



Family 15h Models 10h - 1Fh AMD A-Series Accelerated Processor Product Data Sheet

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Revision History

Date	Revision	Description
December 2012	3.02	Second public release. <ul style="list-style-type: none">• Product update.
June 2012	3.01	Initial public release.

1 Family 15h Models 10h - 1Fh AMD A-Series Accelerated Processor Features

1.1 Family 15h Models 10h - 1Fh AMD A-Series Accelerated Processor Features

This section lists the features and design capabilities of the Family 15h Models 10h - 1Fh AMD A-Series accelerated processor.

- **Compatible with Existing 32-Bit x86 and 64-bit AMD64 Code Base**
 - Including support for 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
 - Runs existing operating systems and drivers
 - Local APIC on the chip
 - Light Weight Profiling (LWP) support
- **AMD64 Technology**
 - AMD64 technology instruction-set extensions
 - 64-bit integer registers, 48-bit virtual addresses, and 40-bit physical addresses
 - Sixteen 64-bit integer registers
 - Sixteen 128-bit SSE/SSE2/SSE3/SSE4a registers
- **Family 15h Architecture**
 - Dual-core and quad-core options
 - Shared L2 cache architecture storage in addition to exclusive L1 cache
- **Cache Structures**
 - **16-Kbyte 4-Way Associative, Write-through ECC-Protected L1 Data Cache per Core**
 - Two 64-bit operations per cycle, 3-cycle latency
 - **64-Kbyte 2-Way Associative Parity-Protected L1 Instruction Cache Shared between Two Cores**
 - With advanced branch prediction
 - **2048¹-Kbyte Maximum 16-Way Associative ECC-Protected L2 Cache Shared between Two Cores**
 - ¹ 2048 Kbytes of L2 cache per compute unit are available on quad-core options, and 1024 Kbytes of L2 cache per compute unit are available on dual-core options.
 - Exclusive cache architecture storage in addition to L1 caches
- **Floating-Point Unit**
 - 256-bit shared or two dedicated 128-bit floating-point units (FPU)
 - Shared between two cores
- **Management and Virtualization Features**
 - AMD Virtualization™ (AMD-V™) technology
 - SVM pause count capability
 - SVM disable and lock
 - Rapid virtualization indexing (nested paging)
 - Improved world-switch speed
 - IOMMU v2.0
 - Refer to the *AMD I/O Virtualization Technology (IOMMU) Specification*, order# 34434, for additional information.
 - Address translation support
 - Page request interface
 - Nested paging

- Flush all command
- Architected performance counters
- **Power Management**
 - Multiple low-power states
 - AMD PowerNow!™ technology
 - System Management Mode (SMM)
 - ACPI-compliant, including support for processor performance states (P-states)
 - Supports processor power states C0, C1, C1E, C6, and CC6
 - Supports sleep states² including S0, S3, S4, and S5
 - ² Model 6000 series processors support IOIC with optimized S3 and S4 resume.
 - PCIe® core power gating
 - PCIe speed power policy
 - System Clock Deep Sleep
 - AMD Turbo CORE technology 3.0 with per core power gating
- **Electrical Interfaces**
 - DDR3 SDRAM: Compliant with JEDEC DDR3 1.5V, LV-DDR3 1.35V, and UL-DDR3 1.25V SDRAM specifications³
 - ³ UL-DDR3 1.25V SDRAM is available on selected Model 6000 series processors.
 - Refer to the *Electrical Data Sheet (EDS) for AMD Family 15h Models 10h-1Fh Processors*, order# 47080, for electrical details of AMD Family 15h (Models 10h-1Fh) processors.
- **Thermal Controls**
 - Sideband temperature control (SB-TSI)
 - Hardware thermal control (HTC)
 - Local hardware thermal control (LHTC)
 - DRAM thermal protection
- **PCIe Technology**
 - PCIe Gen 1.0 and PCIe Gen 2.0 technology supported:
 - Configurable x8 and x16 external graphics card expansion PCIe link
 - Configurable x4 General Purpose Ports (GPP) link
 - x4 unified media interface link
 - AMD A85X FCH supports 2 x8 or 1 x16 GFX links
- **Integrated Memory Controller**
 - AMD Memory Controller PowerCap
 - Low-latency, high-bandwidth
 - DRAM Prefetcher:
 - Adaptive prefetching support
 - 32-entry DRAM prefetch table
 - Differentiation between core prefetch requests and core demand requests
 - Socket FM2 package
 - Two 64-bit DDR3 SDRAM controllers operating at frequencies up to 1866⁴ MT/s (933 MHz) on Model 5000 series processors, and up to 2133⁵ MT/s (1066 MHz) on selected Model 6000 series processors
 - ⁴ On Model 5000 series processors, 1866 MT/s is available when there is either a single dual-rank, or two single-rank 1866 MT/s unbuffered DIMMs present per memory channel.
 - ⁵ On selected Model 6000 series processors, 2133 MT/s is available when there is a single 2133 MT/s unbuffered DIMM present per memory channel.
 - Supports up to two dual-rank SODIMMs per channel at frequencies up to 1866⁶ MT/s (933 MHz)
 - ⁶ 1866 MT/s is available when there is a single 1866 MT/s SODIMM present in a single DIMM slot per memory channel configuration. 1600 MT/s is available when there is a single 1600 MT/s SODIMM present in a single or dual DIMM slot per memory channel configuration.

• Available Packages

- Compliant with RoHS (EU Directive 2002/95/EC), with lead used only in small amounts in specifically exempted applications
- Socket FM2 package
 - Refer to the *AMD Socket FM2 Processor Functional Data Sheet*, order# 48587, for functional and mechanical details of the socket FM2 package processor.
 - 904-pin lidded micro PGA
 - 1.27-mm pin pitch
 - 40 mm x 40 mm
 - 31 x 31 row pin array
 - Organic C4 die attach

1.2 Family 15h Models 10h - 1Fh AMD A-Series Graphics Features

This section lists the graphics features available for the Family 15h Models 10h - 1Fh AMD A-Series accelerated processor when the internal GPU is enabled.

• Graphics

- Discrete-level graphics processor embedded alongside the x86 CPU complex
- Dedicated graphics memory controller
- Refer to *AMD Family 15h Models 10h - 1Fh Processor Power and Thermal Data Sheet*, order# 48935, for graphics engine clock speeds.
- AMD Eyefinity⁷
 - ⁷ AMD Eyefinity is available on selected AMD A-Series accelerated processors and may support up to four displays, when two displays are operating with DisplayPort 1.2 multi-streaming.
- AMD Dual Graphics support⁸
 - ⁸ AMD Dual Graphics support is available on selected AMD A-Series accelerated processors, with limited discrete graphics processors and on the Windows[®] 7 operating system.
- AMD CrossFireX™ support⁹
 - ⁹ AMD CrossFireX support is available on AMD A-Series platforms using AMD A85X FCH with two identical discrete cards and the APU graphics disabled.

• Power Management

- Frame buffer compression in single memory channel
- GPU power gating
- UVD power gating
- VCE power gating
- SCLK deep sleep
- Graphics memory controller (GMC) power gating
- AMD PowerPlay™ power management technology
- Dynamic refresh rate supported with digital panels that support this feature

• 2D Acceleration Features

- Highly-optimized 128-bit engine, capable of processing multiple pixels per clock
- Hardware acceleration of Bitblt, polygon and rectangle fills, bit masking, monochrome expansion, and scissoring
- Game acceleration including support for Microsoft[®] DirectDraw: Double Buffering, Virtual Sprites, Transparent Blit, and Masked Blit
- Acceleration in 1/8/15/16/32-bpp modes:
 - Pseudocolor mode for 8 bpp
 - ARGB1555 and RGB565 modes for 16 bpp
 - ARGB8888 mode for 32 bpp
- Setup of 2D polygons and lines
- Support for GDI extensions:
 - In Windows XP and Windows Vista[®]: Alpha BLT, Transparent BLT, and Gradient Fill
 - In Windows 7: Alpha BLT, Transparent BLT, Color Fill BLT, and Stretch BLT
- Hardware cursor (up to 64 bpp × 64 bpp × 32 bpp), with alpha channel for direct support of Windows XP, Windows Vista and Windows 7 alpha cursor

• 3D Acceleration Features

- DirectX[®] 11 compliant, including full speed 32-bit floating point per component operations
 - Shader Model 5 geometry and pixel support in a unified shader architecture:
 - Vertex, pixel, geometry, compute, domain, and hull shaders
 - 32-bit and 64-bit floating point processing per component

- High performance dynamic branching and flow control
- Shader instruction store, using an advance 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-bit 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 OpenCL™ 1.1
- Support for OpenGL 4.2
- Anti-Aliasing Filtering:¹⁰
 - ¹⁰ Support for anti-aliasing filtering is dependent on application.
 - 2x/4x/8x/16x modes
 - Multi- and super-sample algorithm 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 widescreen HDTV
- Anisotropic Filtering:¹¹
 - ¹¹ Support for anisotropic filtering is dependent on application.
 - 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 maps and luminance maps
 - Angle-invariant algorithm for improved quality
 - Works with single-channel 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
- Support for up to 16k x 16k textures, including 128-bit/pixel textures
- Software-upgradeable, programmable arbitration logic maximizing memory efficiency
- 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 simultaneous support of multiple render targets and textures
- **Motion Video Acceleration Features**
 - Refer to *Virgo Platform Minimum System Recommendations for HD Media Content*, order# 50766, to view the minimum system configurations required to enable HD playback and the maximum resolution supported for each advanced video quality feature.
 - Supports DVD, Blu-ray, and SDTV/HDTV content playback with low CPU usage
 - Supports stereoscopic 3D Blu-ray
 - Video compression engine:
 - Dedicated hardware (VCE 1.0) assisted encoding of HD video streams to H.264 (baseline + CABAC) compressed 1080p at 60 fps format
 - Real-time transcoding by encoding the output from UVD with reduction of CPU utilization and power consumption
 - Faster than real-time transcoding using VCE and 3D shader pipeline

- Motion video decode acceleration technology:
 - Dedicated hardware (UVD 3.2) for H.264, MPEG4 Part 2, VC-1 and MPEG2 decode:
 - H.264 implementation based on the ISO/IEC 14496-10 specification
 - MPEG4¹² Part 2 implementation based on the ISO/IEC 14496-2 specification
 - ¹² Sprite, global motion compensation, and reversible variable length coding are not supported.
 - VC-1 implementation based on the SMPTE 421M specification
 - MPEG2 implementation based on the ISO 13811-2 specification
 - Simultaneous high-definition and standard definition source decode
 - Simultaneous dual high-definition source decode
- Microsoft DirectX video acceleration (DXVA) API (application programming interface) for Windows operating system
- **Motion Video Process Acceleration:**
 - Video scaling and YCrCb to RGB color space conversion for video playback and fully adjustable color controls
 - Motion adaptive and vector based de-interlacing filter eliminates video artifacts caused by displaying interlaced video on non-interlaced displays, and by analyzing image and using optimal de-interlacing functions on a per-pixel basis
 - HD HQV and SD HQV support: noise removal, detail enhancement, color enhancement, cadence detection, sharpness, and advanced de-interlacing
 - Super up-conversion for SD to HD resolutions
 - Multi-plane compositing engine for Blu-ray player applications
 - AMD SteadyVideo technology
- **Display Interfaces¹³**
 - ¹³ Refer to Table 2 on page 12 for maximum resolution, color depth, and audio support per display interface.
 - Four independent display controllers¹⁴ supporting DisplayPort 1.2 with a maximum resolution of 4096 × 2160 at 30 Hz and 30 bpp
 - ¹⁴ See the “Display Interface Design Guidelines” chapter in the *Socket FM2 Processor Motherboard Design Guide*, order #48891 for simultaneous display combinations and display restrictions.
 - HDCP¹⁵ (High-bandwidth Digital Content Protection) supported on HDMI™ (High-Definition Multimedia Interface), DVI (Digital Visual Interface), and DisplayPort
 - ¹⁵ HDCP content protection support is available only to HDCP licensees and can be enabled only when connected to an HDCP-capable receiver.
 - Key information stored in the APU
 - External ROM not needed
 - Protects both audio and video content on all HDMI/DisplayPort outputs
- **DVI/HDMI Features¹⁶**
 - ¹⁶ Refer to Table 1 on page 11 for HDMI feature table.
 - Supports DVI or HDMI 1.4a¹⁷, using TMDS data encoding
 - ¹⁷ HDMI 1.4a version number is equivalent to highest version of the HDMI specification for which an optional HDMI feature is listed and does not imply that all features in HDMI 1.4a are supported.
 - Supports industry-standard CEA-861-B video modes including 480p, 720p, 1080i, and 1080p
 - Advanced DVI capability supporting 10-bit HDR (High Dynamic Range) output in Dual-Link DVI mode with 162 MP/s (megapixels per second) maximum
 - Supports dual-link DVI and single-link DVI with resolutions of up to 2560 × 1600 at 60 Hz and 24 bpp and 1920 × 1200 at 60 Hz and 24 bpp respectively
 - Maximum pixel clock rate of 162 MHz for Single-Link DVI, 268.5 MHz for Dual-Link DVI, and 148.5 MHz for HDMI
 - HDMI deep color support with 30 bpp and 36 bpp for up to 1920 × 1080 with up to 225 MHz HDMI link rates
 - Dolby® Digital (AC-3), Dolby Digital Plus, DTS Digital, DTS-HD High Res, Dolby TrueHD and DTS-HD

Master Audio

- Supports stereoscopic 3D frame transport, stereoscopic 3D gaming, Blu-ray 3D, and stereoscopic 3D video decoding via HDMI 1.4a¹⁸

¹⁸ Support is available through software, in full-screen, OpenGL mode¹⁹, and windowed mode.

¹⁹ OpenGL mode support is available on selected AMD A-Series accelerated processors.

• DisplayPort Features

- Supports all mandatory features of the VESA DisplayPort Standard, Version 1.2, plus the following optional features:
 - 30-bit support
 - YCbCr 4:4:4 and 4:2:2 support
 - HDCP support
 - DisplayPort extension for test-automation features, including test-pattern generation
 - ACM packet-type support
 - ISRC packet-type support
- Supports DP++
- DisplayPort audio
 - Discrete digital multi-point audio
 - Linear PCM, Dolby Digital (AC-3), Dolby TrueHD, DTS, and DTS-HD Master Audio to 24.567 Mbps
 - 16-bit samples
 - Supports up to 8 channels
 - Supports a maximum audio rate of 192 KHz
- Supports 4, 2, or 1-lane transmission
- Supports 5.4 Gbps, 2.7 Gbps, and 1.62 Gbps link bit rates
- Supports 1 Mbps Auxiliary Channel (AUX CH)
- Supports DisplayPort multi-streaming for up to four independent video and audio streams on one connector
- Maximum link bit rate of 5.4 Gbps
- Maximum resolution of 4096 x 2160 at 30 Hz and 30 bpp
- Supports Embedded DisplayPort (eDP) features as described in the VESA eDP Standard, Version 1
- Supports stereoscopic 3D frame transport, stereoscopic 3D gaming, Blu-ray 3D, and stereoscopic 3D video decoding via eDP for 120-Hz sequential frame internal LCD panels

Table 1. HDMI™ Features

HDMI™ Feature	Compatibility
Link Capabilities	
Maximum HDMI Bandwidth (Gbit/s)	6.6825
Maximum Effective Data Rate (Gbit/s)	5.56875
Video Capabilities	
Maximum Resolution	1920 x 1080p at 60 Hz, 36 bpp ¹ 1920 x 1200p at 60 Hz, 24 bpp
RGB	Yes
YCbCr 4:4:4	Yes
YCbCr 4:2:2	Yes
HDMI™ 1.3 xvYCC	Yes
HDMI 1.3 Deep Color	Yes
Underscan	Yes
Maximum 4:4:4 Color Depth (bits per component)	12 ²
Maximum 4:2:2 Color Depth (bits per component)	12 ²
Audio Capabilities	
Auto Lip-Sync	Not in OS or audio drivers (Hardware ready).
PCM (Pulse-Code Modulation) Audio Capabilities	
PCM Audio Rates Supported	192, 176.4, 96, 88.2, 48, 44.1, 32 KHz
PCM Audio Bits per Sample	24, 20, 16
PCM Audio Maximum Channels	8
PCM Audio Maximum Bandwidth (Rate × Bits × Channels)	36.864 Mbps
Compressed-Audio Capabilities	
Compressed-Audio Maximum Bandwidth	24.576 Mbps
Specific non-PCM Audio-Format Support	
IEC 61937 Compressed-Format support. For example, 5.1-channel Dolby® DTS and 5.1-channel AC-3.	Yes
HDMI 1.3 Dolby-TrueHD Bitstream Capable	Yes
HDMI 1.3 DTS-HD Master-Audio Bitstream Capable	Yes
DVD-A (DST) Support	No
SACD (DSD) Support	No
CEC (consumer electronic control) Capabilities	
CEC	No
HDMI 1.4a 3D Display Capabilities	
Packed Frame Stereo 3D Video Formats	1080p at 24 Hz, 1080 at 30 Hz, 720p at 60 Hz, 720p at 50 Hz

Notes:

- 36 bpp mode uses 30 bpp of meaningfully derived data.
- 12 bit mode uses 10 bits of meaningfully derived data.

Table 2 shows the maximum resolution for each output configuration.

Table 2. Display Interface Support

Output Configuration	Maximum Resolution	Bit Depth	Audio
DisplayPort / eDP ¹	4096 × 2160 at 30 Hz	18, 24, 30 bpp	Supported ²
Single-link DVI	1920 × 1200 at 60 Hz	24 bpp	Not Supported
Dual-link DVI	2560 × 1600 at 60 Hz 1920 × 1200 at 60 Hz	24 bpp 30 bpp	Not Supported
Native HDMI™	1920 × 1080 at 60 Hz 1920 × 1200 at 60 Hz	24, 30, 36 bpp 24 bpp	Supported
Type 1 Dual-mode DisplayPort to HDMI Adaptor	1280 × 720 at 60 Hz 1920 × 1200 at 60 Hz	24, 30, 36 bpp 24 bpp	Supported
Type 2 Dual-mode DisplayPort to HDMI Adaptor	1920 × 1080 at 60 Hz 1920 × 1200 at 60 Hz	24, 30, 36 bpp 24 bpp	Supported

Notes:

1. Internal LCD panel.
2. Audio support is only available for DisplayPort.

For display interface mapping, see the “Display Interface Design Guidelines” chapter in the *Socket FM2 Processor Motherboard Design Guide*, order #48891.

2 Compatible Socket Infrastructures

Refer to the *Socket FM2 Infrastructure Roadmap*, order# 49454, for information on platform feature implications of package and infrastructure combinations. Family 15h Models 10h - 1Fh AMD A-Series accelerated processors support the following infrastructure:

- **Socket FM2 Infrastructure**
 - Compatible with socket FM2 package processors
 - Refer to the *AMD Socket FM2 Processor Functional Data Sheet*, order# 48587, for functional and mechanical details of the socket FM2 package processor.