
AMD

**WHITE PAPER**

# *AMD Embedded G-Series SOC Platform: Excellent Performance in an Ultra Compact Footprint with Enterprise-class ECC Support*

*New AMD Embedded G-Series SOC platform enables superior HD multimedia experiences and high performance parallel processing for the next-generation of energy efficient x86 embedded applications*

With the introduction of AMD Embedded G-Series Accelerated Processing Units (APUs) in 2011, AMD set a new bar for multimedia and parallel processing performance, energy efficiency and silicon integration optimized for a new generation of small form factor x86 embedded systems. The combination of a low-power CPU and a discrete-class GPU into a single APU yielded an elegant two-chip platform – comprised of the APU and a companion I/O controller hub – that defied the form factor and performance-per-watt constraints that had previously limited design flexibility for embedded applications spanning digital signage, digital gaming, industrial control and automation, and beyond.

With the introduction of the new AMD Embedded G-Series System-on-Chip (SOC) platform, AMD is building on the strength of the G-Series processor architecture to deliver multimedia- and heterogeneous processing capabilities that promise superior performance-per-watt in the low-power x86-capable microprocessor class of products when running multiple industry standard benchmarks[1]. Designed with breakthrough innovation from CPU to GPU, hardware acceleration and advanced capabilities including enterprise-class error-correction code (ECC) memory support, AMD Embedded G-Series SOCs again raise the bar for power-efficient x86 processing agility. Additionally, with the silicon-level integration of the I/O controller hub, AMD G-Series SOCs reduce the two-chip G-Series APU architecture to one single die, yielding a staggering 33% footprint reduction[2].

## *SUPERIOR PERFORMANCE PER WATT AND ENHANCED MULTIMEDIA CAPABILITIES*

Featuring AMD's next-generation "Jaguar" CPU core and an enhanced integrated AMD Radeon™ GPU core with frequency increase and instructions per cycle (IPC) improvement, AMD G-Series SOCs – available in dual and quad-core variants – deliver up to a 113% CPU performance improvement compared to AMD G-Series APUs, and a 125% CPU improvement versus Intel Atom when running multiple industry-standard compute-intensive benchmarks[3]. New features include enhanced Universal Video Decode (UVD) hardware acceleration (H.264, VC-1, MPEG 2 and more[4]) and new video encode capabilities, with enhanced clock gating and C6 'deep power down' capabilities that lower overall power consumption. AMD G-Series SOCs also support remote wireless display capabilities with minimal latency[5].

The integrated GPU supports DirectX® 11.1, OpenGL 4.2 and OpenCL™ 1.2[6], enabling high-speed parallel processing and high-performance graphics processing that provides up to 20% improvement over AMD G-Series APUs and 5X improvement versus Intel Atom[7]. Support for these computing frameworks affords a host

**AMD G-Series SOC Platform**

Optimized for:

- Industrial Control & Automation
- Digital Signage & Smart Kiosks
- Thin Client
- Digital Gaming
- SMB Storage Appliances
- Security & Surveillance

of software development options with advanced graphics APIs, while extending application lifetime thereby helping maximize software development costs and ROI.

OpenCL-enabled CPU/GPU parallel processing can be especially beneficial to high-precision applications such as industrial control and automation, security and surveillance, and communications infrastructure, allowing OpenCL APIs to access the integrated GPU with 256 GFLOPS per clock compute power. Meanwhile, seamless DirectX 11 and OpenGL support complements AMD G-Series SOCs' DisplayPort 1.2-enabled dual independent display capability, providing high-resolution multi-display support that yields stunningly crisp visual experiences for graphics-driven applications spanning digital signage, digital gaming, thin client and human machine interface (HMI).

## *SMALLER FOOTPRINT, LOWER POWER, LOWER SYSTEM COSTS*

With integrated low-power AMD "Jaguar" CPUs and a 33% footprint reduction versus AMD G-Series APUs[2], AMD G-Series SOCs are optimized for power and space-constrained applications and can contribute to greater design and cost efficiencies. The reduction of the two-chip APU platform architecture to a single chip streamlines design cycles and can help lower BOM costs with a potential to reduce board layers and simplify power supply design. The low power attributes of the AMD G-Series SOC can also enable fan-less designs, further driving down system costs, helping reduce system noise, and boosting system reliability by eliminating the failure points inherent to moving parts.

Offering an array of dual and quad-core performance options and SKUs spanning from 9W to 25W with uniform pin compatibility across the product family, the AMD G-Series SOC platform allows OEMs to utilize a single board design to enable solution scalability from entry level to high end product offerings. This 'common platform' design approach may simplify OEMs' product development business on both the supply and the production sides, which could result in significant cost savings.

The AMD G-Series SOCs' platform design makes possible new levels of performance in small SBC and COMs form factors, enabled in part by the reduction in board layers via the single-chip SOC architecture. This helps designers to more easily and cost-effectively implement the AMD G-Series SOC platform into innovative, small form factor designs such as Pico-ITX, Qseven, PCIe/104, ETX and COM Express. Additionally, the I/O controller integrated within AMD G-Series SOCs offers expansion capabilities to address a wide range of market needs, supporting PCIe®, SATA and other mainstream I/O interfaces.

## *x86 AGILITY AND ENTERPRISE-CLASS ERROR-CORRECTION CODE*

Traditionally, ECC support has been limited to power-hungry processor platforms, however, the evolution of a new class of ultra energy-efficient, compute-intensive x86 IT infrastructure and precision control systems makes ECC an increasingly important requirement. The ability of the AMD G-Series SOC platform to support enterprise-class ECC memory distinguishes it as an excellent fit for applications requiring high levels of data integrity without compromising energy efficiency.

The rich ecosystem of industry-standard, x86-optimized software, applications, operating systems and development environments readily available to embedded designers contributes to a low total cost of ownership, multi-generation product longevity and greater investment protection for systems based on AMD G-Series SOCs. Providing x86 computing agility with enterprise-class features like ECC, AMD G-Series SOCs help provide tight integration with enterprise IT networks, Internet backbone infrastructure and x86-based distributed control systems, which introduces additional benefits for the myriad applications hosted on these networks.

## *DESIGNED FOR HIGH PERFORMANCE AT LOW POWER*

AMD Embedded G-Series SOCs build on the strength of the AMD G-Series APU architecture to provide an array of performance and power options and enhanced multimedia capabilities via a single scalable architecture – in 33% less space as compared to the AMD G-Series two chip platform[2]. This improvement is made possible by the seamless single chip integration of CPU, GPU and I/O controller. Delivering up to a 113% performance improvement compared to AMD G-Series APUs when running multiple industry-standard compute-intensive benchmark[3], with ECC support and available dual and quad-core configurations, AMD Embedded G-Series SOCs liberate embedded designers to achieve new levels of system performance and HD multimedia versatility in ultra compact form factors.

For more information about AMD Embedded G-Series SOCs visit www.amd.com/g-series

While the AMD Embedded G-Series SOC is a great fit for applications requiring a low-power, small footprint solution, the AMD Embedded G-Series APU remains a fully-supported solution from AMD and its board and system partners, as well as its ecosystem partners. The two-chip APU architecture is well-suited for small form factor solutions with extremely low thermal requirements. For assistance in selecting the right solution for your application, please contact your local AMD Embedded Solutions sales representative at http://www.amd.com/us/products/embedded/product-guide-and-buy/Pages/embedded-sales-rep.aspx

## *About AMD*

AMD is a semiconductor design innovator leading the next era of vivid digital experiences with its groundbreaking AMD Accelerated Processing Units (APUs) that power a wide range of computing devices. AMD Embedded Solutions give designers ample flexibility to design scalable, x86- based, low-cost and feature-rich products, and drive energy conservation into their systems without compromising application performance or compatibility, graphics performance or features. For more information, visit www.amd.com/embedded.


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1 The low-power x86 microprocessor class includes: GX-420CA @ 25W TDP (scored 19); GX-415GA @ 15W (25), GX-217GA @ 15W (17), GX-210HA @ 9W (20), G-T56N @ 18W (12), G-T52R @ 18W (7), G-T40N @9W (14), G-T16R @ 4.5W (19), Intel Atom N270 @ 2.5W (20), Intel Atom D525 @ 13W (9), Intel Atom D2700 @ 10W (12) & Intel Celeron G440 @ 35W (5). Performance score based on an average of scores from the following benchmarks: Sandra Engineering 2011 Dhrystone ALU, Sandra Engineering 2011 Whetstone iSSE3, 3DMark® 06 (1280 x 1024), PassMark Performance Test 7.0 2D Graphics Mark, and EEMBC CoreMark Multi-thread. All systems running Windows® 7 Ultimate for Sandra Engineering, 3DMark® 06 and PassMark. All systems running Ubuntu version 11.10 for EEMBC CoreMark. All configurations used DirectX 11.0. AMD G-Series APU system configurations used iBase MI958 motherboards with 4GB DDR3 and integrated graphics. All AMD G-Series SOC systems used AMD "Larne" Reference Design Board with 4GB DDR3 and integrated graphics. Intel Atom D2700 was tested with Jetway NC9KDL-2700 motherboard, 4GB DDR3 and integrated graphics. Intel Celeron system configuration used MSI H61M-P23 motherboard with 4GB DDR3 and integrated graphics. Intel Atom N270 system configuration used MSI MS-9830 motherboard with maximum supported configuration of 1GB DDR2 (per http://download.intel.com/design/intarch/manuals/320436.pdf,) and Intel GM945 Intel Atom D525 used MSI MS-A923 motherboard with platform integrated 1GB DDR3 and integrated graphics. EMB-36

2 AMD G-Series SOC FT3 BGA package dimension 24.5mm x 24.5mm = 600.25mm2 SOC; AMD G-Series APU FT1 and Controller Hub two-chip platform: 19mm x 19mm + 23mm x 23mm = 890mm2; 33% improvement. EMB-40

3 AMD GX-415GA scored 209, AMD G-T56N scored 98, and Intel Atom D525 scored 93, based on an average of Sandra Engineering 2011 Dhyrstone, Sandra Engineering 2011 Whetstone and EEMBC CoreMark Multi-thread benchmark results. AMD G-T56N system configuration used iBase MI958 motherboard with 4GB DDR3 and integrated graphics. AMD GX-415GA system configuration used AMD "Larne" Reference Design Board with 4GB DDR3 and integrated graphics. Intel Atom D525 system configuration used MSI MS-A923 motherboard with platform integrated 1GB DDR3 and integrated graphics. All systems running Windows® 7 Ultimate for Sandra Engineering and Ubuntu version 11.10 for EEMBC CoreMark. EMB-37

4 AMD does not necessarily provide a license to the intellectual property relating to H.264, MPEG and other related technology.

5 Remote display capability refers to Wireless Display which can be over Wi-Fi or Ethernet.

6 OpenCL 1.2 currently supported in the following operating systems: Microsoft Windows 7; Microsoft Windows Embedded Standard 7; Microsoft Windows 8; Microsoft Windows Embedded Standard 8; Linux (AMD Catalyst™ drivers). OpenGL 4.2 currently supported in the following operating systems: Microsoft Windows 7; Microsoft Windows Embedded Standard 7; Microsoft Windows 8; Microsoft Windows Embedded Standard 8; Linux (AMD Catalyst drivers). Ongoing support options TBA.

7 Based on performance evaluation of AMD G-Series SOC model GX-415GA vs. AMD G-Series APU model G-T56N; and vs. Intel Atom model D525 and D2700 while running Sandra Engineering 2011 Dhrystone benchmark. EMB-38