Product Brief

1st and 2nd Generation 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. 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 1st 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.  
- 1st Generation AMD G-Series SOC’s advanced GPU, supporting DirectX 11.1, OpenGL 4.2, and OpenCL 1.2, 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.
- 1st Generation AMD G-Series SOC’s advanced GPU 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.

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, 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 and universal pin compatibility across the AMD G-Series SOC portfolio, 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.
- AMD G-Series SOCs support Thermal Design Profiles (TDPs) from 5W to 25W and offer dynamically configurable TDP capabilities.

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 and providing a dedicated Platform Security Processor (PSP) compatible with ARM® TrustZone, 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.
### Product Brief: AMD Embedded G-Series System-on-Chip (SOC)

- AMD’s commitment to long-term availability and support (5-10 years) maximizes ROI.7
- 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, and Electronic Gaming Machines.

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>OPN</th>
<th>NO. OF CORES</th>
<th>TDP</th>
<th>SHARED L2 CACHE</th>
<th>CPU FREQUENCY</th>
<th>GPU CUS</th>
<th>GPU FREQUENCY</th>
<th>DDR FREQUENCY</th>
<th>OPERATING TEMP RANGE</th>
<th>°C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1st Generation G-Series SOCs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CX-210UA</td>
<td>GE210UICJ23HM</td>
<td>2</td>
<td>8.50W</td>
<td>1MB</td>
<td>1.0GHZ</td>
<td>N/A</td>
<td>N/A</td>
<td>1333</td>
<td>0-90°C</td>
<td></td>
</tr>
<tr>
<td>CX-416RA</td>
<td>GE416RIBJ44HM</td>
<td>4</td>
<td>15.00W</td>
<td>2MB</td>
<td>1.6GHZ</td>
<td>N/A</td>
<td>N/A</td>
<td>1600</td>
<td>0-90°C</td>
<td></td>
</tr>
<tr>
<td>CX-209HA</td>
<td>GE209HJSJ23HM</td>
<td>2</td>
<td>9.00W</td>
<td>1MB</td>
<td>1.0GHZ</td>
<td>2</td>
<td>225</td>
<td>1066</td>
<td>-40-105°C</td>
<td></td>
</tr>
<tr>
<td>CX-210HA</td>
<td>GE210HICJ23HM</td>
<td>2</td>
<td>9.00W</td>
<td>1MB</td>
<td>1.0GHZ</td>
<td>2</td>
<td>300</td>
<td>1333</td>
<td>0-90°C</td>
<td></td>
</tr>
<tr>
<td>CX-210JA</td>
<td>GE210JIHJ23HM</td>
<td>2</td>
<td>6.00W</td>
<td>1MB</td>
<td>1.0GHZ</td>
<td>2</td>
<td>225</td>
<td>1066</td>
<td>0-90°C</td>
<td></td>
</tr>
<tr>
<td>CX-217GA</td>
<td>GE217GIBJ23HM</td>
<td>2</td>
<td>15.00W</td>
<td>1MB</td>
<td>1.65GHZ</td>
<td>2</td>
<td>450</td>
<td>1600</td>
<td>0-90°C</td>
<td></td>
</tr>
<tr>
<td>CX-411CA</td>
<td>GE411GIRJ44HM</td>
<td>4</td>
<td>15.00W</td>
<td>2MB</td>
<td>1.1GHZ</td>
<td>2</td>
<td>300</td>
<td>1066</td>
<td>-40-105°C</td>
<td></td>
</tr>
<tr>
<td>CX-415CA</td>
<td>GE415GIBJ44HM</td>
<td>4</td>
<td>15.00W</td>
<td>2MB</td>
<td>1.5GHZ</td>
<td>2</td>
<td>500</td>
<td>1600</td>
<td>0-90°C</td>
<td></td>
</tr>
<tr>
<td>CX-420CA</td>
<td>GE420CIAJ44HM</td>
<td>4</td>
<td>25.00W</td>
<td>2MB</td>
<td>2.0GHZ</td>
<td>2</td>
<td>600</td>
<td>1600</td>
<td>0-90°C</td>
<td></td>
</tr>
<tr>
<td><strong>2nd Generation G-Series SOCs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CX-424CC</td>
<td>GE424HIYJ44JB</td>
<td>4</td>
<td>25W</td>
<td>2MB</td>
<td>2.4GHz</td>
<td>2CU</td>
<td>655MHz/800MHz</td>
<td>DDR3-1866</td>
<td>0-90°C</td>
<td></td>
</tr>
<tr>
<td>CX-420MC</td>
<td>GE420MIXJ44JB</td>
<td>4</td>
<td>17.5W</td>
<td>2MB</td>
<td>2.0GHz</td>
<td>N/A</td>
<td>N/A</td>
<td>DDR3-1600</td>
<td>0-90°C</td>
<td></td>
</tr>
<tr>
<td>CX-412TC</td>
<td>GE412TIVJ44JB</td>
<td>4</td>
<td>6W</td>
<td>2MB</td>
<td>1.0GHZ/1.4GHz</td>
<td>N/A</td>
<td>N/A</td>
<td>DDR3-1333</td>
<td>0-90°C</td>
<td></td>
</tr>
<tr>
<td>CX-412HC</td>
<td>GE412HIIJ44JB</td>
<td>4</td>
<td>7W</td>
<td>2MB</td>
<td>1.4GHz/1.6GHz</td>
<td>2CU</td>
<td>267MHz/350MHz</td>
<td>DDR3-1333</td>
<td>0-90°C</td>
<td></td>
</tr>
<tr>
<td>CX-410VC</td>
<td>GE410VIZJ44JB</td>
<td>4</td>
<td>7W</td>
<td>2MB</td>
<td>1.0GHZ</td>
<td>N/A</td>
<td>N/A</td>
<td>DDR3-1066</td>
<td>-40-105°C</td>
<td></td>
</tr>
<tr>
<td>CX-224PC</td>
<td>GE224PIXJ23JB</td>
<td>2</td>
<td>25W</td>
<td>1MB</td>
<td>2.4GHz</td>
<td>N/A</td>
<td>N/A</td>
<td>DDR3-1866</td>
<td>0-90°C</td>
<td></td>
</tr>
<tr>
<td>CX-222GC</td>
<td>GE222GICTJ23JB</td>
<td>2</td>
<td>15W</td>
<td>1MB</td>
<td>2.2GHz/2.4GHz</td>
<td>2CU</td>
<td>655MHz/800MHz</td>
<td>DDR3-1600</td>
<td>0-90°C</td>
<td></td>
</tr>
<tr>
<td>CX-216HC</td>
<td>GE216HIBJ23JB</td>
<td>2</td>
<td>10W</td>
<td>1MB</td>
<td>1.6GHz</td>
<td>2CU</td>
<td>300MHz</td>
<td>DDR3-1066</td>
<td>-40-105°C</td>
<td></td>
</tr>
<tr>
<td>CX-212JC</td>
<td>GE212JIYJ23JB</td>
<td>2</td>
<td>6W</td>
<td>1MB</td>
<td>1.2GHz/1.4GHz</td>
<td>2CU</td>
<td>267MHz/300MHz</td>
<td>DDR3-1333</td>
<td>0-90°C</td>
<td></td>
</tr>
<tr>
<td>CX-210JC</td>
<td>GE210IJZJ23JB</td>
<td>2</td>
<td>7W</td>
<td>1MB</td>
<td>1.0GHz</td>
<td>2CU</td>
<td>267MHz</td>
<td>DDR3-1066</td>
<td>-40-105°C</td>
<td></td>
</tr>
</tbody>
</table>
### 1st-generation APU SOC design
- Integrates Controller Hub functional block as well as CPU+GPU+NB
- 28nm process technology, FT3, and FT3b BGA packages, 24.5mm x 24.5mm
- Dual- or Quad-“Jaguar” or “Jaguar+” CPU cores with 2MB shared L2 cache

### 2nd-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

### Improved power-saving features
- Power gating added to Multimedia Engine, Display Controller, and NB
- DDR P-states for reduced power consumption

### 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 x4 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

---

**Product Brief: AMD Embedded G-Series System-on-Chip (SOC)**

**HIGH-PERFORMANCE BOX PC WITH AMD G-SERIES SOC**

**Memory**
- DDR P-states for reduced power consumption
- Improved power-saving features

**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 x4 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

---

**CPU 0**
- Dual- or Quad-“Jaguar” or “Jaguar+” CPU cores with 2MB shared L2 cache

**CPU 1**
- 2nd-generation graphics core
- Compute performance (GFLOP) improvement
- DirectX® 11.1 graphics support

**CPU 2**
- 2nd-generation graphics core
- Compute performance (GFLOP) improvement
- DirectX® 11.1 graphics support

**CPU 3**
- 2nd-generation graphics core
- Compute performance (GFLOP) improvement
- DirectX® 11.1 graphics support

---

**Boot Flash**
- SD Card Reader v3.0 or SDIO controller

**SATA v3.x**
- SATA 2.x/3.x (up to 6Gb/s)

**USB 2.0/3.0**
- 8 USB 2.0 + 2 USB 3.0

**PCIe® x1**
- PCIe 1x4
- PCIe x1

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

**RS-232/485**
- 2 SATA 2.x/3.x (up to 6Gb/s)
- SD Card Reader v3.0 or SDIO controller

**IEEE 1588 (Opt)**
- Supports two simultaneous displays
- Supports 4-lane DisplayPort 1.2, DVI, HDMI™ 1.4a, Integrated VGA, and Integrated eDP or 18bpp single-channel LVDS

**USB 2.0/3.0**
- 8 USB 2.0 + 2 USB 3.0

**PCIE 1x4**
- Supports two simultaneous displays
- Supports 4-lane DisplayPort 1.2, DVI, HDMI™ 1.4a, Integrated VGA, and Integrated eDP or 18bpp single-channel LVDS

---

1. The low-power microprocessor class includes: G-Series 4500B @ 25W TDP (scored 18); G-Series 4550B @ 28W TDP (scored 20); G-Series 4400B @ 28W TDP (scored 22); G-Series 4300B @ 35W TDP (scored 23). Performance score based on an average of scores from the following benchmarks: Synergy Engine, AMD GC-1200 3D Mark Performance Test 2.20, GraphicMark, and EMPHEC CoreMark Multi-thread. All systems running Windows® 7 Ultimate for Sandy Bridge Engineering. AMD® CoreMark. For all systems, running Ubuntu version 11.10 for EMPHEC. CoreMark. All configurations used Direct3D 11.0 C. AMD G-Series TOE system configurations used Blade H5584 motherboards with 4GB DDR3 and integrated graphics. All AMD® Series SOC systems used AMD® Lane Reference Design Board with 4GB DDR3 and integrated graphics. Intel Atom 2020 was tested with jetway N68Q 2700 motherboard, 4GB DDR3 and integrated graphics. Intel-terektron system configuration used MS-H55842 (409) motherboard with 4GB DDR3 and integrated graphics. Intel Atom N700 system configuration used MS-H55843 motherboard with maximum supported configuration of 1280x1024. (See http://download.intel.com/design/intarchs/manuals/320436.pdf.)
2. AMD-EM1X44A scored 25%; AMD-EM1X43A scored 16%; and Intel-EM1X36A scored 10%. Based on an average of Sandy Bridge 2011/8090, Sandy Bridge Engineering, and EMPHEC CoreMark Multi-thread benchmark results. AMD-EM1X44A system configuration used Blade H5584 motherboard with 4GB DDR3 and integrated graphics. AMD-EM1X43A system configuration used AMD® Lane Reference Design Board with 4GB DDR3 and integrated graphics. Intel Atom N700 system configuration used MS-H55843 motherboard with maximum supported configuration of 1280x1024. Intel Atom N700 system configuration used AMD® Lane Reference Design Board with 4GB DDR3 and integrated graphics. Intel Atom N700 system configuration used AMD® Lane Reference Design Board with 4GB DDR3 and integrated graphics. Intel Atom N700 system configuration used MS-H55843 motherboard with maximum supported configuration of 1280x1024.
3. 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

---

©2015 Advanced Micro Devices, Inc. All rights reserved. AMD, the AMD arrow logo, Radeon, and combinations thereof are trademarks of Advanced Micro Devices, Inc. Direct3D and Windows are trademarks of Microsoft Corporation in the U.S. and/or other jurisdictions. AMD is a trademark of AMD Micro Devices, Inc. BlackRock is a trademark of BlackRock, Inc. All other names used in this publication are for informational purposes only and may be trademarks of their respective owners. AMD 1061774 A.