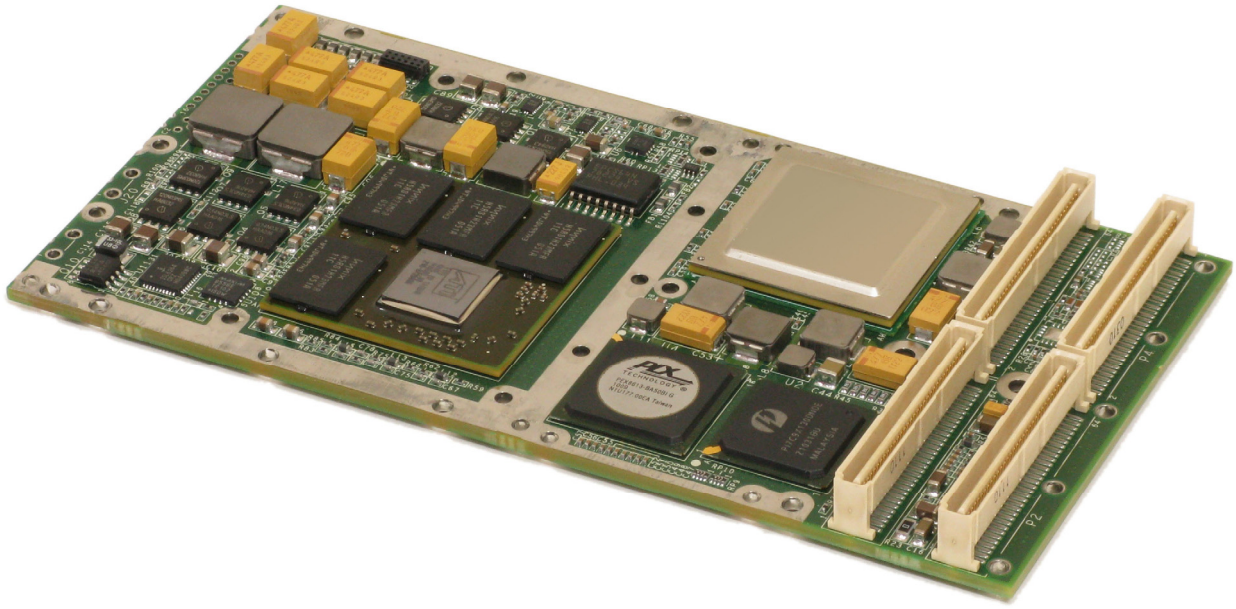
M597
E4690 Graphics and Video PMC



- **Single Width PMC**
- **PCI-X 64-bit @ 133 MHz Connectivity**
- **E4690 Embedded GPU @ up to 600 MHz**
  - **Dual Independent Graphics Heads**
  - **512 MB DDR3 SDRAM @ up to 700 MHz with 128-bit interface**
- **Video Output Interfaces**
  - **Digital Outputs configurable as**
    - DVI
    - HDMI
  - **SD-SDI/HD-SDI Output**
  - **Non-interlaced RGBHV Outputs**
  - **Analog TV Output**
    - Composite, S-Video
    - RS-170A (NTSC)/PAL
- **Video Input Interfaces**
  - **Composite Video Inputs, supporting RS-170A (NTSC)/PAL**
  - **SD-SDI/HD-SDI Inputs**
- **Video Capture and Video Overlay Support**
- **Video I/O Routed to PMC Front Panel and P4 I/O Connectors**
- **Features**
  - **Full 2D/3D processing capabilities**
  - **OpenGL 3.x, OpenGL ES 2.0, OpenGL SC 1.0**
  - **DirectX 10.1**
  - **UVD (Unified Video Decoder) supporting H.264, VC-1, and MPEG-2 decoding**
  - **Audio decoding (for HDMI)**
  - **BIOS Flash memory**
- **Software Support**
  - **Windows®**
  - **Linux®**
  - **VxWorks®**
  - **INTEGRITY®**
- **Conduction and Air-Cooled Versions**
- **Vibration and Shock Resistant**

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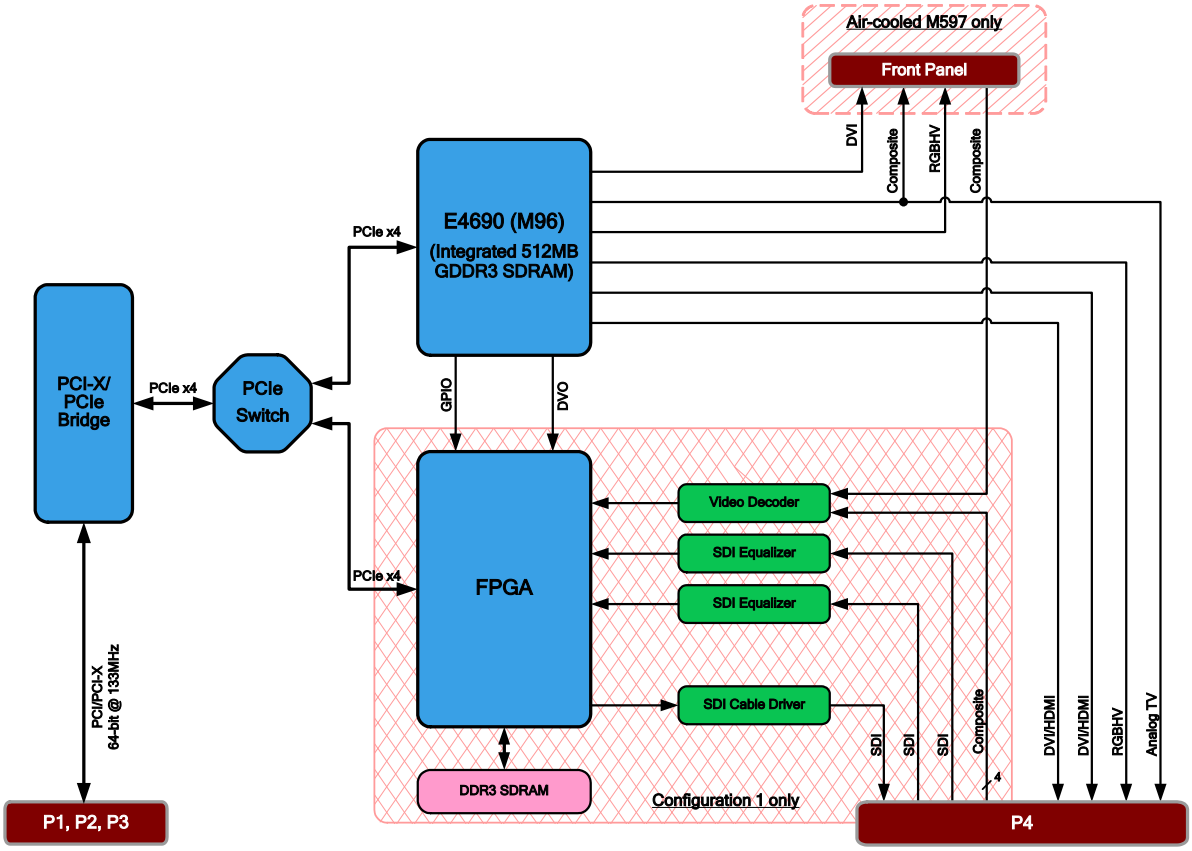
Advanced Dual Head Video/Graphics Processing Supporting Multiple I/O Standards

Aitech's M597 graphics and video PMC provides a high-performance, highly versatile embedded graphics and video solution for harsh environment applications. Designed around the AMD/ATI E4690 Graphics Dual Head Processing Unit with its 512 MB GDDR3 SDRAM frame buffer array, the M597 can simultaneously drive two independent video streams in a wide variety of output formats. It integrates multiple supporting hardware engines such as graphics language accelerators, parallel processing engines, video and audio de-compression units, and more.

The M597 supports the most advanced graphics and video standards including DirectX, OpenGL, and H.264, as well as multiple and versatile analog and digital graphics/video input and output protocols. Most of the standard M597 output video channels are provided through E4690 native integrated video ports. Additional video output protocols/formats and all video inputs are provided by an optional sophisticated FPGA residing alongside the E4690 GPU, to complement the GPU's capabilities.

In addition, the M597 provides advanced video overlay functionality. The E4690 processor generates the graphics images, superimposes an input from one of the various video formats, and drives the result to a monitor. A second overlay process can be implemented simultaneously on the independent second stream, using a different video input. This process can be routed to the FPGA for output on an interface not supported natively by the GPU.

The M597 is equipped with graphic BIOS (by AMD/ATI), making it available for use in x86 based platforms including Microsoft Windows and several Linux distributions. For these platforms, standard software drivers (available from AMD/ATI) can be used. In addition, OpenGL packages are available to support the VxWorks and INTEGRITY RTOSes, and also to support PowerPC architectures.



M597 Block Diagram

Functional Features

Graphics Processor

The M597 graphics engine features the high performance AMD/ATI E4690 GPU. This powerful GPU integrates multiple hardware 2D/3D graphics acceleration engines to provide high-quality 3D polygon and texture processing, as well as video and audio processing. Two independent graphics engines enable the E4690 to simultaneously process two graphics streams. The GPU employs a unified architecture over the 2D/3D and video multiple execution pipelines and memory interface, enabling high-flexibility data handling and preventing overload of data paths.

The E4690 is a hybrid device with an integrated on-chip 512 MB SDRAM array (GDDR3 @ up to 700 MHz). The SDRAM is used by the GPU for processing operations, frame buffer, texture buffer, and overlay buffer. The wide (128-bit) memory bus ensures that the memory array is always available to the graphics processor when needed.

Dual independent display controllers on the E4690 support true 30-bpp throughout the display pipe, with flexible control over combinations of display outputs.

A Unified Video Decoder (UVD) integrated in the E4690 accelerates video processing and supports H.264, VC-1, and MPEG-2 video processing. *

The E4690 also includes an audio processor generating the audio stream integrated in the HDMI output streams. *

* Requires AMD driver support

Video Interfaces

The M597 is a high channel count PMC supporting a wide variety of video input and output protocols and formats, including digital high definition video.

Most of the video output streams use native E4690 integrated modules (with no external transmitters or encoders). Additional video outputs, and all video inputs, are provided by an optional FPGA device.

The FPGA interconnects to the GPU through a 24-bit video port, and PCIe fabric. This architecture allows either of the GPU's video streams to be converted into formats not natively supported by the E4690 GPU.

Available interfaces and numbers of video I/O channels are determined by M597 functional configuration and mechanical form factor. For more information, see *Configuration Options* below.

Video Outputs

- Digital outputs software configurable as:
  - DVI Single-Link (up to 1600x1200 @ 60 Hz)
  - HDMI (up to 1920x1080 @ 60 Hz)
- RGBHV outputs (up to 1600x1200 @ 60 Hz)
- Analog TV output
  - Composite – RS-170A (NTSC)/PAL
  - S-Video – RS-170A (NTSC)/PAL
- SDI output (provided by optional FPGA)
  - SD-SDI supporting SMPTE 259M (480i @ 60 Hz, 576i @ 50 Hz)
  - HD-SDI supporting SMPTE 292M (720p @ 60 Hz, 1080i @ 60 Hz)

Video Inputs (provided by optional FPGA)

- SDI inputs configurable as:
  - SD-SDI supporting SMPTE 259M (480i @ 60 Hz, 576i @ 50 Hz)
  - HD-SDI supporting SMPTE 292M (720p @ 60 Hz, 1080i @ 60 Hz, 1080p @ 30 Hz)
- Multiplexed Composite inputs supporting RS-170A (NTSC)/PAL formats

Front Panel I/O

The air-cooled M597 front panel is fitted with one DVI-I connector and two SMB connectors, providing access to the following video I/O:

- One DVI output
- One RGBHV output
- One Composite input
- One Composite output

An optional factory configuration can provide SDI input and output interfaces at the front panel, in place of Composite interfaces. Consult with your Aitech sales representative for more information.

Video Overlay

The M597 provides video capture and overlay capabilities through its high-performance high-speed FPGA. All M597 video inputs are routed to the FPGA through their respective physical layer devices.

The FPGA can simultaneously capture any two input video sources, manipulate them (if needed) and transfer them to the two GPU graphics engines (heads) as overlays. This transfer is accomplished using the FPGA integrated DMA channels. The GPU overlays a software-generated synthetic image over the externally-captured video source to generate a combined video stream driven out of the GPU over its native video ports to an external display. Two such captured video streams can be independently and simultaneously handled by the FPGA through its internal resources and operational units.

Video overlay functionality is currently supported for VxWorks.

Video Switching

The M597 can route any video input to any video output, under software control (currently supported for VxWorks).

PCI Bus Interface

The M597 provides 64/32-bit PCI-X/PCI operation at 33 MHz through a 133 MHz host interface for connecting to the PMC.

The PMC host PCI interface fully complies with the PCI Rev. 3.0 and PCI-X Rev. 2.0a specifications.

The local bus infrastructure of the M597 is based on PCIe fabric, as both the E4690 GPU and the FPGA integrate PCIe cores in them. The two PCIe agents connect to a PCIe switch through x4 links. The switch is connected to a PCIe to PCI/PCI-X Bridge providing connectivity to the host PCI system.

The M597 is a universal PMC driving +3.3 V PCI signaling levels, and is +5.0 V tolerant. It does not utilize the PMC V_I/O power.

Software Drivers

The M597 is available in several versions for use with different operating systems (see *Ordering Information*). Two versions support VxWorks and INTEGRITY, and the other supports Windows and various distributions of Linux.

One VxWorks/INTEGRITY version of the M597 is bundled with the CoreAVI OpenGL driver providing:

- OpenGL 1.3, OpenGL ES 2.0, OpenGL SC
- Dual Display Support
- Drivers for INTEGRITY (Green Hills Software) and VxWorks (Wind River Systems)

A second VxWorks/INTEGRITY version is available without the CoreAVI driver. This version is only for customers who have a licensing agreement with CoreAVI as it cannot be used without the CoreAVI driver.

For systems requiring DO-178B certification, the CoreAVI Software DO-178B OpenGL package is also available.

The general Windows/Linux version of the M597 includes the standard AMD/ATI BIOS, and is supported by AMD's freely available standard driver package for the Windows and Linux operating systems (including OpenGL 3.x). The standard AMD drivers support the E4690 integrated modules and native video interfaces, but do not support the additional M597 functionality provided by the optional FPGA.

Mechanical Features

The mechanical/thermal design of the M597 ensures effective thermal paths for cooling of high power components. The resulting optimal heat distribution allows operation of the M597 in extreme environmental conditions.

In order to efficiently cool the conduction-cooled version, the M597 is supplied with a thermal interface material (TIM) assembled on the heatsinks. When the M597 is assembled on the host board, the TIM ensures an additional thermal interface that enables the M597 to cool itself efficiently.

Form Factor and Dimensions

The M597 PMC is available in two mechanical formats:

- Air-cooled per IEEE 1386-2001 for installation on IEEE 1101.1 commercial and rugged air-cooled carrier boards.
- Conduction-cooled per ANSI/VITA 20-2001 for installation on IEEE 1101.2 conduction-cooled carrier boards.

Weight

- Air-cooled: < 270 g
- Conduction cooled: < 200 g

Environmental Features

Please refer to the Aitech Ruggedization datasheet.

Performance and Power Consumption

The M597 draws its power from the host +5.0 V and +3.3 V power supplies.

Power consumption and performance of the M597, with various performance tests, are shown in the table below.

Power Consumption				Performance (4)	
GPU Clock (1)	Memory Clock (1)	Idle Power (2)	Max Power (3)	Test	Score
150 MHz	200 MHz	5.9 W	13.65 W	3DMark	1834
				SM2.0	581
				HDR/SM3.0	730
200 MHz	300 MHz	5.9 W	15.9 W	3DMark	3579
				SM2.0	1192
				HDR/SM3.0	1496
450 MHz	600 MHz	7.4 W	27.4 W	3DMark	5200
				SM2.0	1830
				HDR/SM3.0	2270
600 MHz	700 MHz	7.4 W	34.15 W	3DMark	6184
				SM2.0	2250
				HDR/SM3.0	2778

(1) GPU and memory clock frequencies can be dynamically controlled using the GPU software

(2) Idle Power is measured in Windows XP idle mode

(3) Max Power is measured during 3DMark06 Pixel Shader Test

(4) Test platform for these measurements is:

- Calpella evaluation board (Ft. Sumter) with Intel® Core™ i7 CPU @ 2 GHz and 1 GB RAM
- Windows® XP SP2 with ATI Radeon™ E4690 rev 8.900.0.0 driver
- Benchmark suite is 3DMark 06

Configuration Options

This table lists the number of I/O channels for each of the standard M597 variants.

		Configuration 0 Outputs Only – No FPGA (6)		Configuration 1 General Purpose	
		Conduction-Cooled	Air-Cooled (4)	Conduction-Cooled	Air-Cooled (4)
Outputs	DVI/HDMI (1) (2) (3) (7) (11)	2	3	2	3
	SDI (10)	0	0	1	1
	RGBHV (8) (12)	1	2	1	2
	Analog TV (9) (12)	1	1	1	1
Inputs	Composite (5)	0	0	4	5
	SDI (10)	0	0	2	2

(1) Software selectable
(2) Individually selectable as DVI or HDMI.
(3) Display Identification (DDC & HPD) signals are available for one of these outputs.
(4) Additional channels available in air-cooled configurations are routed only to front panel connectors.
(5) Only one Composite input can be active at any given time.
(6) Pinout compatibility with the Aitech M591 PMC is a special configuration available per customer request.
(7) Only two of these (including front panel outputs) are available at any given time.
(8) RGBHV outputs can be clones of DVI outputs at the same resolution, using the same graphics head.
(9) The Analog TV output always uses one graphics head.
(10) The M597 is factory configured for 75 Ω single-ended SDI operation mode (standard default configuration). 100 Ω differential configuration is available per customer request.
(11) Only one HDMI can be active at any given time.
(12) RGBHV and Analog TV outputs share the same DAC and are not available simultaneously.

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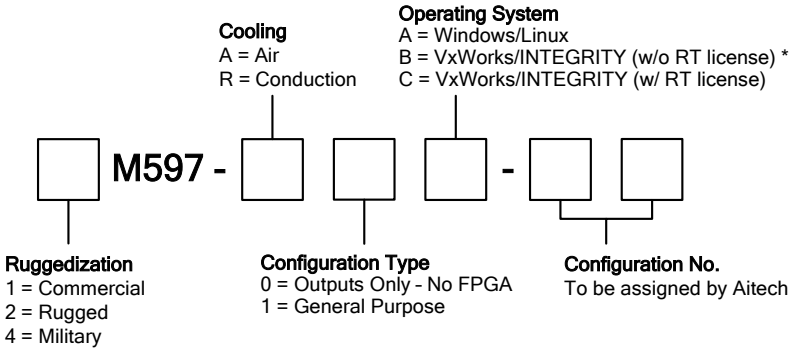
Ordering Information



* CoreAVI driver and RT license are required for each board. It is the responsibility of the customer to procure them from CoreAVI.

Example: 4M597-R1C-00

For more information about the M597 or any Aitech product, please contact Aitech Defense Systems sales department at (888) Aitech-8 (248-3248).

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