

***AMD HD5450***  
***PCIe X1® ADD-IN BOARD***  
***Datasheet***

***Advantech model number: AEGX-A3T5-71FST1***

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## 1. Feature

Model Name	<b>AEGX-A3T5-71FST1</b>
<b>Graphics Processing Unit</b>	
APU	HD5450 ( Park LP)
Process Technology	40 nm
Graphics Engine Operating Frequency (max)	650 GHz
Form Factor	ATX (167 X 69 mm)
Card Interface	PCI Express® 2.1 (X1)
Shader Processing Units	80 shaders
Floating Point Performance (single precision, peak)	104 GFLOPs
DirectX® capability	DirectX® 11
Shader Model	Shader Model 5.0
OpenGL	OpenGL™ 4.1
OpenCL™	OpenCL™ 1.1
Unified Video Decoder (UVD)	UVD3 for H.264, VC-1, MPEG-2, MPEG-4 part 2 decode
<b>Memory</b>	
Memory Operating Frequency (max)	333 MHz / 666 Mbps
Configuration, type	64-bit wide, 512 MB, DDR2
<b>Display Interface</b>	
Single / Dual-Link DVI	Dual DVI-D X1
CRT	15-pin D-SUB X 1
HDMI	HDMI X1

## 2. Functional Overview

### 2.1. Memory Interface

Memory configuration support

The Cedar has two DRAM sequencers. Each DRAM channel is 32-bit wide. All DRAM devices must be of the same type, have the same size on each channel, and must run at the same voltage.

**Supported DRAM Component Organizations:**

- 4, 8, or 16 banks (2-, 3-, or 4-bank bits). Single- or dual-rank.
- Rows: 1024, 2048, 4096, 8192, or 16384 (10, 11, 12, 13, or 14 bits).
- Columns: 256, 512, or 1024
- CS (chip select): 1 or 2

### 2.2. Acceleration Features

- Fully DirectX® 11 compliant, including full-speed 32-bit floating point per component operation:
  - Shader Model 5.0 geometry and pixel support in a unified-shader architecture:
    - ◆ Vertex, pixel, geometry, compute, domain, and hull shaders.
    - ◆ 32- and 64-bit floating-point processing per component.
    - ◆ High-performance dynamic branching and flow control.
    - ◆ Nearly unlimited shader-instruction store, using an advanced caching system.
    - ◆ Advanced shader design, with ultra-threading sequencer for high efficiency operations.
    - ◆ Advanced, high-performance branching support, including static and dynamic branching.
    - ◆ High dynamic-range rendering with floating-point blending, texture filtering and anti-aliasing support.
    - ◆ 16- and 32-bit floating-point components for high dynamic-range computations.
    - ◆ Full anti-aliasing on render surfaces up to and including 128-bit floating-point formats.
- Support for OpenGL 3.2.

- Support for OpenCL™ 1.0.
- Anti-Aliasing Filtering:
  - ◆ 2x/4x modes.
  - ◆ Multi- and super-sample algorithms with gamma correction, programmable sample patterns, and centroid sampling.
  - ◆ Custom filter anti-aliasing with up to 12-samples per pixel.
  - ◆ Adaptive anti-aliasing mode.
  - ◆ Lossless color compression (up to 8:1) at all resolutions, up to and including wide-screen HDTV.
- Anisotropic Filtering:
  - ◆ 2x/4x/8x/16x modes.
  - ◆ Up to 128-tap texture filtering.
  - ◆ Anisotropic biasing to allow trading quality for performance.
  - ◆ Improved quality mode due to improved sub-pixel precision and higher precision LOD computations.
  - ◆ Advanced texture compression (3Dc+™).
  - ◆ High-quality 4:1 compression for normal and luminance maps.
  - ◆ Angle-invariant algorithm for improved quality.
  - ◆ Works with any single- or two-channel data format
- Hardware support to overcome "small batch" issues in CPU limited applications.
- 3D resources virtualized to a 32-bit addressing space for support of large numbers of render targets and textures.
- Up to 16k × 16k textures, including 128-bit/pixel textures are supported.
- Programmable arbitration logic maximizes memory efficiency and is software upgradeable.
- Fully associative texture, color, and z-cache design.
- Hierarchical z- and stencil-buffers with early z-test.
- Lossless z-buffer compression for both z and stencil.
- Fast z-buffer clear.
- Fast color-buffer clear.
- Z cache optimized for real-time shadow rendering.
- Z- and color-compression resources virtualized to a 32-bit addressing space, for support of multiple render targets and textures simultaneously.

## 2.3. Avivo™ Display System

The AMD Avivo™ display system supports VGA, VESA super VGA, and accelerator

mode graphics display on three independent display controllers.

The full features of the AMD Avivo display system are outlined in the following sections.

## 2.4. DVI/HDMI Features

- Advanced DVI capability supporting 10-bit HDR (high dynamic range) output.
- Supports industry-standard CEA-861B video modes including 480p, 720p, 1080i, and 1080p. For a full list of currently supported modes, contact your local AMD support person.
- Maximum pixel rates for 24-bpp outputs are:
  - ◆ DVI — 162 MP/s (megapixels per second) per link for 30-bpp dual-link; double for 24-bpp dual-link.
  - ◆ HDMI — 148.5 MP/s.
- Fully compliant with the DVI electrical specification.
- HDMI meets Windows Vista® logo requirements.

## 2.5. DisplayPort Features

- Supports all the mandatory features of the DisplayPort Version 1.1a
- Specification and the following optional features:
  - ◆ 30-bit support.
  - ◆ YCbCr 444 up to 30-bpp and 422 up to 20-bpp support.
  - ◆ HDCP support.
  - ◆ DisplayPort extension for test-automation features, including test-pattern generation.
  - ◆ DisplayPort Audio.
- Each DisplayPort link can support three options for the number of lanes and two options for link-data rate as follows:
  - ◆ Four, two, or one lane(s).
  - ◆ 2.7- or 1.62-GHz link-data rate per lane.
- Supports all video modes supported by the display controller that do not oversubscribe the link bandwidth.
- Examples of supported pixel-rate/resolution support for four lanes at 2.7-GHz link rate:
  - ◆ Link bandwidth allows pixel clocks of up to 359 MP/s for 24 bpp or 287 MP/s for 30 bpp.

- ◆ 2560×1600@60Hz, 30 bpp is supported.
- Examples of supported pixel-rate/resolution support for two lanes at 2.7- GHz link rate:
  - ◆ Link bandwidth allows pixel clocks of up to 179 MP/s for 24 bpp or 143 MP/s for 30 bpp.
  - ◆ 1920×1200@60Hz, 24 bpp is supported.
- The following table shows the maximum pixel rates for four, two, or one lane(s) at 2.7-GHz link rate

Table 2-5 Maximum pixel rates for four, two, or one lane(s) at 2.7 GHz link rate

	18 bpp	24 bpp	30 bpp
One lane	119 MP/s	89 MP/s	71 MP/s
Two lanes	239 MP/s	179 MP/s	143 MP/s
Four lanes	478 MP/s	359 MP/s	287 MP/s

## 2.6. Integrated HD-Audio Controller (Azalia) and Codec

- The integrated HD-Audio codec supports linear PCM and Dolby Digital (7.1) audio formats for HDMI and DisplayPort outputs.
 

**Note:** Player applications may limit audio output capabilities.
- Separate logical-chip function.
- Can encrypt data onto one associated HDMI output.
- Compatible Microsoft® UAA driver support for basic audio.
  - ◆ For advanced functionality, a 3rd party driver is required.
- Internally connected to the integrated HDMI interface, hence no external cable is required.
- Supports Dolby True HD, DTS-HD, Dolby Digital (AC3), and DTS.
- LPCM and high-bit rate audio support — up to 24 bits/sample and up to 192-kHz sampling rate.
- Support for up to eight channels.
- HDCP content-protection support for software-audio stack.
- True audio plug-and-play capability for enhanced-audio modes.
- Audio DRM supported.

## 2.7. Dual Analog-Out Feature

### 2.7.1. Dual DACs

- Two integrated triple 10-bit DACs with a built-in reference circuit, which takes the output from either one of the internal display controllers (primary or secondary) or the internal analog-TV encoder.
- Dual RGB-CRT output.
- Support for the stereo-sync signal to drive a 3D display.
- Maximum pixel frequency of 400 MHz.
- Individual power-down feature for each of the three guns.
- Fully compliant with the VSIS electrical specification.
- Fully integrated with built-in band gap reference circuitry.
- Optional dynamic monitor detection for hot-plug/unplug capability. This feature affects the DAC-voltage ranges. Please check with AMD for details before enabling.
- Integrated monitor- and TV-detection circuit (TV detection for DAC2 only).
- Internal demultiplexer in DAC2, allowing it to be output on one of the two output signal groups (TV or CRT), which allows separate external output filters without an external multiplexer. See the following section for TV-out features.

### 2.7.2. TV-out(on DAC2)

- Internal CE-class TV encoder for YPbPr, NTSC, and PAL (all variants supported). Can take its input from either internal display controller and output on DAC2.
- Component output: YPbPr for 480i, 480p, 576i, 576p, 720p, 1080i, and 1080p.
- YC S-video output for NTSC and PAL.
- Composite output for NTSC and PAL.
- Support for under scan in all TV modes.
- Scaling and internal adaptive-flicker filtering available on both display paths for interlaced TV outputs.
- CGMS (copy-generation management system) copy-protection support.
- Two-line comb-on-the-way-out for luma-chroma cross-talk prevention.
- Capable of supporting the following VBI-data insertion standards:
  - ◆ Line 21 for NTSC data on odd and even fields separately, including closed caption, parental rating information, and other extended data services (EDS).



- ◆ Wide-screen signaling (WSS) for both PAL and NTSC, including CGMS-A(analog copy-generation management system).
- ◆ Teletext data for PAL.
- NABTS (North American broadcast teletext specification) data for NTSC.

## 2.8. Bus Support Features

3. Fully compliant with PCI Express® Base Specification Revision 2.1 PCIe® bus interface.
4. Supports x1 lane widths.
5. Supports 2.5 GT/s and 5.0 GT/s link-data rates.
6. Supports x1 lane reversal where the receiver on lane 0 on the graphics endpoint is mapped to the transmitter on lane 0 on the root complex.
7. Supports x1 lane reversal where the transmitter on lane 0 on the graphics endpoint is mapped to the receiver on lane 0 on the root complex (requires corresponding support on the root complex).
8. Supports full-swing and low-swing transmitter output levels.

### 3. PIN Assignment and Description

Pin	Side B Connector		Side A Connector	
#	Name	Description	Name	Description
1	+12v	+12 volt power	PRSNT#1	Hot plug presence detect
2	+12v	+12 volt power	+12v	+12 volt power
3	RSVD	Reserved	+12v	+12 volt power
4	GND	Ground	GND	Ground
5	SMCLK	SMBus clock	JTAG2	TCK
6	SMDAT	SMBus data	JTAG3	TDI
7	GND	Ground	JTAG4	TDO
8	+3.3v	+3.3 volt power	JTAG5	TMS
9	JTAG1	+TRST#	+3.3v	+3.3 volt power
10	3.3Vaux	3.3v volt power	+3.3v	+3.3 volt power
11	WAKE#	Link Reactivation	PWRGD	Power Good
<b>Mechanical Key</b>				
12	RSVD	Reserved	GND	Ground
13	GND	Ground	REFCLK+	Reference Clock Differential pair
14	HSOp(0)	Transmitter Lane 0, Differential pair	REFCLK-	
15	HSOn(0)		GND	Ground
16	GND	Ground	HSIp(0)	Receiver Lane 0, Differential pair
17	PRSNT#2	Hotplug detect	HSIn(0)	
18	GND	Ground	GND	Ground

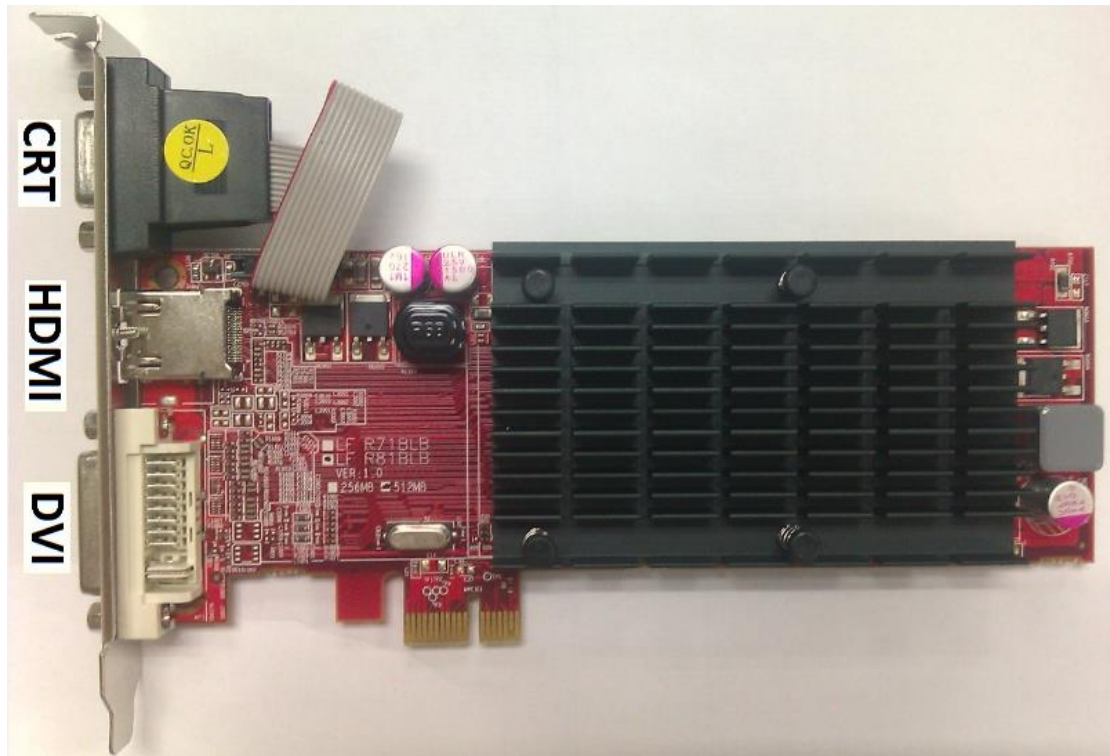
## **4. Power Consumption**

<b>Application</b>	<b>Total ASIC Power + DRAM Power (W)</b>
Static Windows	<b>3.73</b>

<b>Application</b>	<b>Total ASIC Power + DRAM Power (W)</b>
3D Mark 2003	<b>19.36</b>

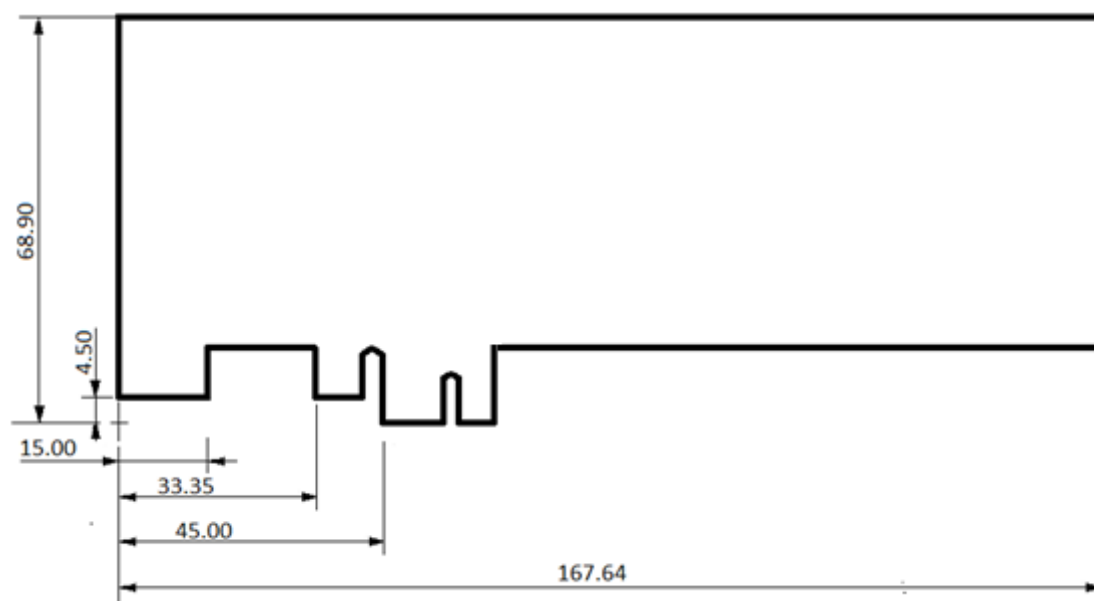
## 5. Output configuration and Board Dimension

### 5.1. Output Configuration



## 5.2. Board Dimension

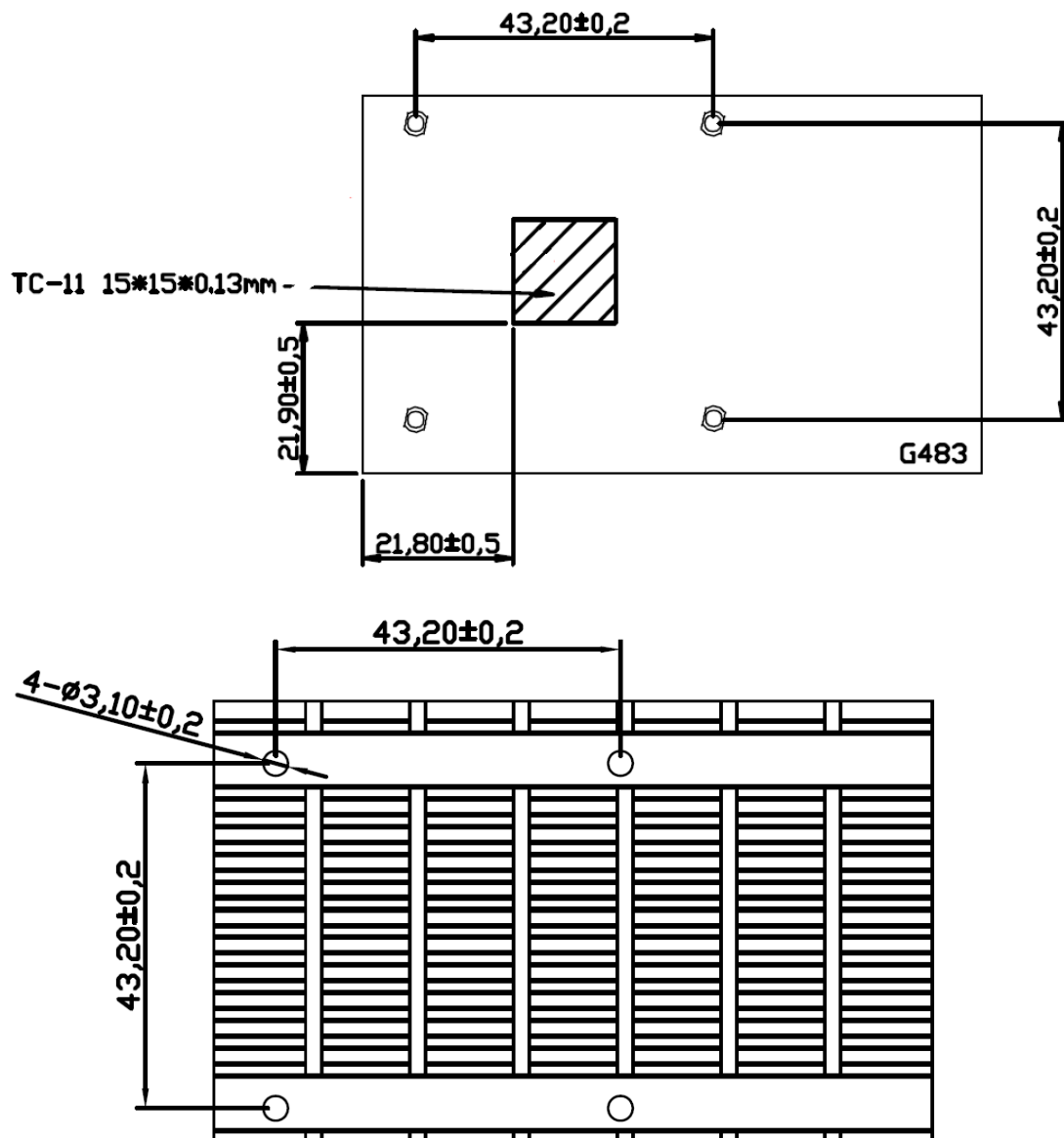
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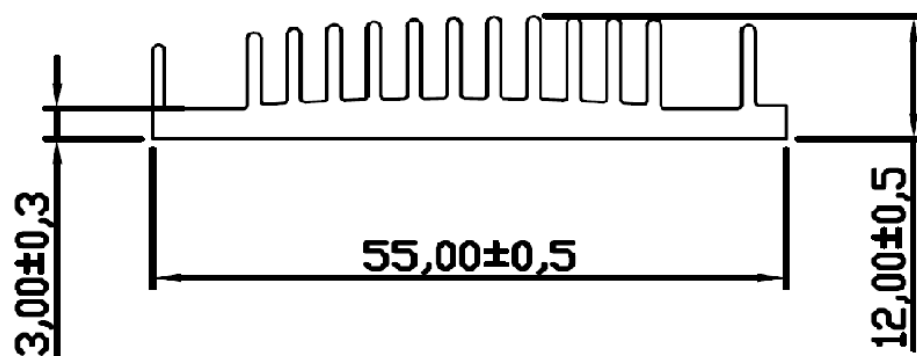
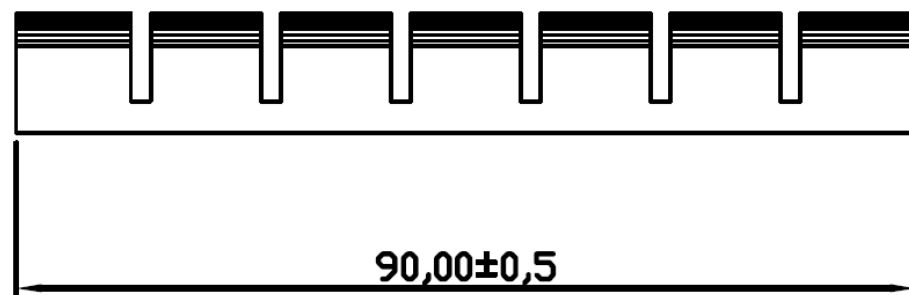


Tolerances :  $\pm 0.13$  mm

## 6. Thermal Mechanism

(Unit : mm)





## 7 Order Information

Model	GPU	Form Factor	Memory	DVI-D	HDMI	VGA	Bracket	Thermal Solution	Remark
AEGX-A3T5-71FST1	HD5450	ATX (167 X 69 mm)	64-bit wide, 512MB, DDR2	1	1	1	Full Height / Low Profile	Fanless	PCI-E 16X

## 8 Change Log Update History

Rev.	Data	History
0.1	2012/8/10	1 <sup>st</sup> Draft
0.2	2012/11/6	Modify page 12, output port on bracket picture, DVI-D to DVI-I.
0.3	2013/8/27	Correct Memory Spec.
0.4	2015/09/16	Modify P/N from GFX-A3T5-71FST1 to AEGX-A3T5-71FST1 Add Item 7: Order Information