DISRUPTING DESKTOP PERFORMANCE

MULTI-THREAD PERFORMACE

Desktop PC Performance

AMD Ryzen 1
1st GEN DESKTOP

AMD Ryzen 2
2nd GEN DESKTOP

AMD Ryzen 3
3rd GEN DESKTOP

2015  2016  2017  2018  2019
DEVELOPING AS PROMISED

14nm / 12nm
Shipping July 2019

7nm
Shipping Q4 2020

“ZEN”
“ZEN+”

“ZEN 2”

“ZEN 3”
OUR “ZEN” JOURNEY

“ZEN”/”ZEN+”
- Up to 4.35GHz max boost
- +52% IPC
- 4-core complex
- 8MB L3 per complex
- SMT enabled
- New boost algorithms
- 14nm/12nm

“ZEN 2”
- Up to 4.7GHz max boost
- +15% IPC
- 4-core complex
- 16MB L3 per complex
- Chiplet design
- FP-256
- 7nm

“ZEN 3”
- Higher max boost
- Significant IPC uplift
- New core layout
- New cache topology
- 7nm

2017

2020

* 1. GP-618; 2. RZ3-74; 3. See endnote GP-150 for max boost.
“ZEN 3” CORE ARCHITECTURE
WIDER, FASTER, AND EVEN MORE EFFICIENT

8 CORE
LOWER LATENCY
Significant Accelerator for PC Gaming Applications

2X
DIRECT ACCESS L3 CACHE
Reduced Memory Latency for Gaming

~19%
DESKTOP IPC UPLIFT\(^1\)
Greater Performance Across All Applications

\(^1\) See section R10.03.
INDUSTRY LEADERSHIP

“ZEN 3” 19% IPC UPLIFT FOR PCs

GEOMEAN OF 25 WORKLOADS¹
(Fixed 4GHz Frequency, 8 Cores)

+19%

“ZEN 3” PERFORMANCE CONTRIBUTORS

- Cache Prefetching
- Execution Engine
- Branch Predictor
- Micro-op Cache
- Front End
- Load/Store

¹ See entry 1.5K003
“ZEN 2” LAYOUT

“ZEN 3” LAYOUT

2X L3 Cache Directly Accessible Per Core
Accelerates Core and Cache Communication for Gaming
Reduction in Effective Memory Latency
LEADERSHIP POWER EFFICIENCY

“ZEN 3” STRENGTHENS OUR LEAD

Performance per Watt

- **AMD RYZEN™ 7 1800X “ZEN”**
- **AMD RYZEN™ 9 3900XT “ZEN 2”**
- **AMD RYZEN™ 9 “ZEN 3”**

Values: 2.0X, 2.4X

*1 See endnotes RS4012.*
LEADERSHIP POWER EFFICIENCY

“ZEN 3” STRENGTHENS OUR LEAD

AND

MORE EFFICIENT THAN CORE i9-10900K\(^1\)

2.8X

AMD RYZEN® 7
1800X
“ZEN”

AMD RYZEN® 9
3900XT
“ZEN 2”

AMD RYZEN® 9
“ZEN 3”

*1 See endnotes RSF007.
INTRODUCING THE

AMD RYZEN™ 9 5900X

12 Cores | 24 Threads

UP TO 4.8 GHz Boost

70 MB L2+L3 Cache

105W TDP
AMD RYZEN™ 5900X

Cinebench 1T Run
TIMELAPSED DEMO

631

First desktop processor to break 600 points in single-thread performance

CORE i9-10900K

AMD RYZEN™ 5900X

*1. See endnote RSF004.
AMD RYZEN™ 9 5900X

1920x1080 Resolution
High Image Quality Preset

- Core i9-10900K
- AMD Ryzen™ 9 5900X

<table>
<thead>
<tr>
<th>Game/Task</th>
<th>Core i9-10900K</th>
<th>AMD Ryzen™ 9 5900X</th>
<th>% Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEAGUE OF LEGENDS™ (DX11)</td>
<td></td>
<td></td>
<td>+21%</td>
</tr>
<tr>
<td>PUBG™ (DX11)</td>
<td></td>
<td></td>
<td>+5%</td>
</tr>
<tr>
<td>DOTA™ 2 (Vulkan*)</td>
<td></td>
<td></td>
<td>+6%</td>
</tr>
<tr>
<td>F1™ 2019 (DX12)</td>
<td></td>
<td></td>
<td>+6%</td>
</tr>
<tr>
<td>BATTLEFIELD™ V (DX12)</td>
<td></td>
<td></td>
<td>-3%</td>
</tr>
<tr>
<td>TOTAL WAR™ THREE KINGDOMS (BATTLE TEST) (DX11)</td>
<td></td>
<td></td>
<td>+1%</td>
</tr>
<tr>
<td>CS:GO™ (DX9)</td>
<td></td>
<td></td>
<td>+19%</td>
</tr>
<tr>
<td>SHADOW OF THE TOMB RAIDER™ (DX11)</td>
<td></td>
<td></td>
<td>+6%</td>
</tr>
<tr>
<td>FAR CRY* NEW DAWN (DX11)</td>
<td></td>
<td></td>
<td>+2%</td>
</tr>
<tr>
<td>ASHES OF THE SINGULARITY™ [CPU TEST] (Vulkan*)</td>
<td></td>
<td></td>
<td>+5%</td>
</tr>
</tbody>
</table>

*1 See endnotes R5K6B.
AMD RYZEN™ 9 5900X

THE WORLD’S BEST GAMING CPU

*1 See endnotes RSX002
AVAILABLE NOVEMBER 5
AMDRYZEN™ 5900X
Performance Per Dollar Leadership

+13%
Single Thread
Performance per $

+23%
Multi Thread
Performance per $

+3%
1080p Gaming
Performance per $

I9-10900K ($529)   AMDRyzentm 5900X ($549)
AMDRYZEN™ 5800X
Performance Per Dollar Leadership

+9%
Single Thread
Performance per $

+11%
Multi Thread
Performance per $

TIE
1080p Gaming
Performance per $

I7-10700K ($409)
AMD Ryzen™ 7 5800X ($449)
AMD RYZEN™ 5950X

THE BEST FOR GAMERS MEETS THE BEST FOR CREATORS

16 Cores
32 Threads

UP TO 4.9 GHz Boost

72 MB L2+L3 Cache

105W TDP
**AMD RYZEN™ 9 5950X**

**CONTENT CREATION PERFORMANCE**

<table>
<thead>
<tr>
<th>Category</th>
<th>Core i9-10900K</th>
<th>AMD Ryzen™ 9 5950X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video Editing</td>
<td></td>
<td>+59%</td>
</tr>
<tr>
<td>Adobe Premiere Pro 14.3.1</td>
<td>+13%</td>
<td></td>
</tr>
<tr>
<td>Rendering</td>
<td></td>
<td>+6%</td>
</tr>
<tr>
<td>V-Ray 4.10</td>
<td></td>
<td>+14%</td>
</tr>
<tr>
<td>CAD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SolidWorks 2019</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compiling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GCC Compile Time</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**GAMING PERFORMANCE**

<table>
<thead>
<tr>
<th>Game</th>
<th>Core i9-10900K</th>
<th>AMD Ryzen™ 9 5950X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ashes of the Singularity™</td>
<td>+11%</td>
<td></td>
</tr>
<tr>
<td>[CPU TEST] (Vulkan®)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Far Cry® New Dawn</td>
<td>TIED</td>
<td></td>
</tr>
<tr>
<td>[DX* 11]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shadow of the Tomb Raider*</td>
<td>+5%</td>
<td></td>
</tr>
<tr>
<td>[DX* 12]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total War® Three Kingdoms</td>
<td>+5%</td>
<td></td>
</tr>
<tr>
<td>[BATTLE TEST] (DX* 11)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1 See endnotes RS-014
AMD RYZEN™ 9 5950X
THE BEST FOR GAMERS MEETS THE BEST FOR CREATORS

$799
AVAILABLE NOVEMBER 5
BIOS UPDATES FOR RYZEN™ 5000 SERIES
GETTING YOUR MOTHERBOARD DROP-IN READY

AMD 500 Series Chipsets

- **GET READY:** AMD 500 Series motherboards require a BIOS with AGESA 1.0.8.0 (or newer) for POST/boot (already available)
- **AT LAUNCH:** Users should upgrade to a BIOS with AGESA 1.1.0.0 (or newer) for the best experience on November 5

AMD 400 Series Chipsets

- BIOS updates for AMD Ryzen 5000 Series processors currently in development with motherboard partners
- Customers should expect first beta releases for AMD 400 Series motherboards starting in January, 2021
## A RELENTLESS PACE OF INNOVATION

**RYZEN™ 5000 SERIES DELIVERS WHAT GAMERS WANT**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Market Leader</th>
</tr>
</thead>
<tbody>
<tr>
<td>1080p Gaming</td>
<td>AMD</td>
</tr>
<tr>
<td>Core Architecture IPC</td>
<td>AMD</td>
</tr>
<tr>
<td>Power Efficiency</td>
<td>AMD</td>
</tr>
<tr>
<td>Single-Thread Performance</td>
<td>AMD</td>
</tr>
<tr>
<td>Multi-Thread Performance</td>
<td>AMD</td>
</tr>
<tr>
<td>Performance per Dollar</td>
<td>AMD</td>
</tr>
<tr>
<td>Backwards Compatibility</td>
<td>AMD</td>
</tr>
</tbody>
</table>
BORDERLANDS 3 (DX 12) Badass Quality
CALL OF DUTY: MODERN WARFARE (DX 12) Ultra Quality
GEARS OF WAR 5 (DX 12) Ultra Quality

3840x2160 (4K) Frames Per Second
ENDNOTES

- **RZ3-24**: Based on AMD Labs testing in May 2019, an AMD "Zen 2"-based system configured with a "Matisse" B0 sample, AMD Reference Mobo, AMD Reference Cooler, 4x8GB DDR4-2667 RAM, Ubuntu O/S, and GeForce GTX 1080 GPU vs. a similarly configured "Summit Ridge" B2 sample, scored an estimated 15% higher using estimated SPECint_base2006 results. SPEC and SPECint are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org.

- **GD-108**: 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 11. 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 DDR3-1866 ("Excavator")/8GB DDR3-1233 ("Piledriver"), Ubuntu Linux x86 (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 scores: "Zen" vs. "Piledriver" (139 vs. 79 both at 3.4GHz | +75%), "Zen" vs. "Excavator" (160 vs. 97.5 both at 4.0GHz | +64%).

- **RSK-002**: Testing by AMD performance labs as of 9/2/2020 based on the average FPS of 40 PC games at 1920x1080 with the High image quality preset using an AMD Ryzen™ 9 5900X processor vs. Core i9-10900K. Results may vary.

- **RSK-003**: Testing by AMD performance labs as of 09/01/2020. IPC evaluated with a selection of 25 workloads running at a locked 4GHz frequency on 8-core "Zen 2" Ryzen 7 3800XT and "Zen 3" Ryzen 7 5800X desktop processors configured with Windows® 10, NVIDIA GeForce RTX 2080 Ti (451.77). Samsung 860 Pro SSD, and 2x8GB DDR4-3600. Results may vary.

- **RSK-004**: Testing by AMD performance labs as of 09/01/2020 with a Ryzen 9 5950X processor vs a Core i9-10900K configured with NVIDIA GeForce GTX 2080 Ti graphics, Samsung 860 Pro SSD, 2x8 DDR4-3600, Windows 10 and a Noctua NH-D15s cooler. Single-core performance evaluated with Cinebench R20 1T benchmark. Results may vary.

- **RSK-007**: Testing by AMD Performance Labs as of 09/01/2020 using Cinebench R20 nT versus system wall power during full load CPU test using a Core i9-10900K, Ryzen 9 3900XT, Ryzen 9 5900XT, Ryzen 9 3950X, and a Ryzen 9 5950XT configured with: 2x8GB DDR4-3600, GeForce RTX 2080 Ti, Samsung 860 Pro SSD, Noctua NH-D15s cooler, and an open-air test bench with no additional power draw sources. Results may vary.
ENDNOTES

- **R5K-012**: Testing by AMD Performance Labs as of 09/01/2020 using a Ryzen 7 1800X, Ryzen 9 3900XT, and a Ryzen 9 5900X CPU in Cinebench R20 nT versus system wall power during full load CPU test. All systems configured with: 2x8GB DDR4-3600, GeForce RTX 2080 Ti, Samsung 860 Pro SSD, Noctua NH-D15s cooler, and an open-air test bench with no additional power draw sources. Results may vary.

- **R5K-013**: Testing by AMD Performance Labs as of 09/25/2020 with a Ryzen 9 3950X vs a Ryzen 9 5950X CPU. All systems configured with: 2x8GB DDR4-3600, GeForce RTX 2080 Ti (451.77), Samsung 860 Pro SSD, Noctua NH-D15s cooler, Windows* 10 build 2004. Games tested at 1080p resolution with High image quality preset and the newest graphics API available to the title (e.g. DirectX® 12 or Vulkan * or DirectX® 11). Results may vary.

- **R5K-014**: Testing by AMD Performance Labs as of 09/25/2020 with the Ryzen 9 5950X vs Core i9-10900K. All systems configured with: 2x8GB DDR4-3600, GeForce RTX 2080 Ti (451.77), Samsung 860 Pro SSD, Noctua NH-D15s cooler, Windows* 10 build 2004. Games tested at 1080p resolution with High image quality preset and the newest graphics API available to the title (e.g. DirectX® 12 or Vulkan*). Results may vary.

- **RX-532**: Testing done by AMD performance labs 09/26/20 on a system configured with a new AMD graphics card, graphics driver 2009241322_20.45, Ryzen 9 5900X CPU, 16GB DDR4-3200MHz, engineering motherboard and bios, on Win 10 Pro x64 19041.508. Games tested at 4K as follows: Borderlands 3 (DX12, Badass), Call of Duty: Modern Warfare (DX 12, Ultra), Gears of War 5 (DX 12, Ultra). Performance may vary. GPU redacted AMD Confidential. RX-532