
*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

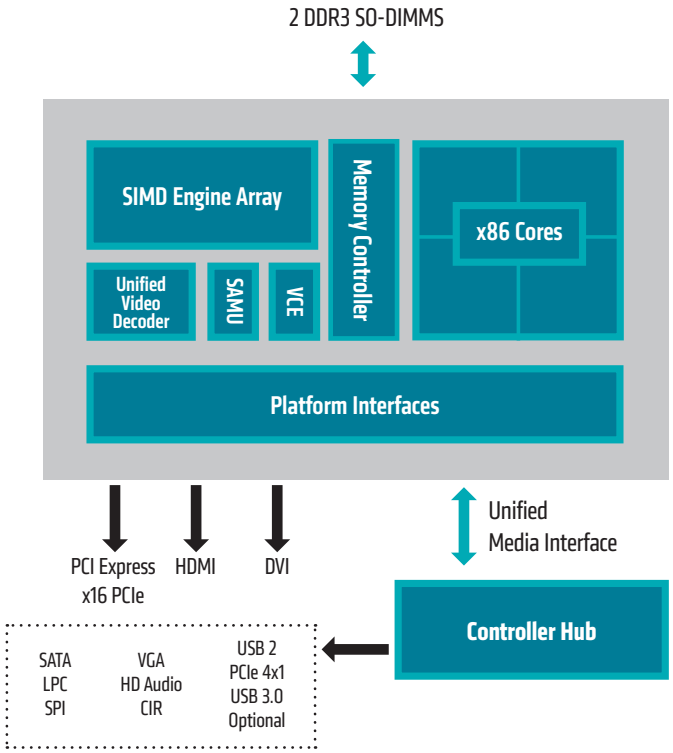
**APU Integrated Graphics Core Architecture**
- Dedicated graphics memory controller
  - *High efficiency ring bus memory controller*
  - *Direct connection to memory*
- 2D Acceleration
  - *Highly-optimized 128-bit engine, capable of processing multiple pixels per clock*
- 3D Acceleration
  - *Full 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 |

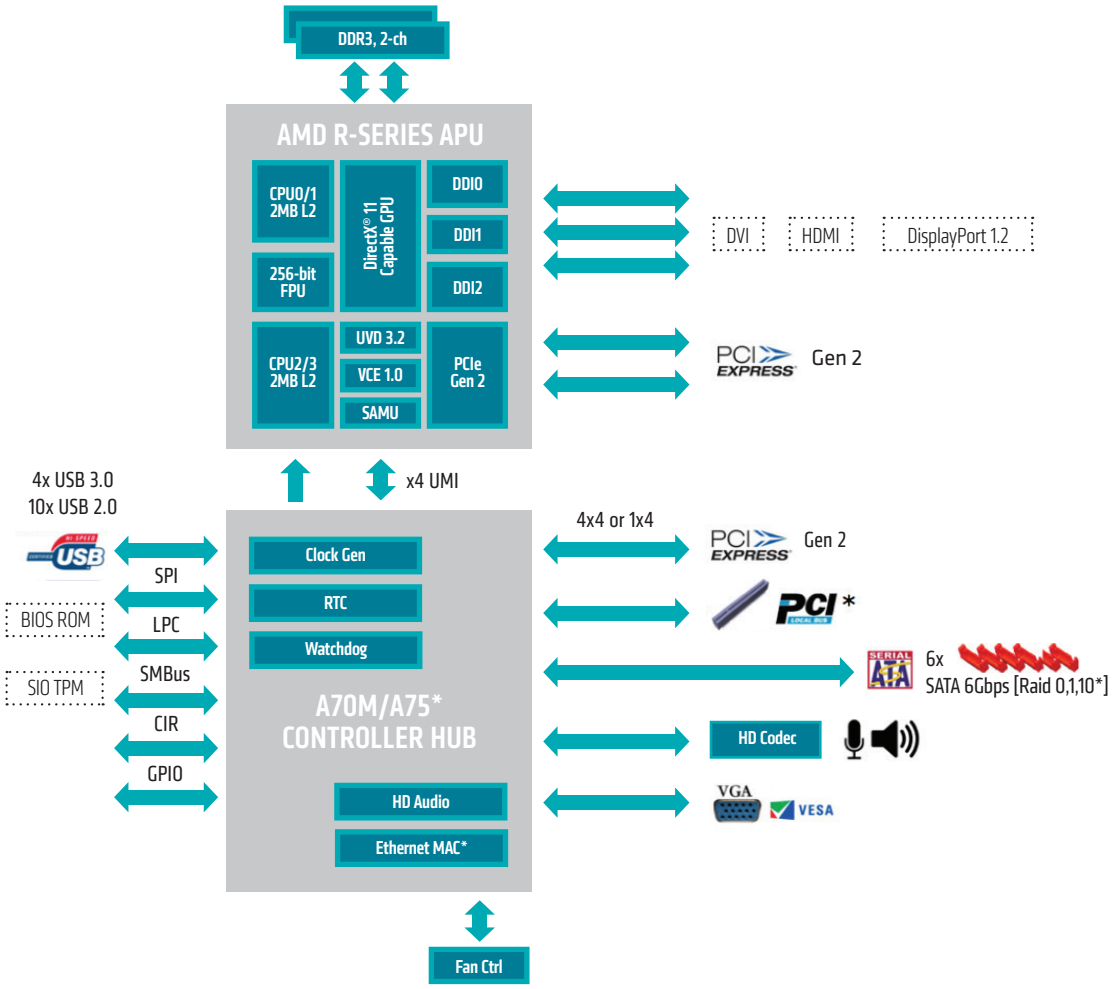
## AMD R-Series APU Controller Hubs

| 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.



AMD EMBEDDED SOLUTIONS