AMD

Product Brief

AMD Embedded R-Series Platform

Delivering exceptional performance in a power-efficient platform

Product Overview

The AMD Embedded R-Series Processor platform delivers high-performance processing coupled with a premium high-definition visual experience in a solution that is power efficient. It enables unprecedented integrated graphics and multi-display capabilities in compact, low power embedded applications.

The AMD R-Series APU (Accelerated Processing Unit) is designed to efficiently handle advanced multimedia and computational workloads. With average power below 13 Watts[1] and discrete-class AMD Radeon™ HD 7000G Series graphics integrated into the AMD R-Series APU, applications that previously required a discrete graphics card can be developed with a single-chip solution in smaller form factors with lower power and cost. The third generation Unified Video Decoder in the AMD R-Series APU enables the delivery of crisp and clear video for ad content, instructional materials, or live teleconferencing. For more demanding graphics applications, AMD Radeon™ Dual Graphics technology[2] combines the processing power of AMD R-Series APUs and discrete AMD Radeon™ Embedded 6000 Series GPUs to more than double graphics performance[3] compared to using discrete graphics alone.

The innovative CPU architecture integrates dedicated resources that deliver exceptional performance, with shared resources that reduce power consumption and die space. And through AMD Turbo CORE 3 technology the power being consumed by the APU is allocated to accomplish the work at hand, helping to minimize unnecessary system optimization by automatically delivering an optimized balance between performance and power consumption.

With between 128 and 384 compute units delivering a calculated 172 to 563 SP GFLOPs[4] of performance, AMD R-Series APUs help enable a wide range of compute intensive applications that are low power and fit into small form factors. Support for Open-CL™ helps make it easier to take advantage of a substantial increase in performance, for applications that can leverage parallel processing.

AMD Embedded R-Series CPUs are designed for applications that require high performance x86 compute such as network attached storage (NAS). These options include quad-core and dual-core CPUs scaling from 2.2 GHz to 3.2 GHz at 17 watts to 35 watts thermal design power (TDP). The AMD R-Series CPUs can be combined with discrete AMD Embedded 6460 or 6760 Radeon™ graphics for driving up to 10 independent displays. These options provide cost-effective solutions for maximum compute and graphics capabilities.

Additional Features and Benefits

- Hardware Video Compression Engine enables efficient encoding and fast video conversion.

- Secure Asset Management Unit lowers power/CPU overhead when dealing with protected content.

- A wide range of parallel compute capabilities offered to suit the requirements of many embedded applications.

Enabling Innovative Multi-display Designs

- Drive up to 4 displays[5] from a single highly integrated processor.

- Drive multiple displays simultaneously as independent displays, or as a single large surface with AMD Eyefinity technology.[6]

- Display resolutions of up to 4k x 2k @ 30 Hz utilizing a single display output.

- Drive up to 10 independent displays by pairing an AMD R-Series

- APU with an AMD Radeon™ Embedded 6000 Series discrete graphics processor or card.[5,6]

Key Architecture Benefits

Processor Features

- High performance integrated x86 cores
- AMD Radeon™ HD 7000G Series graphics integrated into the AMD R-Series APUs
- Unified North Bridge
- High-bandwidth, low-latency integrated memory controller
- Low-latency platform interface

x86 Core Architecture

- Dual or quad-core x86 processor
- 2nd Generation "Bulldozer" core architecture
  - *Combination of dedicated and shared resources*
- 256-bit shared or two dedicated 128-bit floating-point units (FPU)
  - *Shared between two cores*
- AMD64 64-bit ISA
- SSE, SSE2, SSE3, SSE4a, SSE4.1, SSE4.2, SSSE3, ABM, AVX, AVX1.1, AES, BMI, XSAVE/XRSTOR, XGETBV/ XSETBV, PCLMULQDQ, FMA, FMA4, TBM, XOP, MMX™, and legacy x86 instructions

Integrated DDR3 Memory Controller

- Two 64-bit DDR3 SDRAM controllers operating at frequencies up to 1600 MT/s (800 MHz)
- Two single-rank SO-DIMMs or unbuffered DIMMs
- Support for 1.5V/1.35V/1.25V DDR3

APU Integrated Graphics Core Architecture

- Dedicated graphics memory controller
  - *High efficiency ring bus memory controller*
  - *Direct connection to memory*
- 2D Acceleration
  - *Highly-optimized 128-bit engine, capable of processing multiple pixels per clock*
- 3D Acceleration
  - *Full DirectX® 11 support, including full speed 32-bit floating point per component operations*
  - *Shader Model 5*
  - *OpenCL™ 1.1 support*
  - *OpenGL 4.2 support*
- UVD 3.2 dedicated hardware video decoder
  - *H.264, MPEG4 Part 2, VC-1 and MPEG2 decode[7]*
  - *Simultaneous dual HD source decode*
- VCE (Video Compression Engine) 1.0
  - *Hardware assisted encoding of HD video streams*
  - *H.264 (baseline + CABAC) 1080p at 60 fps*
  - *Real time transcoding*

Display Interfaces

- Multiple DisplayPort 1.2, DVI and HDMI™
- Up to 4 independent displays[8]

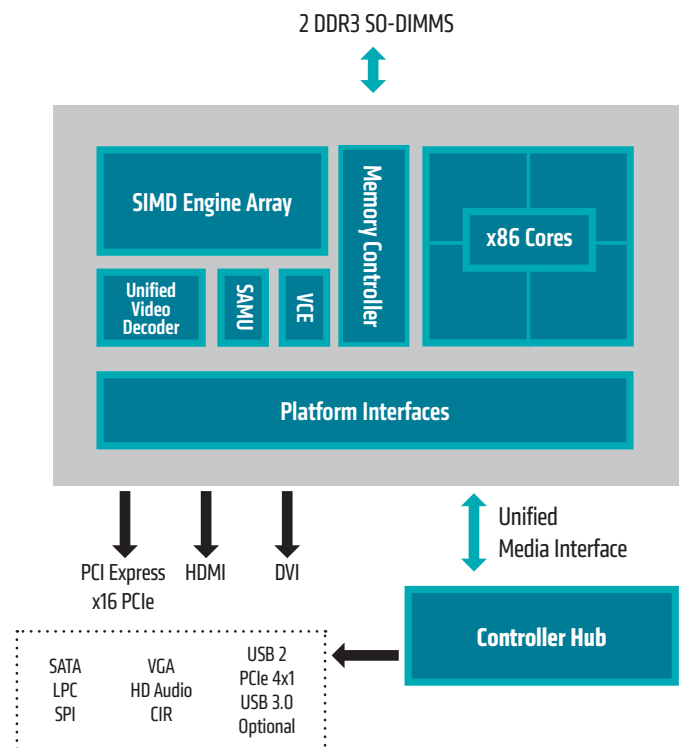### AMD Virtualization™ Technology (AMD-V™)

- SVM pause count capability
- SVM disable and lock
- Rapid virtualization indexing (nested paging)
- Improved world-switch speed

I/O

- Gen2 PCI Express® x16 Interface (x8 on FP2 packaged APUs)
- Additional 4x1 or 1x4 Gen2 PCI Express® interface on APU
- See controller hub table for detailed I/O features of A70M and A75

Package

- APU/CPU FS1r2
  - *722-pin lidless µ PGA*
  - *35mm x 35mm*
  - *1.2192-mm pin pitch*
- APU/CPU FP2
  - *827-ball lidless µ BGA*
  - *27mm x 31mm*
  - *.8mm to 1.2-mm ball pitch*
- Controller Hub
  - *656-ball lidless µ BGA*
  - *24.5mm x 24.5mm*
  - *8mm ball pitch*

AMD Embedded R-Series APU Models and Key Features

| AMD G-Series Accelerated Processing Units														
Model	OPN	Pckg	CPU Cores	L2 Cache	Memory Interface	CPU Core Frequency - P2/P0	Discrete	GPU Core Frequency	Hardware Video Acceleration[12]	Graphics	Display Outputs[13]	Display Resolutions	Thermal Design Power	Tdie
R-464L	RE464LDEC44HJE	1225mm2 722-PGA	4	2MBx2	128 Bit organized as two 64 bit channels supporting ULVDDR3 (1.25V), LVDDR3 (1.35V), and up to DDR3-1600 (1.5V)	2.3/3.2 GHz	AMD Radeon™ HD 7660G	685MHz/496MHz	H.264 Decode (HD+HD up to 1080p and 1080i) H.264 encode (baseline+CABAC) 1080p@60Hz H/W security including AES Decryption	DirectX® 11 Shader Model 5 OpenCL™ 1.1 OpenGL 4.2	Quad independent display controllers providing 4 active outputs: 4x single link DVI 4x DisplayPort 1.2 (Requires MST Hub) 1x HDMI™ 1x VGA	DisplayPort/eDP: 4096x2160@30Hz 18/24/32 bpp Single Link DVI: 1920x1200@60Hz 24 bpp Dual Link DVI: 2560x1600@60Hz 1920x1200@60Hz 24/30 bpp Native HDMI: 1920x1080@60Hz 24/30/36 bpp 1920x1200@60Hz 24 bpp Type 1 Dual Mode DisplayPort to HDMI Adaptor: 1280x720@60Hz 24/30/36 bpp 1920x1200@60Hz 24 bpp Type 2 Dual Mode DisplayPort to HDMI Adaptor: 1920x1080@60Hz 24/30/36 bpp 1920x1200@60Hz 24 bpp	35W	100°C
R-460H	RE460HDEC44HJE		4	2MBx2		1.9/2.8 GHz	AMD Radeon™ HD 7640G	654MHz/496MHz	H.264 Decode (HD+HD up to 1080p and 1080i) H.264 encode (baseline+CABAC) 1080p@60Hz H/W security including AES Decryption				35W	100°C
R-272F	RE272FDEC23HJE		2	1MB		2.7/3.2 GHz	AMD Radeon™ HD 7520G	685MHz/496MHz	H.264 Decode (HD+HD up to 1080p and 1080i) H.264 encode (baseline+CABAC) 1080p@60Hz H/W security including AES Decryption				35W	100°C
R-268D	RE268DDEC23HJE		2	1MB		2.5/3.0 GHz	AMD Radeon™ HD 7420G	654MHz/480MHz	H.264 Decode (HD+HD up to 1080p and 1080i) H/W security including AES Decryption				35W	100°C
R-460L	RE460LSIE44HJE	837mm2 827-BGA	4	2MBx2	128 Bit organized as two 64 bit channels supporting ULVDDR3 (1.25V), LVDDR3 (1.35V), and up to DDR3-1333 (1.5V)	2.0/2.8 GHz	AMD Radeon™ HD 7620G	496MHz/360MHz	H.264 Decode (HD+HD up to 1080p and 1080i) H.264 encode (baseline+CABAC) 1080p@60Hz H/W security including AES Decryption	DirectX® 11 Shader Model 5 OpenCL™ 1.1 OpenGL 4.2	Quad independent display controllers 4 active outputs from: 4x single link DVI 4x DisplayPort 1.2 (Requires MST Hub) 1x HDMI™	DisplayPort/eDP: 4096x2160@30Hz 18/24/32 bpp Single Link DVI: 1920x1200@60Hz 24 bpp Dual Link DVI: 2560x1600@60Hz 1920x1200@60Hz 24/30 bpp Native HDMI: 1920x1080@60Hz 24/30/36 bpp 1920x1200@60Hz 24 bpp Type 1 Dual Mode DisplayPort to HDMI Adaptor: 1280x720@60Hz 24/30/36 bpp 1920x1200@60Hz 24 bpp Type 2 Dual Mode DisplayPort to HDMI Adaptor: 1920x1080@60Hz 24/30/36 bpp 1920x1200@60Hz 24 bpp	25W*	100°C
R-452L	RE452LSHE44HJE		4	2MBx2		1.6/2.4 GHz	AMD Radeon™ HD 7600G	424MHz/327MHz	H.264 Decode (HD+HD up to 1080p and 1080i) H.264 encode (baseline+CABAC) 1080p@60Hz H/W security including AES Decryption				19W*	100°C
R-260H	RE260HSHE24HJE		2	2MB		2.1/2.6 GHz	AMD Radeon™ HD 7500G	424MHz/327MHz	H.264 Decode (HD+HD up to 1080p and 1080i) H.264 encode (baseline+CABAC) 1080p@60Hz H/W security including AES Decryption				17W*	100°C
R-252F	RE252FSHE23HJE		2	1MB		1.9/2.4 GHz	AMD Radeon™ HD 7400G	424MHz/327MHz	H.264 Decode (HD+HD up to 1080p and 1080i) H/W security including AES Decryption				17W*	100°C
R-464L	RE464LDFE44HJE		4	2MBx2		2.3/3.2 GHz	AMD Radeon™ HD 7660G	685MHz/496MHz	H.264 Decode (HD+HD up to 1080p and 1080i) H/W security including AES Decryption				35W*	100°C
R-460H	RE460HDFE44HJE		4	2MBx2		1.9/2.8 GHz	AMD Radeon™ HD 7640G	654MHz/496MHz	H.264 Decode (HD+HD up to 1080p and 1080i) H/W security including AES Decryption				35W*	100°C

AMD R-Series APU Controller Hubs

Model	OPN	CPU Interface	Package	PCI Express®	PCI	SATA	FIS-Based Switching	USB	HD Audio	LPC SPI SMBus	Max GPIOs	APU Fan Control	APU Clock Gen	Power
A70M	100-CG2389	Unified Media Interface (UMI) x4 Gen1 +DP	656-BGA 600mm²	4 x1 or 1x4 Gen2	No	6x 6Gb/s Raid 0,1	No	4 v3.0 10 v 2.0 2 v1.1	Up to 4-channels	Yes	32	Yes	Yes	Configuration Specific
A75	100-CG2386	Unified Media Interface (UMI) x4 Gen1 +DP	656-BGA 600mm²	4 x1 or 1x4 Gen2	33MHz 3 Slots	6x 6Gb/s Raid 0,1,10	Yes with RAID 0,1,10	4 v3.0 10 v 2.0 2 v1.1	Up to 4-channels	Yes	32	Yes	Yes	2.7W-5.9W

AMD Embedded R-Series CPU

Model	OPN	Package	CPU Core	L2 Cache	Memory Interface	CPU GHz	Discrete Class Graphics	GPU Freq	HW Video	Graphics	Display Outs	Display Resolution	TDP	Tdie
R-464X	RE464XDEC44HJ	FS1r2 PGA 1225mm² 722-PGA	4	2x2MB	128 Bit organized as two 64 bit channels supporting ULVDDR3 (1.25V), LVDDR3 (1.35V), and up to DDR3-1600 (1.5V)	2.3GHz / 3.2 GHz	None	None	None	None	None	None	35W	100C
R-272X	RE272XDEC23HJ	FS1r2 PGA 1225mm² 722-PGA	2	1MB		2.7GHz / 3.2 GHz		4 v3.0 10 v 2.0 2 v1.1	Up to 4-channels	Yes	32	Yes	35W	100C
R-264X	RE264XSHE23HL	FP2 BGA 837mm² 827-BGA	2	1MB	128 Bit organized as two 64 bit channels supporting ULVDDR3 (1.25V), LVDDR3 (1.35V), and up to DDR3-1333 (1.5V)	2.2GHz / 2.8 GHz							17W	100C

AMD Embedded R-Series APU Platform Block Diagram
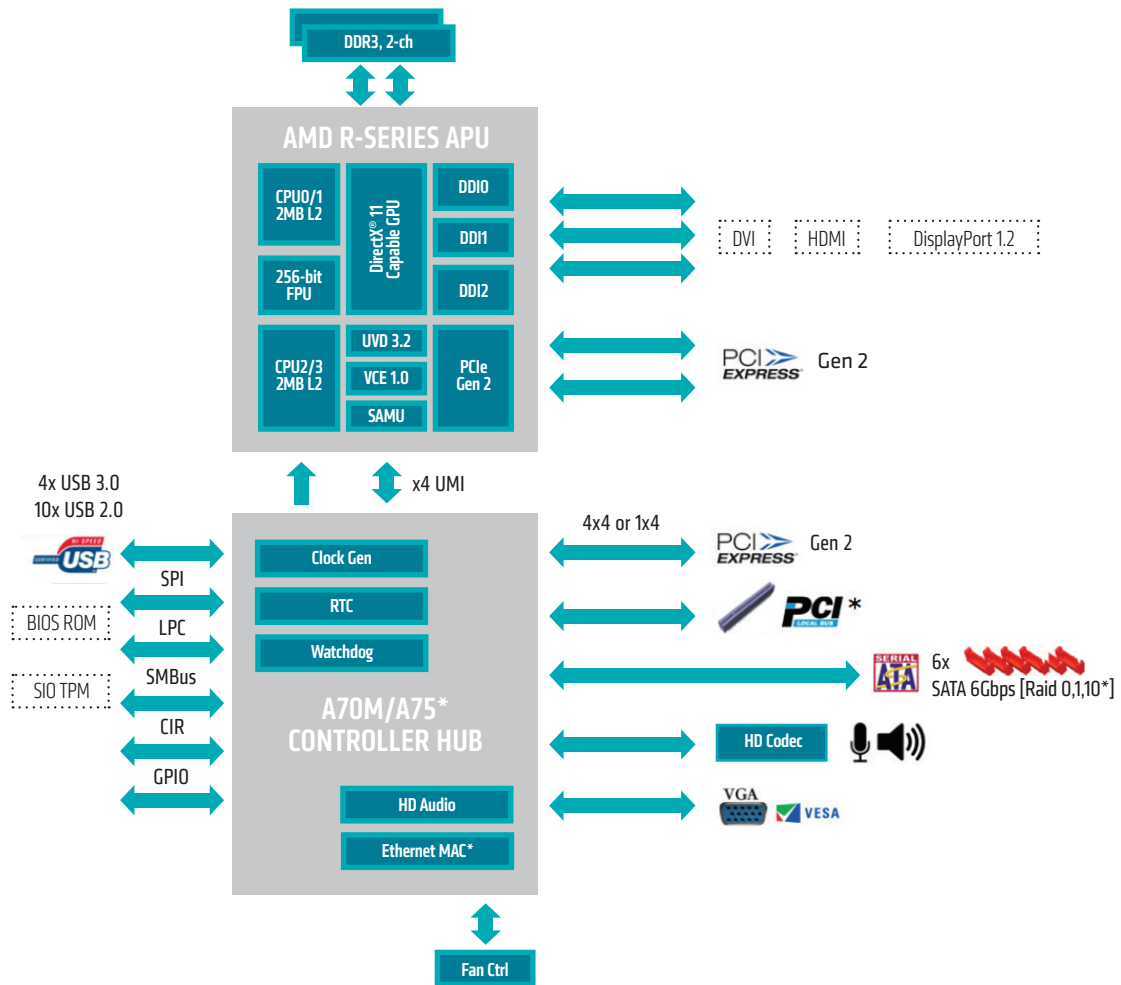
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1   The average power for the 35W TDP AMD R-464L APU when system is running one iteration of 3DMark 06 default run was 12.861 Watts. R-464L testing was performed on an equivalent A10 Series APU. System configuration: AMD A10 2.3GHz 4/1/0, "Pumori" development platform, 4 GB RAM, Windows 7 Ultimate.

2   AMD Radeon™ Dual Graphics technology combines the processing power of select AMD APUs and select AMD Radeon GPUs and can support displays connected to either the APU or the discrete GPU. Windows Vista® or Windows® 7 operating system required.

3   3DMark™ Vantage P score for AMD Radeon E6460 alone is 2162. The combined 3DMark Vantage P score for the E6460+R-464L is 4538. System configuration: AMD R-464L APU, "Parmer" development platform, AMD Radeon E6760 6XMDP graphics adapter, 4 GB RAM, Windows 7 Home Premium.

4   Calculated SP GFLOPs = (# of x86 cores x (128 bit (FPUs) / 32-bit (SP Operation)) * CPU Base Frequency) + (# of shader units * (64 bit (shader) / 32- bit (SP Operation)) * GPU Max Frequency)

5   Support for the 4th display requires the use of DisplayPort 1.2 multi-streaming technologies with compatible monitors and/or hubs. The number and types of supported displays may vary by board design.

6   AMD Eyefinity technology works with applications that support non-standard aspect ratios, which is required for panning across multiple displays. AMD Eyefinity technology can support up to 4 displays using a single enabled AMD R-Series APU or up to 6 displays using a single enabled AMD graphics card with Windows Vista or Windows 7 operating systems – the number and type of displays may vary by board design. Some implementations may require DisplayPort 1.2 multi-streaming technologies with compatible monitors and/or hubs. SLS ("Single Large Surface") functionality requires an identical display resolution on all configured displays.

7   AMD does not provide a license/sublicense to any intellectual property rights relating to any to any standards, including but not limited to any audio and/or video codec technologies such as AVC/H.264/ MPEG-4, AVC, VC-1, MPEG-2, and DivX/xVid.

8   Support for the 4th Display Port output requires the use of DisplayPort 1.2 multi-streaming technologies with compatible monitors and/or hubs. The number and types of supported displays may vary by board design.