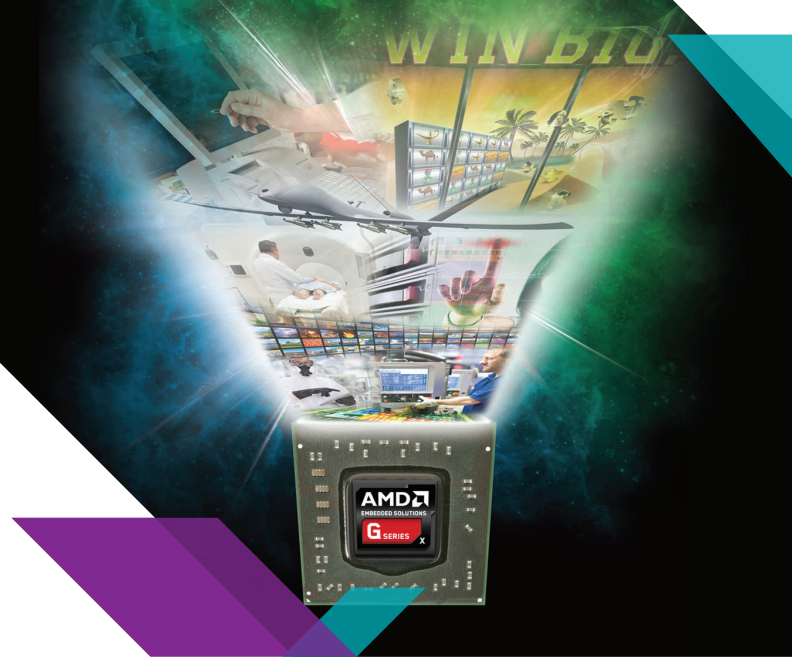




Product Brief

## AMD Embedded G-Series System-on-Chip (SOC)

The embedded evolution continues with x86 CPU, integrated discrete-class GPU and i/o controller on the same die



### Product Overview.

The AMD Embedded G-Series SOC platform is a high-performance, low-power System-on-Chip (SOC) design, featured with enterprise-class error-correction code (ECC) memory support, dual and quad-core variants, integrated discrete-class GPU and I/O controller on the same die.

The AMD G-Series SOC achieves superior performance per watt in the low-power x86 microprocessor class of products when running multiple industry standard benchmarks.<sup>1</sup> This helps enable the delivery of an exceptional HD multimedia experience and provides a heterogeneous computing platform for parallel processing. The small-footprint, ECC-capable SOC sets the new foundation for a power-efficient platform for content-rich multimedia processing and workload processing that is well-suited for a broad variety of embedded applications.

### Superior Performance Per Watt.

The AMD Embedded G-Series SOC platform delivers an exceptionally high-definition visual experience and the ability to take advantage of heterogeneous computing while maintaining a low-power design.

- AMD G-Series SOC's next-generation "Jaguar" based CPU offers 113% improved CPU performance vs. AMD G-Series APU and greater than a 2x (125%) advantage vs. Intel Atom when running multiple industry-standard compute-intensive benchmarks.<sup>2</sup>
- AMD G-Series SOC's advanced GPU, supporting DirectX® 11.1, OpenGL 4.2 and OpenCL™ 1.2<sup>9</sup>, enables parallel processing and high-performance graphics processing that provides up to 20% improvement vs. AMD G-Series APU and a 5x (430%) advantage vs. Intel Atom when running multiple industry-standard graphics-intensive benchmarks.<sup>3</sup>
- Excellent compute and graphics performance with enhanced hardware acceleration delivers up to 70% overall improvement vs. AMD G-Series APU and over 3x (218%) the overall performance advantage vs. Intel Atom in embedded applications when running multiple industry-standard compute- and graphics-intensive benchmarks.<sup>4</sup>

### Enabling Low-Power, Innovative Small Form Factor Designs.

The AMD G-Series SOC is a small footprint and low-power solution that reduces overall system costs.

- The SOC design offers 33% footprint reduction compared to AMD G-Series APU two-chip platform<sup>5</sup>, simplifying design with fewer board layers and simplified power supply.
- AMD G-Series SOC enables fan-less design that further helps drive down system cost and enhance system reliability by eliminating moving parts.
- With an array of performance options, the AMD G-Series SOC platform allows OEMs to utilize a single board design to enable solutions from entry-level to high-end.
- The SOC design enables new levels of performance in small SBC (single board computer) and COMs (computer-on-modules) form factors.

### Optimizing Business Value.

The AMD Embedded G-Series SOC platform brings performance and efficiency with desirable features, delivering lower TCO and higher ROI.

- Supporting ECC memory, AMD G-Series SOC platforms will help to penetrate markets previously inaccessible to x86 products in these power envelopes, at this price point.
- The AMD G-Series SOC helps achieve higher system quality, reliability, and energy efficiency, which contribute to overall lower TCO.
- Multiple performance levels offer upgrade paths to protect software and hardware ecosystem costs.
- AMD's standard embedded 5 year availability and support (additional 2 years under contract possible) maximizes ROI.
- The AMD G-Series SOC platform is well-suited for low-power and high-performance designs in a broad range of markets including Industrial Control & Automation, Digital Signage, Thin Client, Electronic Gaming Machines, and SMB storage appliances.

**First generation SOC design**

- Delivers up to 70% overall improvement over AMD G-Series APU<sup>6</sup>
- Integrates Controller Hub functional block as well as CPU+GPU+NB
- 28nm process technology, 24.5mm x 24.5mm BGA package

**“Jaguar” CPU core with performance increases**

- Dual-core and quad-core, up to 2MB shared L2
- 113% CPU performance improvement over AMD G-Series APU<sup>7</sup>

**Next generation graphics core with performance increase over previous generations**

- 20% compute performance improvement over AMD G-Series APU when running multiple industry-standard graphics-intensive benchmark
- DirectX<sup>®</sup> 11.1 graphics support

**Improved power saving features**

- Power gating added to Multimedia Engine, Display Controller & NB
- DDR P-states for reduced power consumption

**Memory support: single-channel DDR3**

- Up to DDR3-1600 – 1.35V and 1.25V voltage levels supported
- Up to 2 UDIMMs or 2 SO-DIMMs
- ECC support

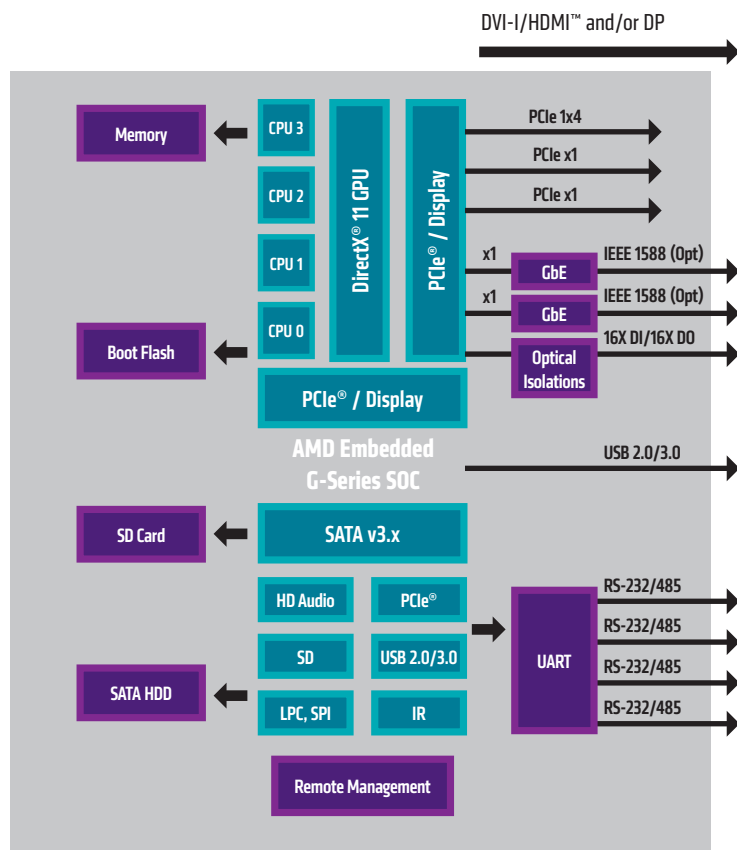
**Integrated display outputs**

- Supports two simultaneous displays
- Supports 4-lane DisplayPort 1.2, DVI, HDMI™ 1.4a
- Integrated VGA
- Integrated eDP or 18bpp single channel LVDS

**Updated I/O (features may be SKU dependent)**

- Four x1 links of PCIe<sup>®</sup> Gen 2 for GPPs
- One x4 link of PCIe Gen 2 for discrete GPU
- 8 USB 2.0 + 2 USB 3.0
- 2 SATA 2.x/3.x (up to 6Gb/s)
- SD Card Reader v3.0 or SDIO controller

| MODEL          | OPN           | # OF x86 CORES | TDP (CPU, GPU, & SB) | SHARED L2 CACHE | CPU FREQ. | GPU FREQ. (GRAPHICS) | DDR SPEED | USB 3.0 | TjC  |
|----------------|---------------|----------------|----------------------|-----------------|-----------|----------------------|-----------|---------|------|
| <b>w/GPU</b>   |               |                |                      |                 |           |                      |           |         |      |
| GX-420CA       | GE420CIAJ44HM | 4              | 25W                  | 2MB             | 2.0GHz    | 600MHz (HD 8400E)    | DDR3-1600 | Yes     | 90°C |
| GX-415GA       | GE415GIBJ44HM | 4              | 15W                  | 2MB             | 1.5GHz    | 500MHz (HD 8330E)    | DDR3-1600 | Yes     | 90°C |
| GX-217GA       | GE217GIBJ23HM | 2              | 15W                  | 1MB             | 1.65GHz   | 450MHz (HD 8280E)    | DDR3-1600 | Yes     | 90°C |
| GX-210HA       | GE210HICJ23HM | 2              | 9W                   | 1MB             | 1.0GHz    | 300MHz (HD 8210E)    | DDR3-1333 | Yes     | 90°C |
| <b>w/o GPU</b> |               |                |                      |                 |           |                      |           |         |      |
| GX-416RA       | GE416RIBJ44HM | 4              | 15W                  | 2MB             | 1.6GHz    | N/A                  | DDR3-1600 | N/A     | 90°C |



HIGH PERFORMANCE BOX PC WITH AMD G-SERIES SOC

### 1st generation APU SOC design

- Integrates Controller Hub functional block as well as CPU+GPU+NB
- 28nm process technology, FT3 BGA package, 24.5mm x 24.5mm
- Dual- or Quad-“Jaguar” CPU cores with 2MB shared L2 cache

### Next generation graphics core

- Compute performance (GFLOP) improvement
- DirectX® 11.1 graphics support

### Memory support: Single-channel DDR3

- Up to 2 UDIMMs or 2 SO-DIMM DDR3-1600 @ 1.35V & 1.25V
- Support for ECC DIMMs

### Integrated display outputs

- Supports two simultaneous displays
- Supports 4-lane DisplayPort 1.2, DVI, HDMI™ 1.4a, Integrated VGA and Integrated eDP or 18bpp single channel LVDS

### Updated I/O

- Four x1 links of PCIe® Gen 2 for GPPs
- One x4 link of PCIe Gen 2 for discrete GPU (not on lower TDPs)
- 8 USB 2.0 + 2 USB 3.0
- 2 SATA 2.x/3.x (up to 6Gb/s)
- SD Card Reader v3.0 or SDIO controller

\*Compared to AMD Embedded G-Series APU

[www.amd.com/embedded](http://www.amd.com/embedded)

1 The low-power x86 microprocessor class includes: CX-420CA @ 25W TDP (scored 19); CX-415GA @ 15W (25), CX-217GA @ 15W (17), CX-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 ALLJ, 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 M1958 motherboards with 4GB DDR3 and integrated graphics. All AMD G-Series SOC systems used AMD “Lame” 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 HG1M-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.

2 AMD CX-415GA scored 209, AMD G-T56N scored 98, and Intel Atom D525 scored 93, based on an average of Sandra Engineering 2011 Dhrystone, Sandra Engineering 2011 Whetstone and EEMBC CoreMark Multi-thread benchmark results. AMD G-T56N system configuration used iBase M1958 motherboard with 4GB DDR3 and integrated graphics. AMD CX-415GA system configuration used AMD “Lame” 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.

3 AMD CX-415GA scored 864, AMD G-T56N scored 724, and Intel Atom D525 scored 162, based on an average of 3DMark® 06 1280x1024 and PassMark Performance Test 7.0 2D Graphics Suite benchmark results. AMD G-T56N system configuration used iBase M1958 motherboard with 4GB DDR3 and integrated graphics. AMD CX-415GA system configuration used AMD “Lame” 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 with DirectX 11.0.

4 AMD CX-415GA scored 369, AMD G-T56N scored 218, and Intel Atom D525 scored 116, based on an average of Sandra Engineering 2011 Dhrystone ALLJ, Sandra Engineering 2011 Whetstone iSSE3, 3DMark® 06 (1280 x 1024), PassMark Performance Test 7.0 2D Graphics Mark, and EEMBC CoreMark Multi-thread. AMD G-T56N system configuration used iBase M1958 motherboard with 4GB DDR3 and integrated graphics. AMD CX-415GA system configuration used AMD “Lame” 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, 3DMark® 06 and PassMark. All configurations used DirectX 11.0.

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

6 Based on an average of Sandra Engineering 2011 Dhrystone ALLJ, Sandra Engineering 2011 Whetstone iSSE3, 3DMark® 06 (1280 x 1024), PassMark Performance Test 7.0 2D Graphics Mark, and EEMBC CoreMark Multi-thread. AMD G-T56N system configuration used iBase M1958 motherboard with 4GB DDR3 and integrated graphics. AMD CX-415GA system configuration used AMD “Lame” Reference Design Board with 4GB DDR3 and integrated graphics. 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.

7 Based on an average of Sandra Engineering 2011 Dhrystone, Sandra Engineering 2011 Whetstone and EEMBC CoreMark Multi-thread benchmark results. AMD G-T56N system configuration used iBase M1958 motherboard with 4GB DDR3 and integrated graphics. AMD CX-415GA system configuration used AMD “Lame” Reference Design Board with 4GB DDR3 and integrated graphics. All systems running Windows® 7 Ultimate for Sandra Engineering and Ubuntu version 11.10 for EEMBC CoreMark.

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9 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 (Catalyst drivers). OpenCL 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 (Catalyst drivers). Ongoing support options TBA.

