

Product Brief: AMD Ryzen[™] Embedded R1000 Processor Family

A New Class of Performance in a Seamlessly Integrated Single-Chip Solution

Product Overview

The AMD Ryzen[™] Embedded R1000 processor brings together the powerful performance of AMD's pioneering "Zen" CPU and "Vega" GPU architectures to the R-Series family. With up to 3x generational CPU performance per watt⁵ and 4x better CPU and graphics performance per dollar than the competition⁵, the R1000 is an ideal fit for embedded applications.

The R1000 SoCs provide platform scalability to the Ryzen[™] Embedded V1000 series via pin-to-pin compatibility and common software foundation whilst leveraging the same high level of connectivity, including integrated 10Gb Ethernet.

The R1000 family delivers an optimal balance of performance and power efficiency that enables a new class of designs with thermal design power (TDP) between 6W and 25W. With a comprehensive set of advanced, integrated security features, AMD Ryzen[™] Embedded R1000 SoCs enable sophisticated system protection capabilities complemented by an expansive breadth of I/O interconnect options.

The AMD Ryzen[™] Embedded R1000 simplifies the design, form factor and thermal management challenges inherent to discrete CPU and GPU configurations. This highly integrated SoC enables system designers targeting thin clients, networking, casino gaming, digital signage, and many other applications to easily and elegantly scale their graphics and compute performance for advanced, feature-rich system designs. A single, smallfootprint AMD Ryzen[™] Embedded R1000 SoC can power up to three independent displays in brilliant 4K resolution, delivering stunningly rich and immersive visual experiences.



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A New Class of Performance

AMD Ryzen[™] Embedded R1000 SoCs provide a new class of performance to the Embedded R-Series portfolio, delivering up to a 52% generational IPC boost at the CPU². Utilizing a 14nm FinFET process, up to 2x "Zen" CPU cores/4x threads

and 3x "Vega" GPU compute units can be harnessed to achieve breakthrough processing throughput for most demanding graphics and compute workloads.

Markets



Gaming Machines Lottery Terminals, VLTs, and AWPs



Digital Signage Digital Signage, POS/ Kiosk, Quick Service Restaurant



Medical Imaging Portable Medical Equipment, Clinical Workstation, MRI, X-ray, CT



Industrial IoT Controls 6 Automation Industrial PC, HMI panels, Surveillance, IoT Gateway



Thin Client Financial/Education, Converged Devices



Communications Infrastructure uCPE, SD-WAN, Routers, Switches, UTM, Security Appliances

Rich Multimedia

AMD Ryzen[™] Embedded R1000 SoCs can power up to three independent displays in crisp 4K resolution via DisplayPort[™] 1.4b and/or HDMI[™] 2.0b. The integrated Video Hardware Accelerator supports decode or encode for various widely used video codecs with resolutions up to 4K: VP9 10-bit decode, H.265 10-bit decode and 8-bit encode, H.264 encode & decode¹.

Seamless Integration & Security Features

Integrating a high-performance CPU and GPU on a single die, the R1000 SoC enables significant space savings, smaller board designs and more efficient cooling architectures than can be achieved with heterogeneous CPU and GPU chipsets – with attendant CAPEX and OPEX savings opportunities.

The R1000 SoCs leverage an onboard AMD Secure Processor for Crypto Co-processing that encrypts data before it feeds to the I/O, complemented with Platform Secure Boot capabilities to help ensure systems are booted from trusted software, with one-time programmable (OTP) capabilities enabling system designers to manage their own keys.



AMD Ryzen[™] Embedded R1000 Processor Family SoC

Additional Key Benefits

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- Equipped with up to dual-channel 64-bit DDR4 with performance up to 2400 MT/s, AMD Ryzen[™] Embedded R1000 SoCs provide up to 8 PCIe[®] lanes, dual 1/2.5/10Gb integrated Ethernet, up to four USB 3.1 Gen 2 interconnects, with additional USB, SATA and NVMe support.
- Planned product availability extends up to 10 years, providing customers with a long-lifecycle support roadmap.

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Performance

Next-generation x86 "Zen" Core

 Two cores / up to four threads with up to 1MB of shared L2 plus 4MB of shared L3 total

Up to dual-channel 64-bit DDR4 Up to 2400 MT/s

- ECC support
- 1 DIMM / channel

Security

Next-generation AMD Secure Processor (PSP)

- fTPM2.0, crypto-offload, platform secure boot, integrated DRM
- Field Programmable Keys
- Secure Memory Encryption Support (SME)

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Integration

Next-generation Graphics Core and Multimedia

- "Vega" GPU with up to 3 Compute Units
- H.265 (10-bit) Decode & (8-bit) Encode, VP9 (10-bit) Decode¹
- Up to 3x DisplayPort[™] 1.4³ or HDMI[™] 2.0b

Enhanced I/O (FP5)

- Up to 4x USB 3.1 Gen2 (10Gb/s) / 1 Type-C with ALT. DP power delivery capable
- Up to 2x USB 2.0
- Up to 2x SATA ports
- NVMe support
- eMMC5.0, SD3, or LPC
- Up to 8L of PCIe® Gen3, 5x link max
- Up to 2x 10 Gigabit Ethernet (1/2.5/10Gb)
- Up to 2x UART, 4x I2C, 2x SMBus, SPI/eSPI, 12S/HDA/SW, GPIO

Model	cTDP Range	CPU Core/ Thread Count	CPU Base Freq. (GHz)	CPU 1T Boost Freq. (up to) (GHz)	Graphics Computing Units (SIMD)	GPU Freq. (GHz) (Max)	Individual Displays	Package	Max DDR4 Rate (MT/s)	Dual Ethernet Ports	Junction Temperature Range (°C)
R1600	12-25W ⁴	2/4	2.6	3.1	n/a	n/a	n/a	FP5	2,400	1/2.5/10Gb	0 - 105
R1606G	12-25W4	2/4	2.6	3.5	3	1.2	3	FP5	2,400	1/2.5/10Gb	0 - 105
R1505G	12-25W4	2 / 4	2.4	3.3	3	1.0	3	FP5	2,400	1/2.5/10Gb	0 - 105
R1305G	8-10W ⁸	2 / 4	1.5	2.8	3	1.0	3	FP5	2,400	1/2.5/10Gb	0 - 105
R1102G	6W9	2 / 2	1.2	2.6	3	1.0	2	FP5	2,400	1/2.5	0 - 105

For more information about the specific features and specifications supported by select products in AMD's solutions portfolio, or to learn more about AMD's Ryzen[™] Embedded R1000 Processor Family, visit **www.amd.com/ryzenembedded-r-series**

AMD.com/embedded

- 1. HEVC (H.265), H.264, and VP9 acceleration are subject to and not operable without inclusion/installation of compatible HEVC players. GD-81
- 2. Updated Feb 28, 2017: Generational IPC uplift for the "Zen" architecture vs. "Piledriver" architecture is +52% with an estimated SPECint_base2006 score compiled with GCC 4.6 0.2 at a fixed 3.4GHz. Generational IPC uplift for the "Zen" architecture vs. "Excavator" architecture is +64% as measured with Gnebench R15 11, and also +64% with an estimated SPECint_base2006 score compiled with GCC 4.6 0.2, at fixed 3.4GHz. System configs: AMD reference motherboard(5), AMD Radeon" R9 290X GPU, 8GB DDR4-2667 ("Zen")/8GB DDR3-3B6 ("Piledriver"). Ubuntu Linux 15x. (SPECint_base2006 estimate) and Windows" 10 xG4 R51 (Gnebench R15). SPECint_base2006 estimates: "Zen" vs. "Piledriver" (315 vs. 20.7] +52%), "Zen" vs. "Excavator" (160 vs. 975 both at 4.0C]+64%). GD-108
- 3. As of June 2017. Product is based on the DisplayPort 1.4 Specification published February 23, 2016, and has passed VESA's compliance testing process (excluding HDR) in June 2017. GD-123
- 4. Nominal TDP = 15W. Configurable in BIOS.
- 5. EMB-158: Testing done at AMD Embedded Software Engineering Lab on 3/13/2019. The AMD R-series Embedded SoC RX-216GD formerly codenamed as "Merlin Falcon" scored 118 and the AMD R-series R1606G scored 361, when running Cinebench® R15 benchmark (Rendering Multi-core preset, 1920x1080x32 resolution). The performance delta of 3x was calculated based on "Merlin Falcons" sperformance score of 118 and R1606G performance score of 315. System Configurations: AMD Embedded R-Series R2.216GD used AMD "Bettong" Platform, with 2x8GB DDR4-2400 RAM, 250GB S5D Drive (non-rotating). TDP 15W, STAPM Enabled and ECC Disabled, Graphics Driver 18.50;1902VIa-33956CI-AES, BIOS RB0190B. Both systems ran Microsoft Windows 10.0 Professional (x64) Build 17763.
- 6. EMB-159. Testing done at AMD Embedded Software Engineering Lab on 3/13/2019. The AMD R1505G Embedded socred 360 running Cinebench R15 Multi-core and 1,988 running 3DMark11 benchmarks. The Intel Core i3-7100U (Kaby Lake) socred 254 running Cinebench R15 Multi-core and 1,444 when running 3DMark11 benchmarks. The Intel Core i3-7100U (Kaby Lake) socred 254 running Cinebench R15 Multi-core and 1,444 when running 3DMark11 benchmarks. The Intel Core i3-7100U (s 251 as of 4/1/2019 (check https://ark.intel.com/content/www/us/en/ark/products/95442/intel-core-i3-7100U urpcossor-24-40-etr. html). DBB price for R1505G is 580. System Configurations. AMD Embedded R1505G used a AMD R1000 Platform, with a 2x68G D084-2400 RAM, 250G SSD Dirke (one-rotating). TDFSW, 512PM Enabled, Craphics balled, Craphics D1902/07a-339028E-AES, BIOS RBB1190B, Microsoft Windows 10 Pro. Intel Core i3-7100U used a HP 15inch Notebook, i3-7100u with Intel[®] HD Graphics 620, tx8GB D0R4-2133 RAM, 1TB 5400 pm SATA, Microsoft Windows 10 Pro. Graphics Drive 2120.16.4627, BIOS FO7.
- 7. GD-150: Max boost for AMD Ryzen and Athlon processors is the maximum frequency achievable by a single core on the processor running a bursty single-threaded workload. Max boost will vary based on several factors, including, but not limited to: thermal paste; system cooling; motherboard design and BIOS; the latest AMD chipset driver; and the latest OS updates

8. Nominal TDP = 8W. Configurable in BIOS.

9. Nominal 6W SDP (Scenario Dissipation Power). Configurable in BIOS.

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