standard, including 16-bit input and output. With the circuit shown in Figure G, VAFC can be implemented without an expensive multiport DAC.

MMUI

343

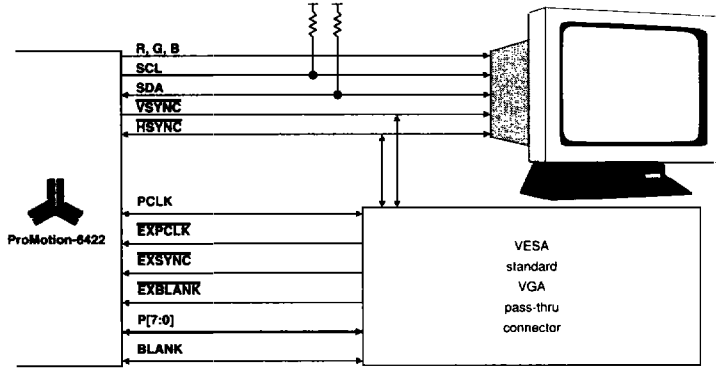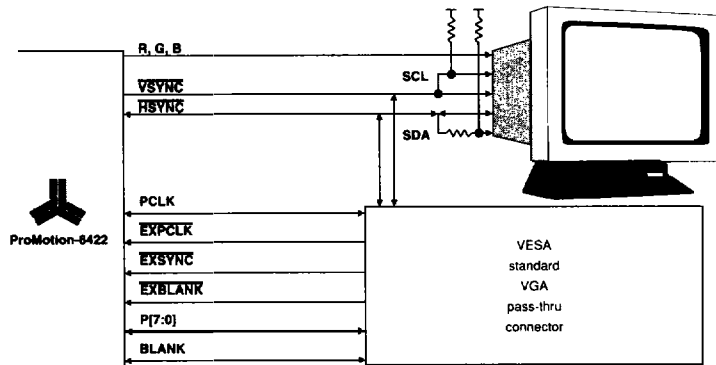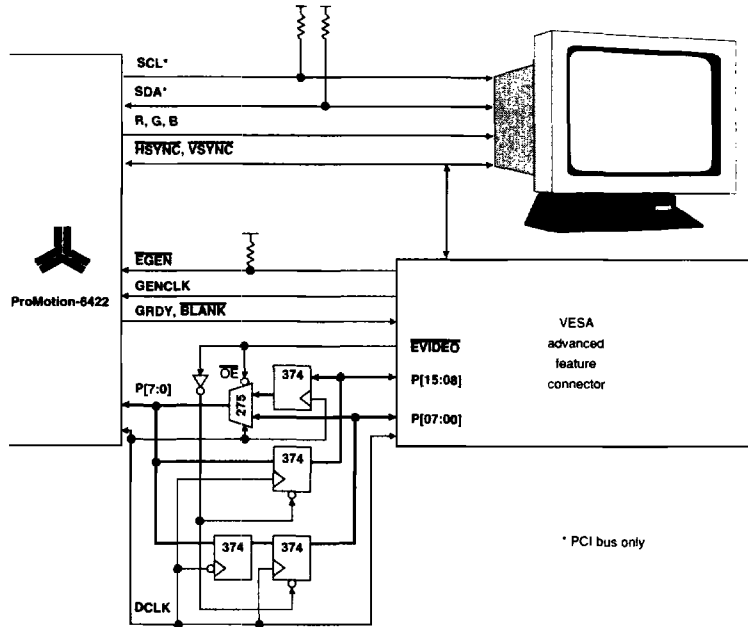Figure E. ProMotion-6422 glueless VSVPC feature connector: PCI bus

Figure F. ProMotion-6422 glueless VSVPC feature connector: VL bus*

*Contact Alliance for VL bus support details.

344

Figure G. ProMotion-6422 VAFC feature connector

DDC 2.0B support

ProMotion-6422 includes dedicated control pins for bi-directional DDC monitor connections in PCI bus configuration.

Using industry standard protocols, software can use DDC to read status and write configurations to compliant monitors.

MMUI