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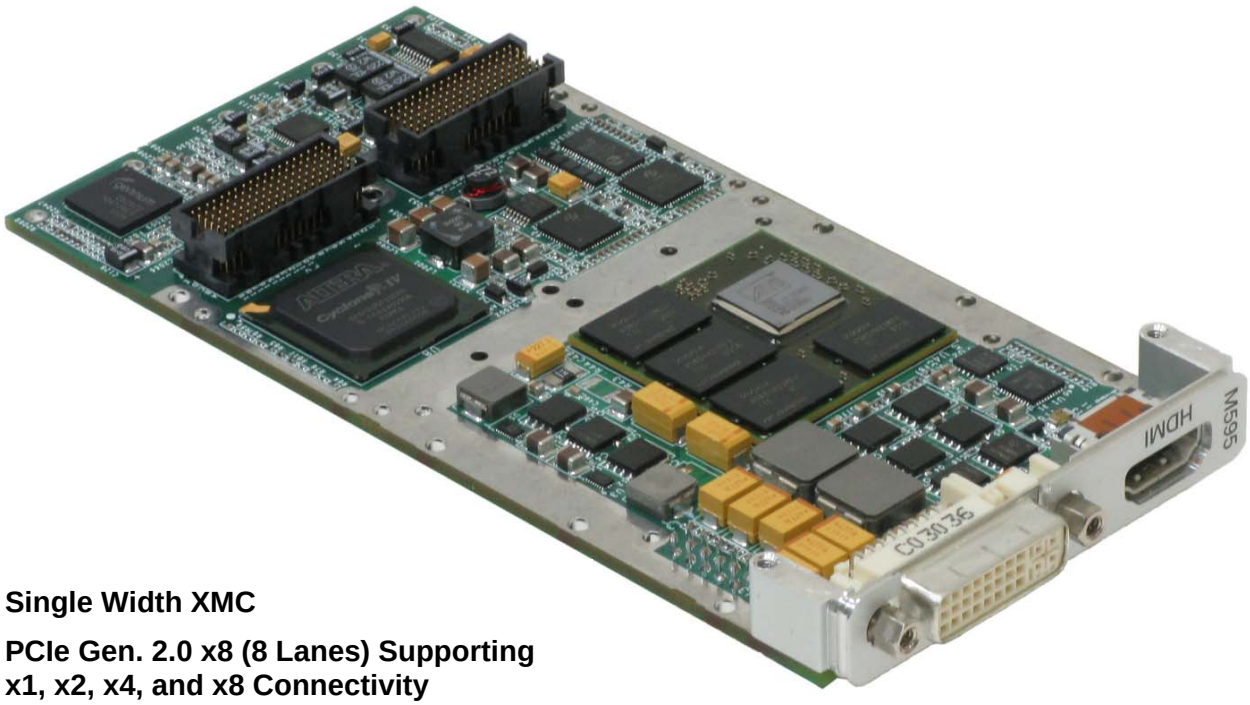
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M595
Dual Head Multiple Output Graphics XMC



- **Single Width XMC**
- **PCIe Gen. 2.0 x8 (8 Lanes) Supporting x1, x2, x4, and x8 Connectivity**
- **E4690 Embedded GPU @ up to 600 MHz**
- **Dual Independent Graphic Heads**
- **512 MB GDDR3 SDRAM @ up to 700 MHz with 128-bit interface**
- **Digital Output Channels**
  - **4 Digital Outputs Configurable as:**
    - Single-Link or Dual-Link DVI
    - HDMI
  - **1 Single/Dual-Link LVDS Output Channel**
  - **2 SD-SDI/HD-SDI Outputs**
- **Analog Output Channels**
  - **2 Analog TV Outputs**
    - Composite (PAL/NTSC/RS-170A)
    - S-Video (PAL/NTSC/RS-170A)
  - **2 Custom RGB Outputs**
    - Interlaced/Non-interlaced
    - Sync-on-green/Hsync, Vsync signaling
    - STANAG 3350 support available
  - **2 Non-interlaced RGBHV Outputs**
- **Video outputs routed to:**
  - **Front Panel (DVI/HDMI/RGBHV)**
  - **XMC P16 I/O Connector (All Interfaces)**
- **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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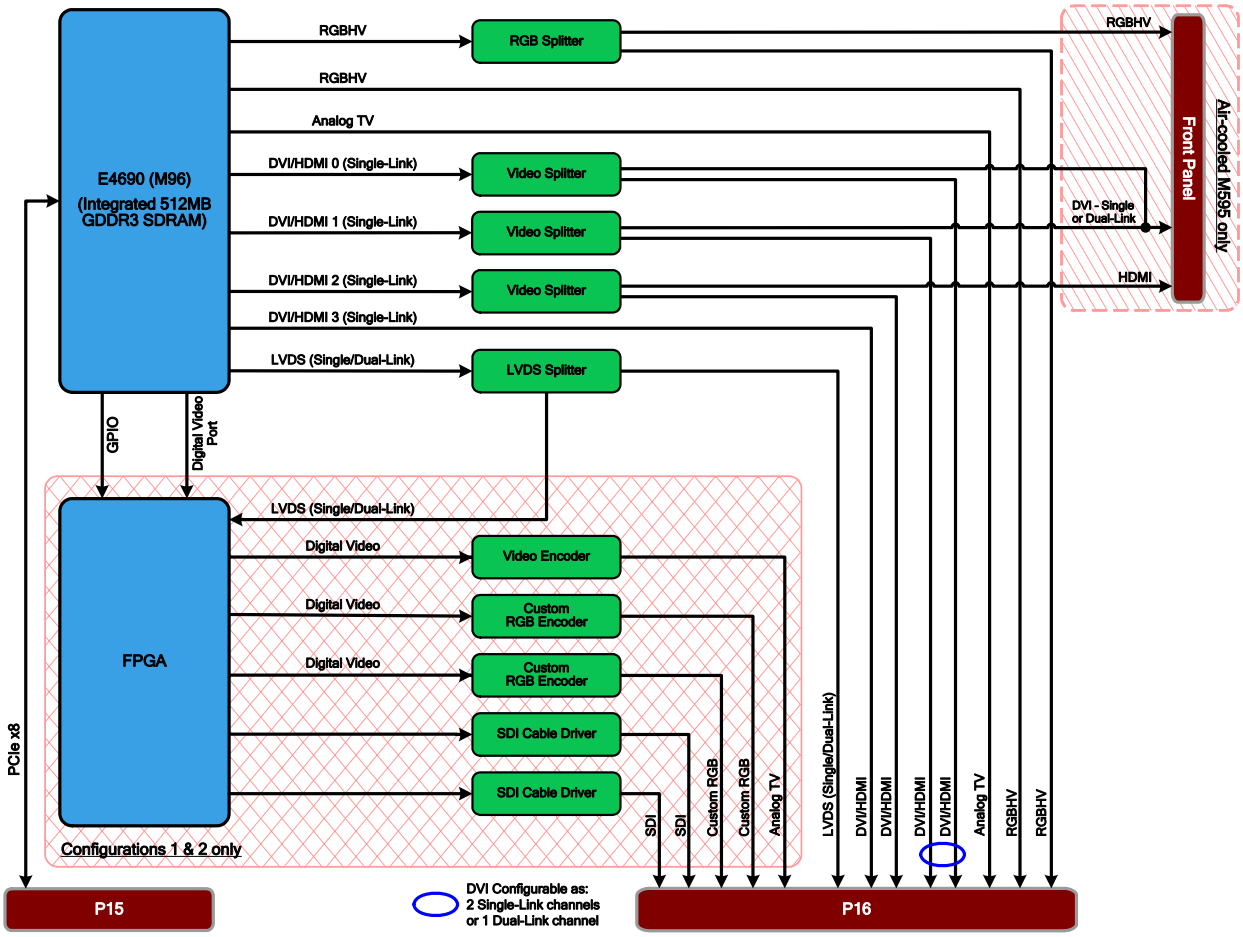
Powerful Dual Head Processing and Multiple Video Outputs

Aitech's M595 Dual Head Multiple Output Graphics XMC provides a high-performance, highly versatile embedded video and graphics solution for harsh environment applications. Designed around the AMD/ATI E4690 Dual Head Graphics Processing Unit with its 512 MB GDDR3 SDRAM frame buffer array, the M595 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 M595 supports the most advanced graphics and video standards including DirectX, OpenGL, and H.264, as well as multiple and versatile graphics and video output protocols. Most of the standard M595 output video channels are provided through E4690 native integrated video ports. Additional video protocols/formats and signal conditioning are provided by an optional sophisticated FPGA residing alongside the E4690 GPU, to complement the GPU's capabilities.

To ensure high-speed transfer of graphics and video, the M595 interconnects with the host system via an 8-port PCIe link.

The M595 is equipped with graphics 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.



M595 Block Diagram

Functional Features

Graphics Processor

The M595 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, and texture 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 M595 is a high channel count XMC supporting a wide variety of video output protocols and formats, including digital high definition video, as well as various exotic and legacy interfaces.

Most of the video output streams use native E4690 integrated modules (with no external transmitters or encoders), while some additional interfaces are provided by an optional FPGA device.

The FPGA interconnects to the GPU through two video links – a dual-link LVDS channel and a 24-bit video port. This architecture allows the GPU's video streams to be converted into formats not natively supported by the GPU.

Available interfaces and numbers of video output channels are determined by M595 functional configuration and mechanical form factor. For more information, see *Configuration Options* below.

E4690 Native Interfaces

The E4690 GPU incorporates multiple video decoders to directly drive outgoing video streams with no need for external decoders and transmitters.

E4690 native video output formats include:

- RGBHV
- Analog TV
  - Composite (CVBS) - RS-170A/NTSC/PAL
  - S-Video (Y/C) - RS-170A/NTSC/PAL
- Single/dual-link DVI
- HDMI (including audio)
- Single/dual-link LVDS

Additional FPGA Interfaces (Optional)

To supplement the native capabilities of the E4690, Aitech developed an FPGA to support several additional video formats and protocols. The FPGA receives the outgoing video stream from the GPU over the LVDS channel or the video port, and manipulates the video data in its integrated video units to generate a different video format.

FPGA video output formats include:

- Custom RGBHV/RGsB channels supporting STANAG 3350
- Additional Analog TV Output
  - Composite (CVBS) - RS-170A/NTSC/PAL
  - S-Video (Y/C) - RS-170A/NTSC/PAL
- SDI Output supporting SD-SDI/HD-SDI

Signal Conditioning Module

The M595 includes a signal conditioning module to support non-standard equipment such as monitors, recording equipment, or other equipment requiring special signal characteristics deviating from the standards. The formats that support signal conditioning include Analog TV (CVBS and S-Video), and supported STANAG 3350 formats.

Signal conditioning levels are hardware-configured at the factory per customer request.

Video Channel Routing

All M595 video output channels are routed to the XMC P16 I/O connector. Due to the high channel count several interfaces share the same connector pins. Refer to the *Configuration Options* section of this datasheet for available output combinations.

The front panel of air-cooled versions of the M595 is fitted with one DVI-I connector and one HDMI connector, providing access to the following video outputs:

- One DVI output
- One HDMI output
- One RGBHV output

PCIe Bus Interface

The M595 interconnects with the host system via the E4690 integrated PCIe end point port. The PCIe port fully complies with PCIe 2.0 and supports x1, x2, x4, and x8 port width.

Software Drivers

The M595 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 M595 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 M595 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 M595 functionality provided by the optional FPGA.

Mechanical Features

The mechanical/thermal design of the M595 ensures effective thermal paths for cooling of high power components. The resulting optimal heat distribution allows operation of the M595 in extreme environmental conditions.

In order to efficiently cool the conduction-cooled version, the M595 is supplied with thermal interface material (TIM) on the heatsinks. When the M595 is assembled on the host board, the TIM ensures an additional thermal interface that enables the M595 to cool itself efficiently.

Form Factor and Dimensions

The air-cooled and conduction-cooled variants of the M595 are compliant with the mechanical and dimensional requirements of ANSI/VITA 42.0-2008, enabling them to be used in conjunction with any IEEE 1101.1 (air-cooled) and IEEE 1101.2 (conduction-cooled) compliant carrier boards with XMC connectors.

Weight

Air-cooled:	<270 g
Conduction cooled:	<170 g (with heatsink)

Environmental Features

Please refer to the Aitech ruggedization data sheet.

For best environmental performance ensure proper installation on the host. Refer to the XMC Installation section of the M595 User's Guide for detailed instructions.

Performance and Power Consumption

The M595 is powered by +3.3 Vdc and VPWR (+5 V/+12 V are both supported seamlessly) supplied by the host/carrier board. ±12 V_AUX service voltages are used for power sequencing and video amplification.

Power consumption and performance of the M595, 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 Core i7 CPU @ 2 GHz and 1 GB RAM.
- WinXP SP2 with ATI Radeon E4690 rev 8.900.0.0 driver.
- Benchmark suite is 3DMark 06.

M595
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Configuration Options

The M595 is available in four standard variants, with backplane outputs as shown in this table.

		Variant			
		With FPGA		Without FPGA	
		1 General Purpose	2 LVDS System	3 General Purpose	4 LVDS System
Outputs	RGBHV0 (1)	1	1	1	1
	RGBHV1/Analog TV (1) (2) (3) (4)	0	0	1	1
	Analog TV (3) (5)	2	2	0	0
	DVI/HDMI (2)	4 (6) (7) (8) (9)	0	4 (6) (8) (9)	0
	Custom RGB (STANAG class C)	2	2	0	0
	LVDS Single/Dual-Link (2)	0	1	0	1
	SDI	2	2	0	0

(1) RGBHV outputs can be clones of DVI outputs at the same resolution, using the same graphics head.

(2) Software selectable

(3) Analog TV outputs are software selectable as Composite or S-Video.

(4) This analog TV output always uses one graphics head.

(5) Does not support RS-170A levels.

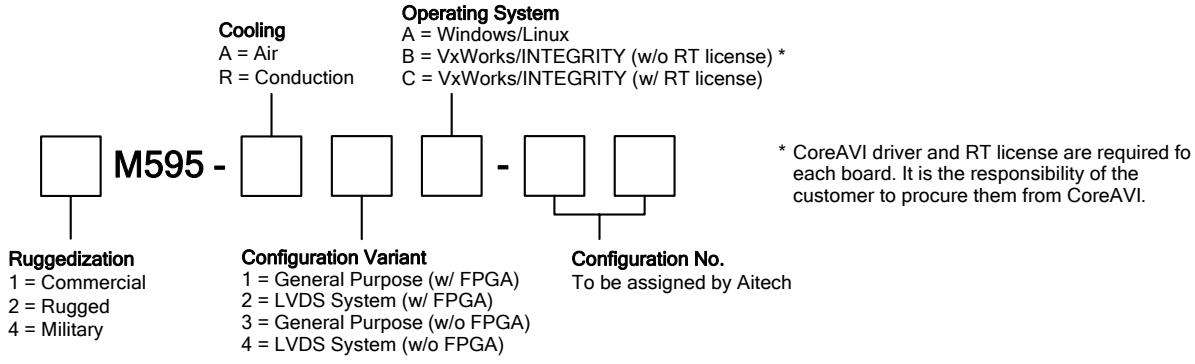
(6) Individually selectable as single-link DVI or HDMI. One pair of single-link DVI outputs can be software configured as one dual-link DVI output.

(7) Display Identification (DDC & HPD) signals are not available for one of these four outputs.

(8) Only two of these are available at any given time.

(9) Only one HDMI is available at any given time.

Ordering Information



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

Example: 4M595-R1C-00

For more information about the M595 or any Aitech product, please contact Aitech Defense Systems sales department at (888) Aitech-8 (248-3248).

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