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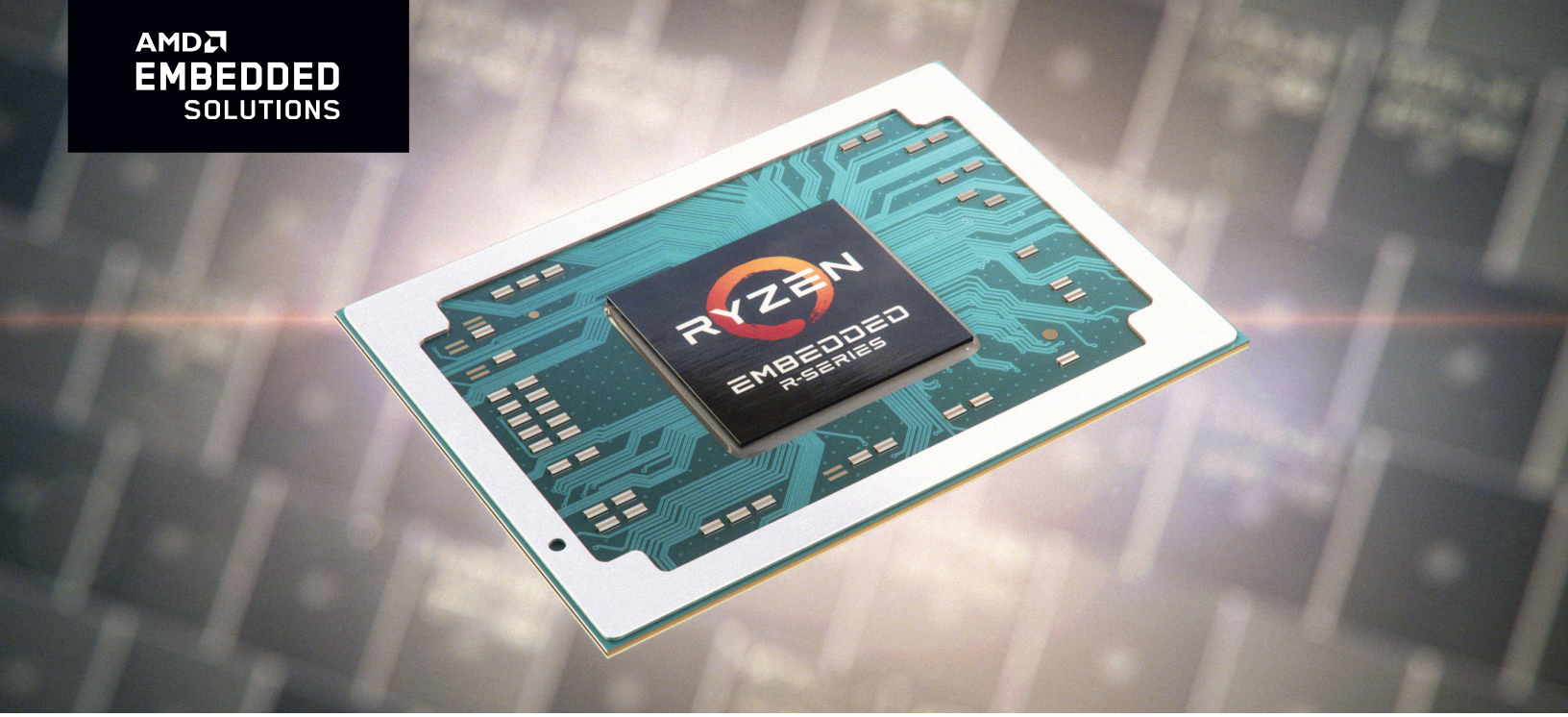
EMBEDDED
SOLUTIONS



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 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 watt[6] and 4x better CPU and graphics performance per dollar than the competition[7], 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 12W and 25W. With a comprehensive set of advanced, integrated security features, AMD Ryzen™ Embedded R1000 SoCs enable sophisticated system protection 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, small-footprint AMD Ryzen™ Embedded R1000 SoC can power up to three independent displays in brilliant 4K resolution, delivering stunningly rich and immersive visual experiences.

2C/4T "Zen" Cores	**3** "Vega" Graphics CUs[1]	**3** 4K Displays	**4K60** H.264/H.265 Enc. & Dec. VP9[2] Decode

Dual 10Gb Ethernet	**SW & HW** Compatibility with V1000	**Secure** Boot and Memory Encryption

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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% IPC boost at the CPU[3]. Utilizing a 14nm FinFET process, the AMD Ryzen™ Embedded R1000 enables 3x better performance per watt[6] when compared to legacy AMD SoC offerings. Up to 2x "Zen" CPU cores/4x threads and 3x Vega GPU compute units[1] can be harnessed to achieve breakthrough processing throughput for the 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 & 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

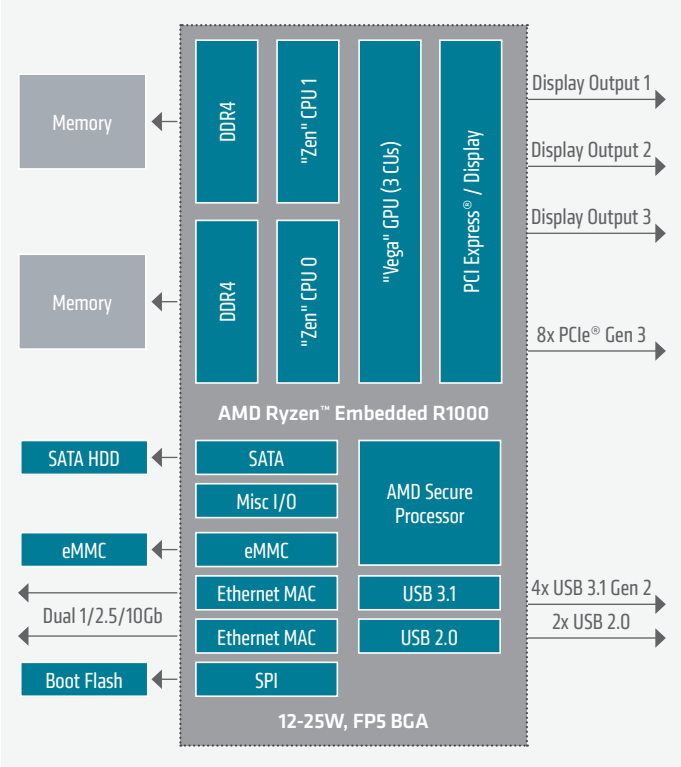
AMD Ryzen™ Embedded R1000 SoCs can power up to three independent displays in crisp 4K resolution via DisplayPort™ 1.4b and/or HDMI™ 2.0b. The integrated Video Hardware Accelerator supports decode or encode for various widely used video codecs with resolutions up to 4K60: VP9 10-bit decode, H.265 10-bit decode and 8-bit encode, H.264 encode & decode[2].

Seamless Integration & Security

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



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Additional Key Benefits

- Equipped with 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.

Performance

Next-generation x86 "Zen" Core
- Two cores / four threads with up to 1MB of shared L2 plus 4MB of shared L3 total

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)

Integration

Next-generation Graphics Core and Multimedia
- "Vega" GPU with up to 3 Compute Units[1]
- H.265 (10-bit) Decode & (8-bit) Encode, VP9 (10-bit) Decode[2]
- Up to 3x DisplayPort™ 1.4[4] 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, I2S/HDA/SW, GPIO

Model	TDP Range	CPU Core/ Thread Count	Base Freq. (GHz)	1T Boost Freq. (GHz)	Graphics Computing Units (SIMD)	GPU Freq. (GHz) (Max)	Individual Displays	Package	Max DDR4 Rate (MT/s)	Dual Ethernet Ports	Junction Temperature Range (°C)
R1606G	12-25W[5]	2 / 4	2.6	3.5	3	1.2	3	FP5	2,400	1/2.5/ 10Gb	0 – 105
R1505G	12-25W[5]	2 / 4	2.4	3.3	3	1.0	3	FP5	2,400	1/2.5/ 10Gb	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**

AMD.com/embedded

1. AMD Radeon™ and FirePro™ GPUs based on the Graphics Core Next architecture consist of multiple discrete execution engines known as a Compute Unit ("CU"). Each CU contains 64 shaders ("Stream Processors") working together. GD-78
2. HEVC (H.265), H.264, and VP9 acceleration are subject to and not operable without inclusion/installation of compatible HEVC players. GD-81
3. 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 –O2 at a fixed 3.4GHz. Generational IPC uplift for the "Zen" architecture vs. "Excavator" architecture is +64% as measured with Cinebench R15 1T, and also +64% with an estimated SPECint_base2006 score compiled with GCC 4.6 –O2, at a fixed 3.4GHz. System configs: AMD reference motherboard(s), AMD Radeon™ R9 290X GPU, 8GB DDR4-2667 ("Zen")/8GB DDR3-2133 ("Excavator")/8GB DDR3-1866 ("Piledriver"), Ubuntu Linux 16.x (SPECint_base2006 estimate) and Windows® 10 x64 RS1 (Cinebench R15). SPECint_base2006 estimates: "Zen" vs. "Piledriver" (31.5 vs. 20.7 | +52%), "Zen" vs. "Excavator" (31.5 vs. 19.2 | +64%). Cinebench R15 1t scores: "Zen" vs. "Piledriver" (139 vs. 79 both at 3.4G | +76%), "Zen" vs. "Excavator" (160 vs. 97.5 both at 4.0G|+64%). GD-108
4. 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
5. Default TDP = 25W. Configurable in BIOS.
6. 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 Falcon's" performance score of 118 and R1606G performance score of 361. System Configurations: AMD Embedded R-Series RX-216GD used AMD "Bettong" Platform, with 2x8GB DDR4-2400 RAM, 250GB SSD Drive (non-rotating), TDP 15W, STAPM Enabled and ECC Disabled, Graphics Driver 18.50.190214a-339560C-AES, BIOS RPD130CB. The AMD Ryzen Embedded V-Series R1606G used an AMD R1000 Platform with 2x8GB DDR4 2400 RAM, 250GB SSD Drive (non-rotating), TDP 15W, STAPM enabled and ECC Disabled, Graphics Driver 18.50_190207a-339028E-AES, BIOS RBB1190B. Both systems ran Microsoft Windows 10.0 Professional (x64) Build 17763.
7. EMB-159 and EMB -160: Testing done at AMD Embedded Software Engineering Lab on 3/13/2019. The AMD R1505G Embedded scored 360 running Cinebench R15 Multi-core and 1,988 running 3DMark11 benchmarks. The Intel Core i3-7100U (Kaby Lake) scored 254 running Cinebench R15 Multi-core and 1,444 when running 3DMark11 benchmarks. Recommended Customer price for Intel Core i3-7100U is $261 as of 4/1/2019 (check https://ark.intel.com/content/www/us/en/ark/products/95442/intel-core-i3-7100u-processor-3m-cache-2-40-ghz.html). DBB price for R1505G is $80. System Configurations: AMD Embedded R1505G used a AMD R1000 Platform, with a 2x8GB DDR4-2400 RAM, 250GB SSD Drive (non-rotating), TDP 15W, STAPM Enabled and ECC Disabled, Graphics Driver 18.50_190207a-339028E-AES, BIOS RBB1190B, Microsoft Windows 10 Pro. Intel Core i3-7100u used a HP 15inch Notebook, i3-7100u with Intel® HD Graphics 620, 1x8GB DDR4-2133 RAM, 1 TB 5400 rpm SATA, Microsoft Windows 10 Pro, Graphics Driver 21.20.16.4627, BIOS F.07.

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