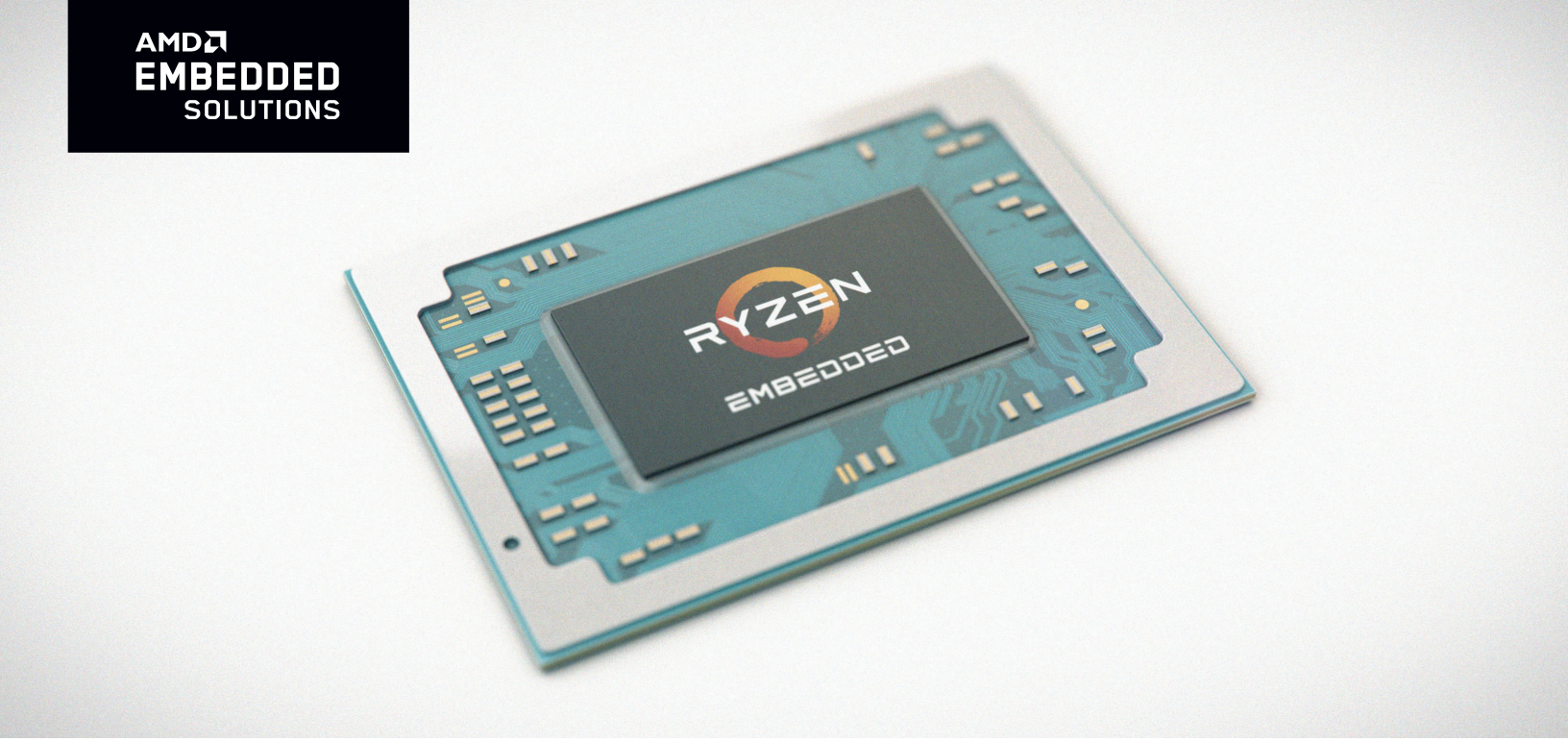
AMD EMBEDDED SOLUTIONS



Product Brief: AMD Ryzen™ Embedded V1000 Processor Family

Ultra-High-Performance Graphics and Compute Processing with Advanced Security Features in a Seamlessly Integrated Single-Chip Solution

Product Overview

The AMD Ryzen™ Embedded V1000 processor family brings together the breakthrough performance of the pioneering AMD "Zen" CPU and "Vega" GPU architectures in a seamlessly-integrated SOC solution that sets a new standard in processing power for next-generation embedded designs. Delivering superior graphics and multimedia processing, and compute performance up to 3.6 TFLOPS with thermal design power (TDP) as low as 12W and as high as 54W, AMD Ryzen™ Embedded V1000 SOCs equip system designers to achieve new levels of processing efficiency and design versatility. With a comprehensive set of advanced, integrated security features, AMD Ryzen™ Embedded V1000 SOCs enable sophisticated system protections complemented by an expansive breadth of I/O interconnect options.

The AMD Ryzen™ Embedded V1000 simplifies the design, form factor and thermal management challenges inherent to discrete CPU and GPU configurations, enabling system designers targeting digital casino gaming, medical displays, thin clients, industrial PCs and 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 V1000 SoC powers up to four independent displays in brilliant 4K resolution, delivering stunningly rich and immersive visual experiences.

Outstanding Performance for Wide Applications

4C/8T	3.6	4	4K60	Dual	Leading Edge Security	Scalability
Zen Cores 14nm	TFLOPS[4]	4K Displays	VP9[2] Decode Support	10GE	SME/SEV	12W – 54W

AMD

New Levels of Graphics and Compute Performance

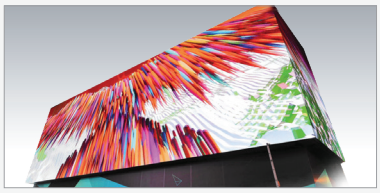
AMD Ryzen™ Embedded V1000 SOCs provide an ultra-high-performance complement to the AMD Embedded R-Series and G-Series SOC portfolios, delivering up to a 52% IPC boost at the CPU[3] and up to a 107% improvement in GPU performance[5]. Utilizing a 14nm FinFET process, the AMD Ryzen™ Embedded V1000 enables scalability to higher performance at comparable TDPs as legacy SOC offerings, or sustained performance levels with significantly reduced thermal budgets[3]. Up to 4 CPU cores/8 threads and 11 GPU compute units[1] can be harnessed to achieve breakthrough processing throughput for the most demanding graphics and compute workloads.

Markets

Gaming Machines

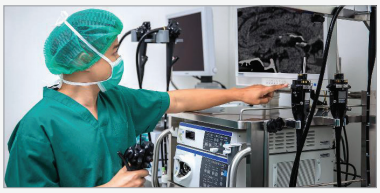
Casino Gaming, Arcade Gaming, Over the top set-top box gaming

Digital Signage



Digital Signage, Pos/kiosk, Quick Service Restaurant

Medical Imaging

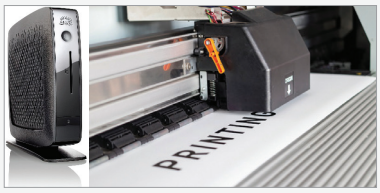


Portable Medical Equipment, Clinical Workstation, MRI, Xray, CT

Industrial Controls & Automation

Industrial HMI/PC, Machine Vision, Surveillance, Smart Server/Gateway

Thin Client & Office Automation



Financial/Education, Converged Devices, Printing & Imaging

Communications Infrastructure

Enterprise/Switch/Router, Service Provider Networking, Iot infrastructure

Seamless Integration

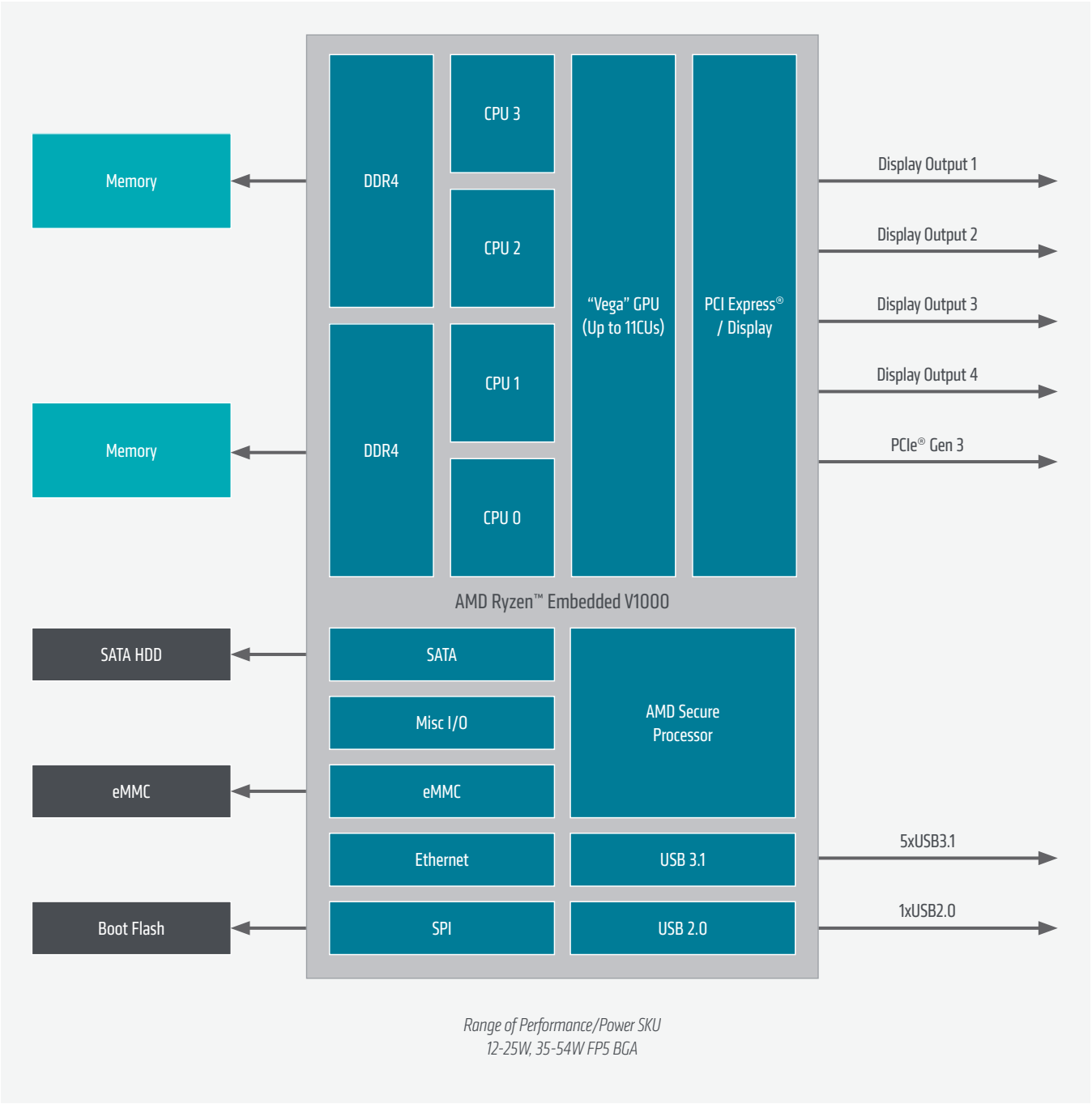
Integrating a high-performance CPU and GPU on a single die, the AMD Ryzen™ Embedded V1000 SOC enables significant space savings, smaller board designs and more efficient cooling architectures than can be achieved with heterogeneous CPU and GPU chipsets – with attendant CAPEX and OPEX savings opportunities. New hardware support for VP9 10-bit decode and H.265 10-bit decoding and 8-bit encoding[2]. Robust I/O support spans new and established embedded interconnects spanning PCIe®, Ethernet, and USB support including USB-C.

Uncompromising Security Features

AMD Ryzen™ Embedded V1000 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 ensure systems are booted from trusted software, with one-time programmable (OTP) capabilities enabling system designers to manage their own keys. Advanced capabilities include Secure Memory Encryption (SME) for defending against unauthorized memory access, and Secure Encrypted Virtualization (SEV) for securely isolating hypervisors and virtual machines (VMs) – with no application code changes required.

Additional Key Benefits

- AMD Ryzen™ Embedded V1000 SOCs can power up to four independent displays in crisp 4K resolution via DisplayPort/ eDP and/or HDMI™, and support for High Dynamic Range (HDR) displays[6].
- Equipped with dual-channel 64-bit DDR4 with performance up to 3200 MT/s, AMD Ryzen™ Embedded V1000 SOCs provide up to 16 PCIe lanes, dual 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.



Range of Performance/Power SKU
12-25W, 35-54W FP5 BGA

Performance

Next-generation x86 "Zen" Core

- Up to four cores / eight threads with up to 2MB of shared L2 plus 4MB of shared L3 total

Dual-channel 64-bit DDR4 Up to 3200 MT/s

- ECC support
- 1 DIMM / channel (Dual-Rank on FP5 32GB total)

Security

Next-generation AMD Secure Processor (PSP)

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

Integration

Next-generation Graphics Core and Multimedia

- "Vega" GPU with up to 11 Compute Units[1]
- H.265[2] Decode & (8-bit) Encode, VP9 Decode[2]
- Up to 4x DisplayPort 1.4[6], HDMI™ 2.0b, or eDP 1.4

Enhanced I/O (FP5)

- Up to 4x USB 3.1 (10Gb/s) / 2 Type-C with ALT. DP power delivery capable
- 1x USB 3.1 (5Gb/s)
- 1x USB 2.0
- Up to 2x SATA ports
- NVMe support
- eMMC5.0, SD3, or LPC
- Up to 16L of PCIe® Gen3 (8 lane GFX, 8 lane GPP) and 7 link max
- 2x 10 Gigabit Ethernet
- 2x UART, 4x I2C, 2x SMBus, SPI/eSPI, I2S/HDA/SW, GPIO

Model	TDP Range	Core/ Thread Count	GPU CU [SIMD]	Ind. Displays	L2 Cache	Package	Max DDR4 Rate	Base Freq. GHz	1T Boost Freq. GHz	GPU Freq. GHz	Dual Ethernet Ports
V1807B	35-54W[7]	4/8	11	4	2M	FP5	3200	3.35	3.8	1.3	10Gb
V1756B	35-54W[7]	4/8	8	4	2M	FP5	3200	3.25	3.6	1.3	10Gb
V1605B	12-25W[8]	4/8	8	4	2M	FP5	2400	2.0	3.6	1.1	10Gb
V1202B	12-25W[8]	2/4	3	4	1M	FP5	2400	2.3	3.2	1.0	1Gb

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 V1000 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. FP16. The equation for FLOPS on the GPU is the following making the assumptions for clock and using 16-bit floating point operands is shown here: FLOPS = 11 CU * 4 SIMD/CU * 4Shaders/SIMD * 4 MAC/Pixel * 4 FLOPS/Cycle/ALU * 1300MHz = 3.66 TFLOPS

5. Testing done at AMD Embedded Software Engineering Lab. The AMD R-series Embedded SOC RX-421BD formerly codenamed as "Merlin Falcon" scored 2399 and the AMD V-series V1807B scored 4978, when running 3dMark® 11P benchmark. The performance delta of 107% was calculated based on "Merlin Falcon's" performance score of 2399 and V1807B's performance score of 4978. AMD Embedded R-Series RX-421BD used AMD "Bettong" Platform, with 2x8GB DDR4-2400 RAM, 250GB SSD Drive (non-rotating), TDP 35W, STAPM and ECC Disabled, Graphics Driver 17.40.2011-171026a-320350C-AES, BIOS RBE1306A. The AMD Ryzen Embedded V-Series V1807B used an AMD "Dibbler" Platform with 2x8GB DDR4 3200 RAM, 250GB SSD Drive (non-rotating), TDP 35W, STAPM and ECC Disabled, Graphics Driver 17.40-171114a-320676E-AES-2-wRV-E9171, BIOS TDB1100EA. Both systems ran Microsoft Windows® 10 Pro.

6. 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

7. Default TDP = 45W

8. Default TDP = 15W

AMD