

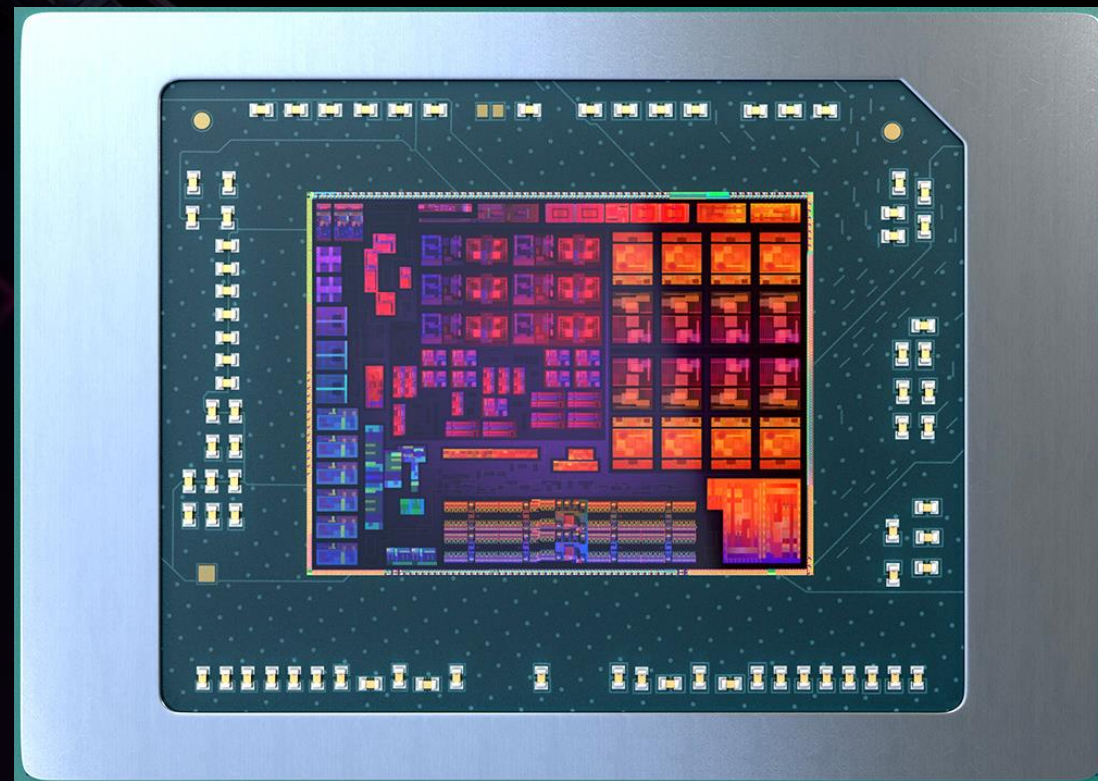


AMD Ryzen™ 6000 Series for Mobile

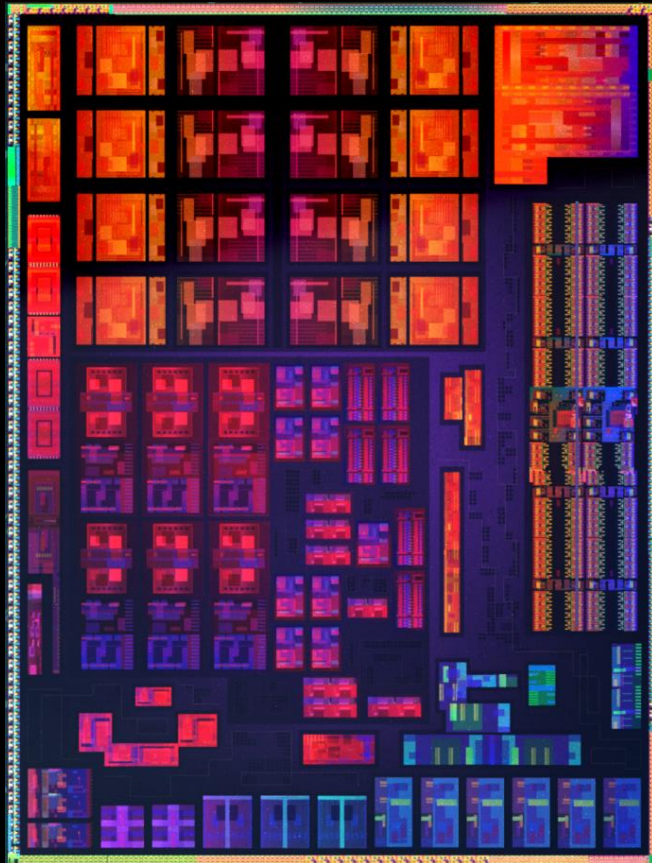
Technology Overview

Jim Gibney

AMD Fellow and SOC Architect



AMD Ryzen™ 6000 Series for Mobile



Tech: TSMC N6 | Transistors: 13.1B | Die size: 210mm²

ZEN3+

"ZEN 3+" Core

Incredible Performance-per-Watt
in x86 Mobile Processors

AMD RDNA 2

RDNA™ 2 Graphics

A Massive Leap in Performance
For Integrated Notebook Graphics

6nm

Technology

Higher Processor Performance
With Leadership Power Efficiency



All-new Platform

(LP)DDR5, PCIE®4.0, USB4® 40Gbps,
WiFi 6E + DBS, Bluetooth 5.2

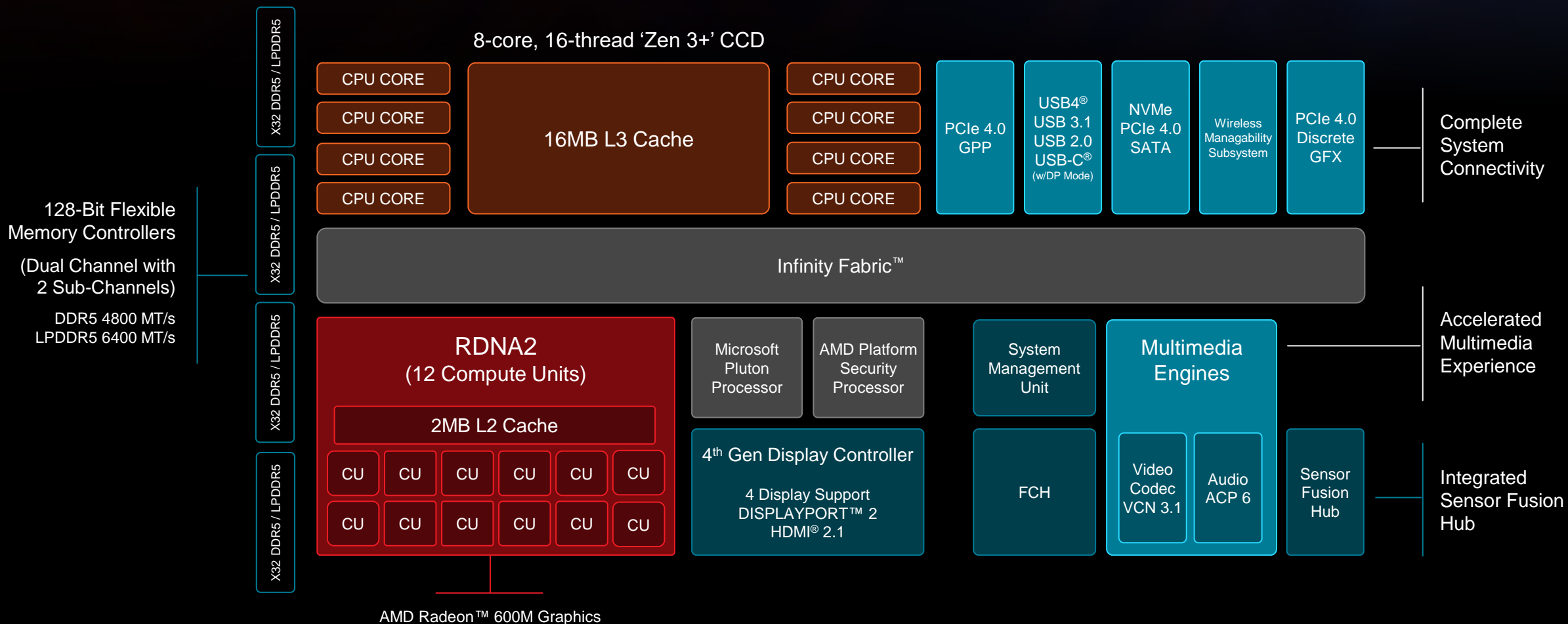


Up to
29 Hours of
Battery Life

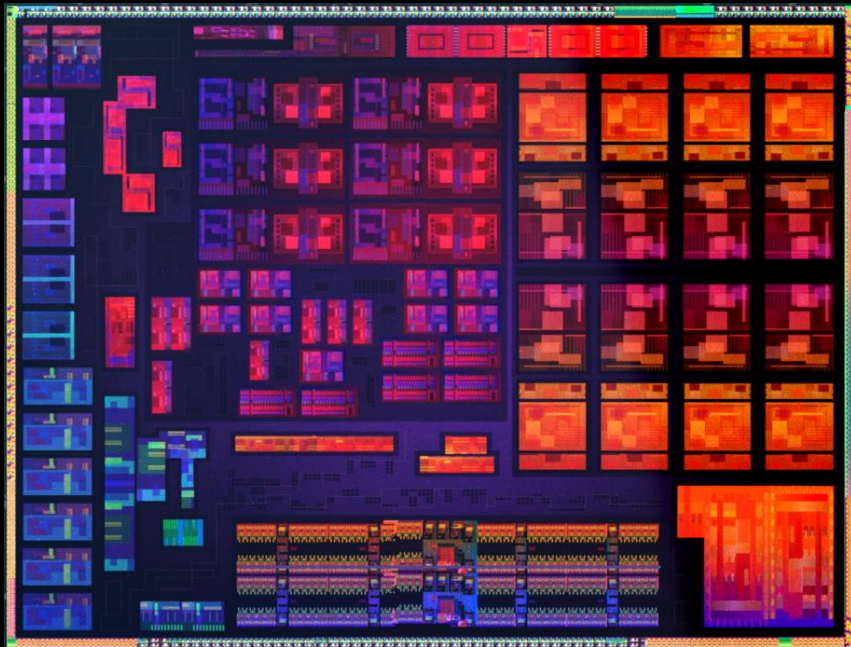
Optimized with 6nm Process Technology
New Power Management Features
New Adaptive Power Control Framework

AMD Ryzen™ 6000 Series for Mobile

“Rembrandt” SoC Topology on 6nm Manufacturing Process



5 Layers of Power Optimization



Core Architecture

New 'Zen 3+' Core, Heavily Optimized for Performance per Watt

Graphics Architecture

New 'RDNA2' Graphics Core, Architected and Configured for Perf/W

SoC Architecture

New Power Planes, New Power Architecture, Deep Partitioning

Platform Optimization

Component Optimizations + AMD Advantage™ Technologies

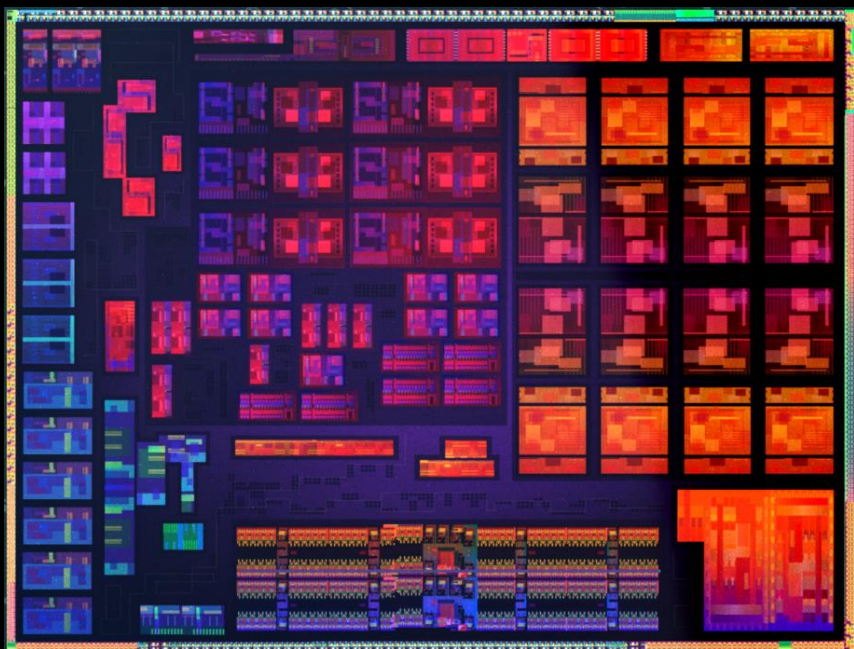
System Software

New Power Management Framework

Our Goal: Unmatched System Perf/W & Perf/mm²

Core Architecture

Updated “Zen 3+” Core with Over 50 New or Enhanced Features for Optimized Efficiency



PC6 Restore

Hardware-assisted wake from sleep for very fast response

Selective SCFCTP Save

on PC6 entry – look at previous core utilization before waking some cores unnecessarily

Delayed L3 Initialization

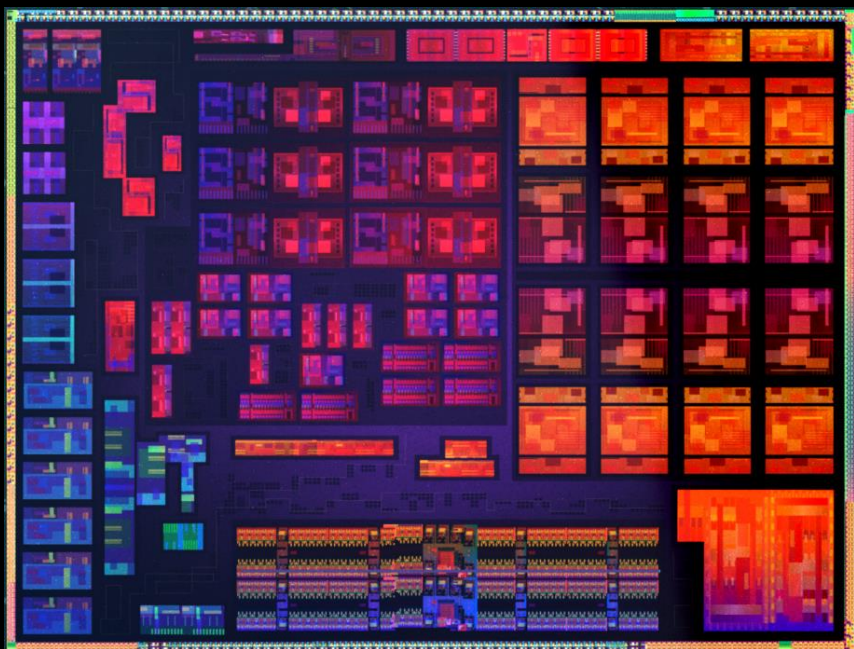
Can skip over L3 cache during wake to improve latency

Cache Dirtiness Counter

If cache misses are high, disallows DRAM power down to save power in the long run

Core Architecture

Updated “Zen 3+” Core with Over 50 New or Enhanced Features for Optimized Efficiency



CPPC per Thread Capability

Can communicate per-thread utilization to the OS now, not just per-core

CCX Light C-State

New shallow state with data fabric sleep and DRAM self-refresh

Enhanced CC1 State

New way to trigger sleep if a core isn't being utilized

Summary

We now have deeper control over every individual processing thread's power level and clock

This is how we secure more performance per watt from a single core complex

U-series Performance at 15 Watts

Incredible efficiency means driving up to 40% higher base clocks at 15 Watts, and that means more performance for AMD Ryzen™ 6000

Up to 1.17X Generational Uplift in CPU Compute	Up to 1.81X Generational Uplift in Graphics	Up to 3 hrs Generational Battery Life Increase
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AMD Ryzen™ 6000 Delivers The Most Processing Power Below 20 Watts

U-series Performance at 28 Watts

OEMs now drive platforms with higher TDPs, and AMD Ryzen™ 6000 can take advantage of that headroom for even more performance

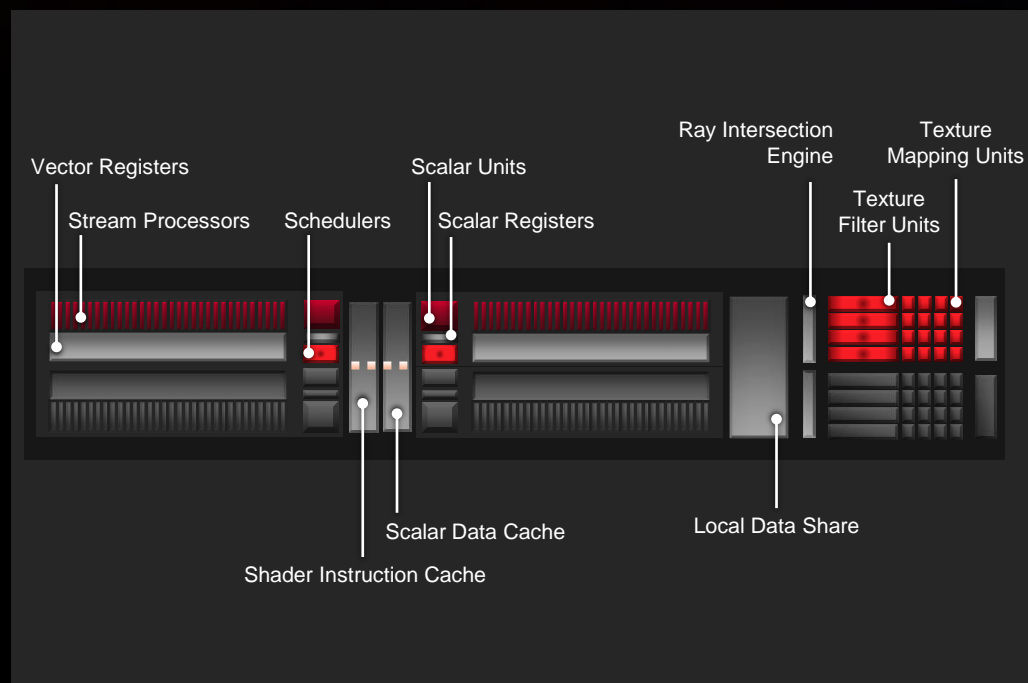
Up to 1.3X Generational Uplift in CPU Compute	Up to 2X Generational Uplift in Graphics	~the same winning Battery Life
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AMD Ryzen™ 6000 Delivers More Compute Performance with the Same leading Battery Life at 28W

Graphics Architecture

AMD Radeon™ 600M Series

RDNA™ 2 Architecture



Architectural Improvements

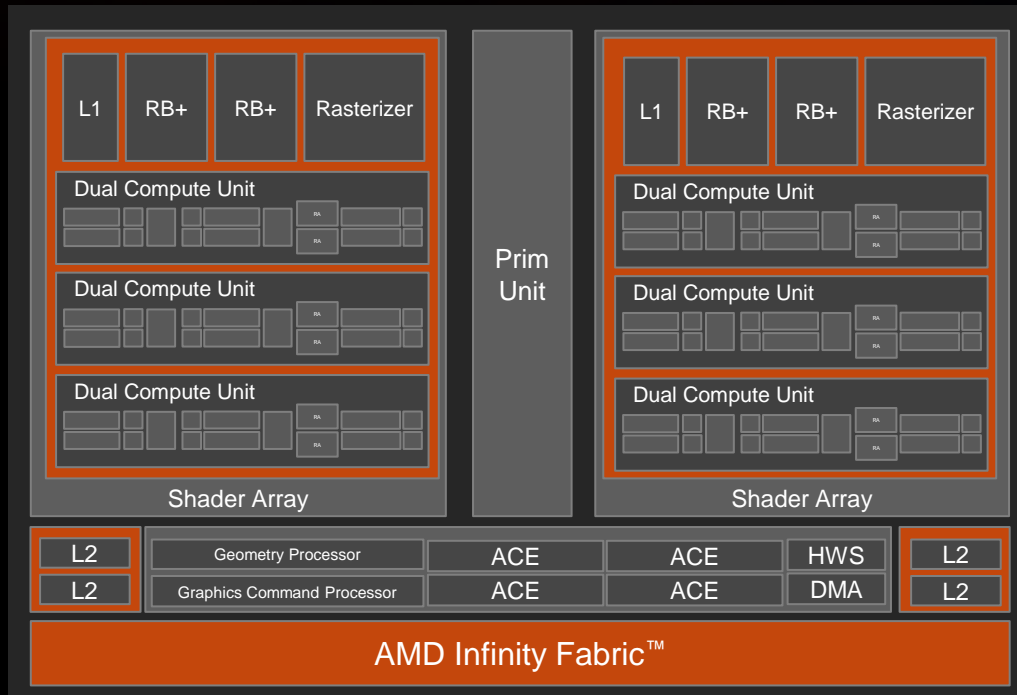
- 50% Larger Execution Engine to 12x CUs (680M)
- 2X Larger Render Backend to 4x RB+ (680M)
- 2X Larger Graphics L2 Cache to 2MB (680M)
- Workgroup Processor: more resources applied to single workgroup
- Faster instruction issue – single cycle: lower latency
- Wave32 execution: support Wave64 through multi-cycling
- Deeper ALU pipeline to allow higher frequency

RDNA 2 Graphics Architecture for The First Time on a PC Processor

Graphics Architecture

AMD Radeon™ 600M Series

Radeon™ 600M Block Diagram



Radeon™ 680M

12 Cores, up to 2.4GHz, 4 RB+

On AMD Ryzen™ 7 and 9

Radeon™ 660M

6 Cores, up to 1.9GHz, 2 RB+

On AMD Ryzen™ 5

RDNA™ 2 Graphics Architecture Capabilities

GPU Max Frequency Now up to 2.5 GHZ

GPU frequencies up to 300MHz higher YoY

Peak Performance Increased

Up to 3.4 TFLOPS (FP32) / 6.8 TLOPS (FP16)

Massive Bandwidth Increase

Thanks to DDR5/LPDDR5 support for up to 1.5x bandwidth

Incredible Power Efficiency

Via both GPU and Display Controller

Graphics Architecture

AMD Radeon™ 600M Series

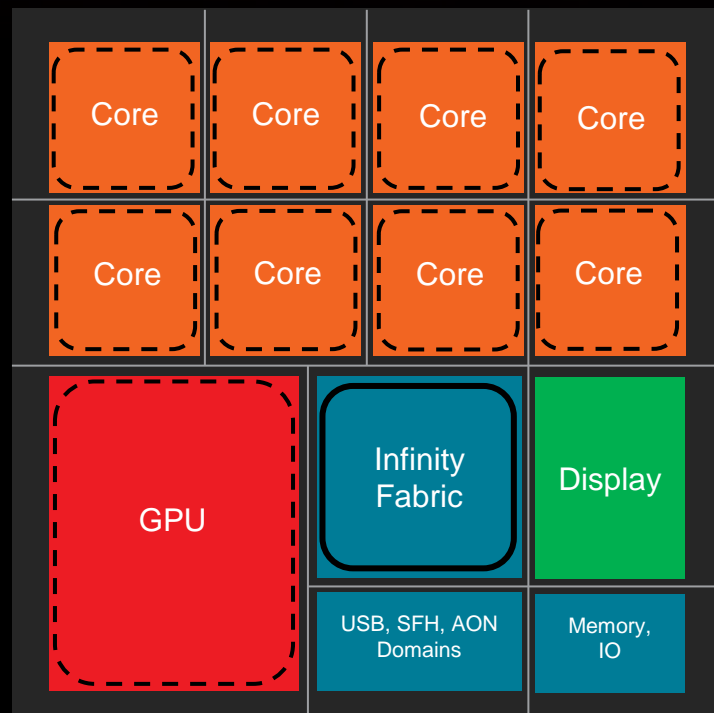
Notebook Graphics Performance Generational Uplift

Ryzen 6000 U Series vs Ryzen 5000 U Series		
	15W	28W
TimeSpy	Up to 81%	Up to 100%

Significant Perf/W Increase vs. Last Gen

SoC Architecture

Updated SoC-wide Partitioning for Optimized Efficiency



KEY:

Internal Linear Reg.
(Gated) Domain

Gated Domain

Deep SoC Power Partitioning and Power States

Separate power partitions and states for graphics complex, display (including full display power off with PSR panel), AMD Infinity Fabric™/wireless management controller, and Southbridge/USB

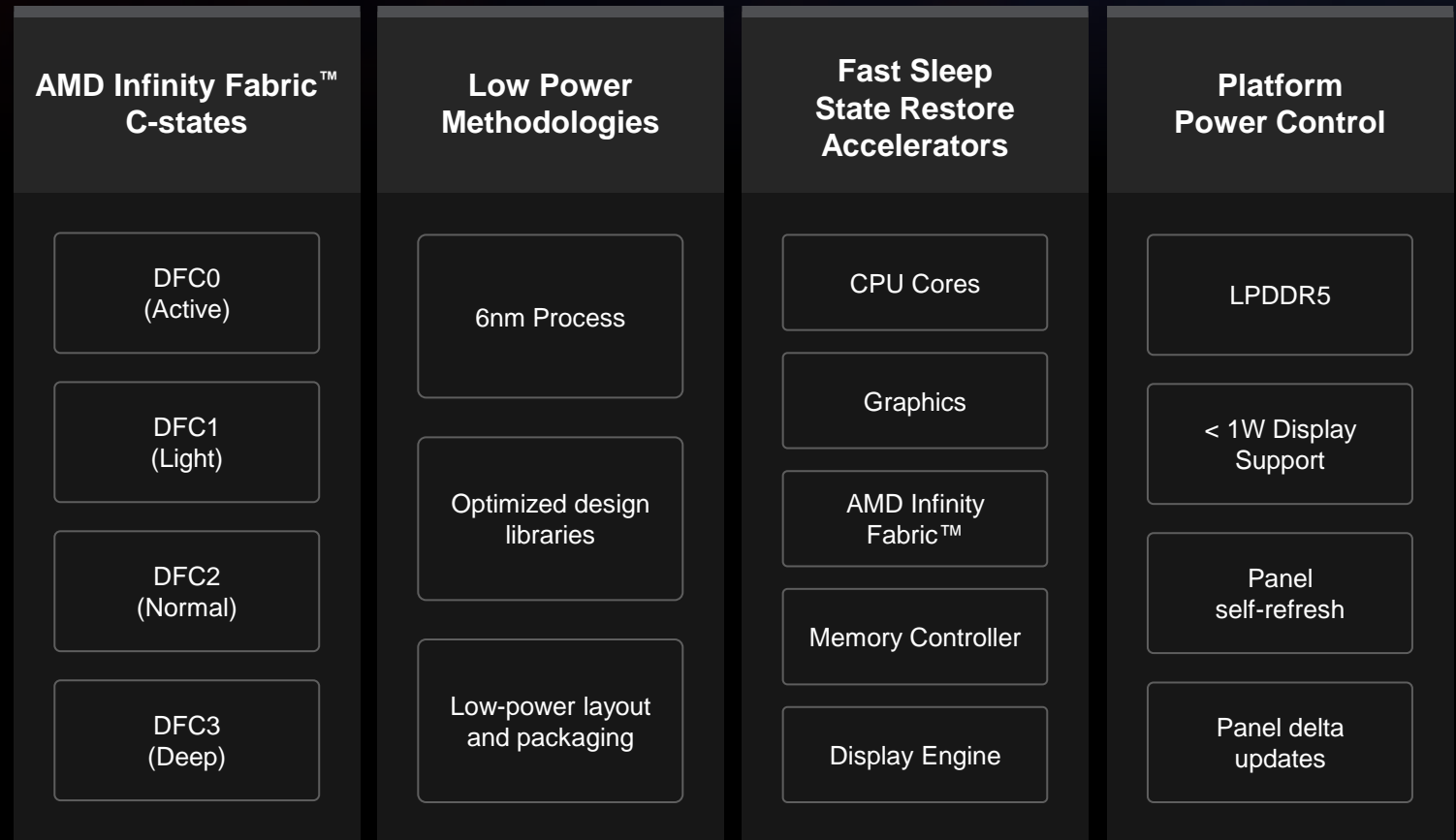
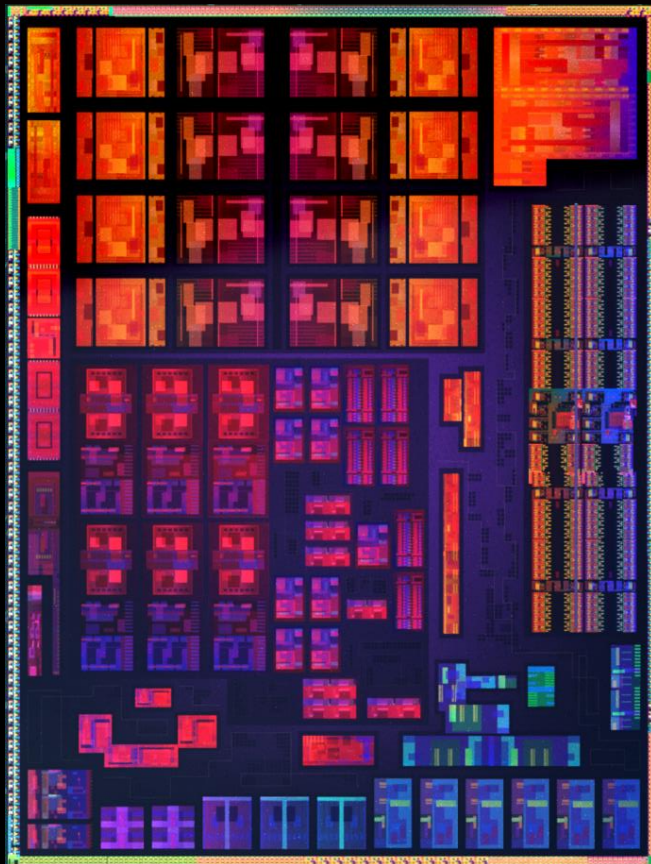
New SoC-wide Save-restore Acceleration

Hardware assisted acceleration for very fast transitions between sleep and wake

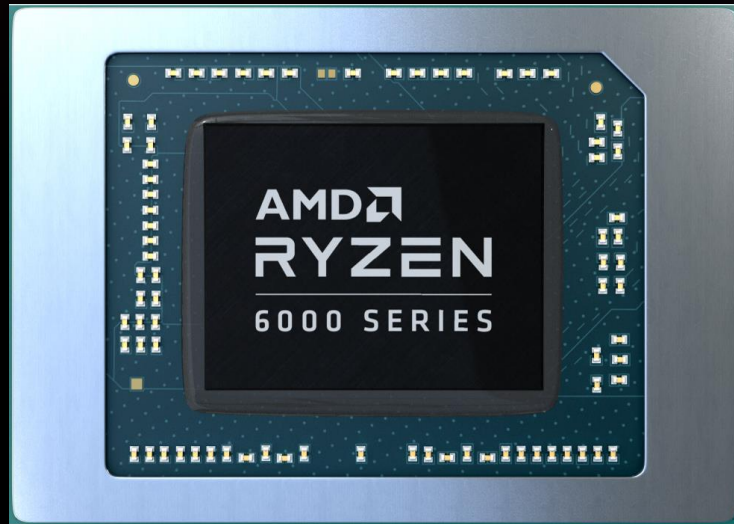
Improved Clock and Power Gating

Clock gating now applicable to all IP. PHY clock and power gating improved as well

New SoC-wide Power Architecture



Platform Optimization



Ryzen 6000 Series has the Newest Platform Connectivity Support for Efficient Operation and Best User Experience

High Speed USB-C Connectivity
USB4®

Wireless
Wifi 6e with DBS

Bluetooth
5.2 with LE Audio

PCI Express®
GEN 4

System Memory
LPDDR5/DDR5

Display
**AMD Freesync™ Technology,
DisplayPort 2.0, HDMI2.1**

Audio & Teleconference
**Realtime Active Noise
Suppression**

Efficient Platform

Display System Optimizations



New Panel Self Refresh State

Enables the SOC to progressively shut down the display controller for additional power savings with PSR/PSR-SU

SVI3 Regulator

Very Fast, more granular platform voltage supply control

< 1W Panel Support

Supports continued reduction of platform power through more efficient display technologies

DSC & FEC over External Displayport

Display Screen Compression, and Forward error correction. Reduces the number of eDP lanes required for a panel-side power savings

Freesync™ PSR-SU

Panel Self Refresh – Selective Update – does not update static portions of the screen that aren't changing

PSR-SU Rate Control

Reduces refresh rate during fullscreen video playback

Display Buffering

Size the buffer appropriately to have longer idle durations

Varibright for OLED


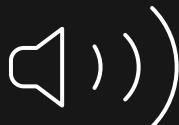


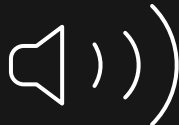

Adjusts content color parameters to save power on OLED embedded panels

Active Audio Noise Suppression

For the First Time on an x86 Processor Die

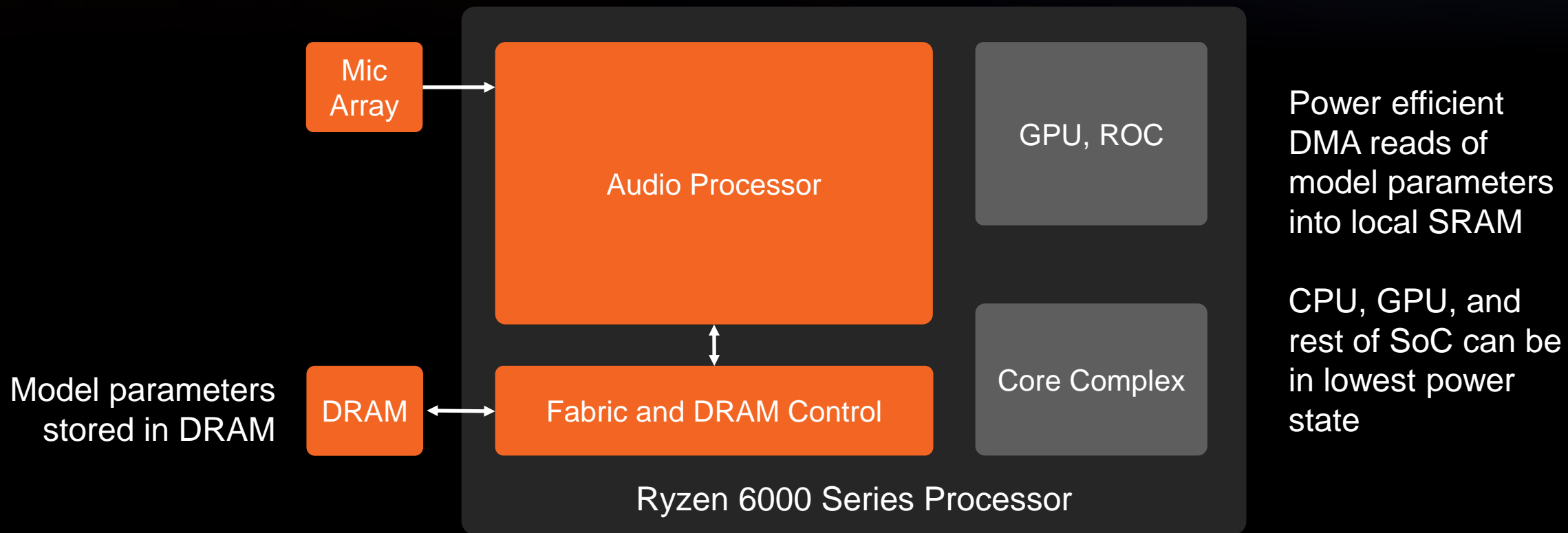
- Built-in Artificial Intelligence/Neural network noise suppression hardware
- Dramatically reduces unwanted background noise during audio/video calls
- On-SoC means an efficiency advantage over competing solutions
- Available only on OEM-enabled systems

Audio Noise Suppression

		Original Sound	With Noise Suppression
	Siren		
	Baby Crying & Ringtone		

Power-saving AI-Noise Suppression System Block Diagram

Low-power Audio Processor performs offload of AI-noise suppression and acoustic echo cancellation

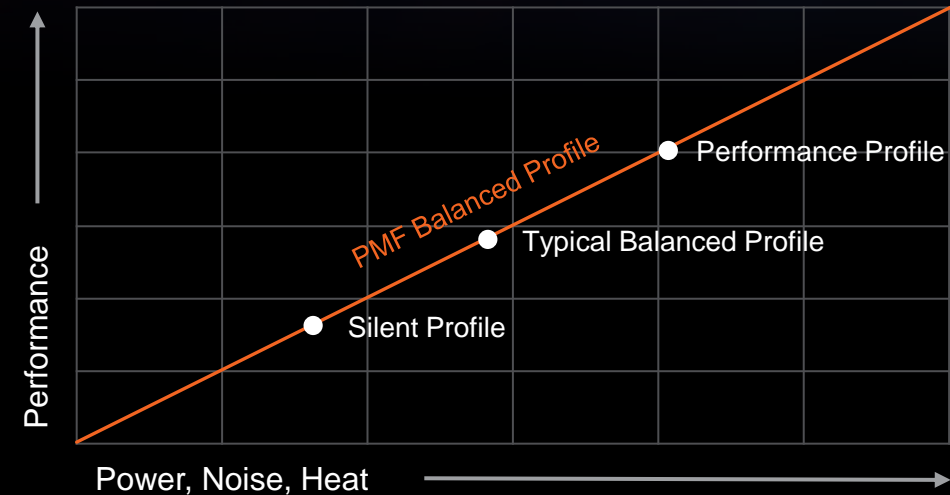


Software

New Power Management Framework (PMF)

A Learning Power Model that Optimizes the User Experience

- **What:** New algorithm implemented through driver and power management firmware
- **How:** New power input and output trackers can customize performance/power/thermals/acoustics (PPTA) relative to every workload
- **Why:** Dynamically enjoy the benefits of Silent Profile acoustics or Performance Profile speed, without manually changing a power plan



Input Capabilities

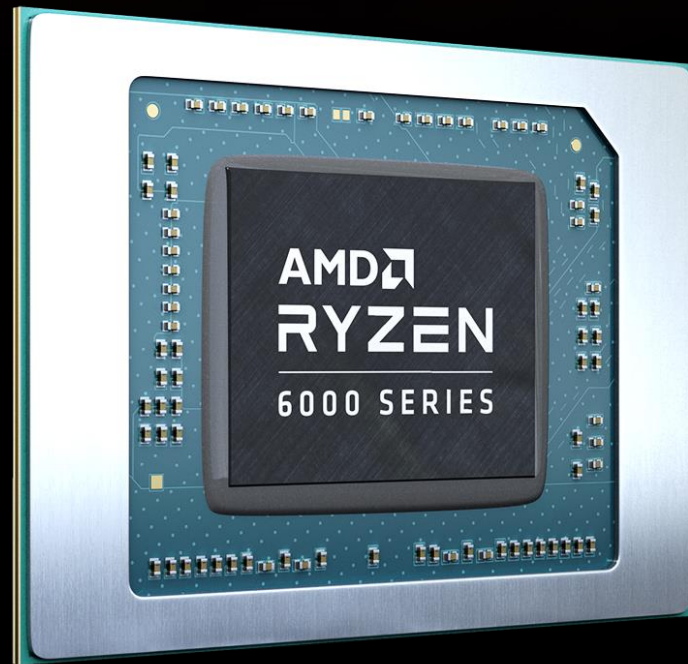
- Skin temperature estimation
- SOC power
- Sensor inputs
- OS inputs
- Application information
- Display information
- Workload policy/type

Output Capabilities

- System Config update – SPL, fPPT, sPPT, STT
- PMFW silent(DC) profile
- Other PMFW parameters like
 - CPU freq
 - Fan policy
 - Display brightness
 - Initiate S0i3/S4
 - Screen lock
 - Smart DC(eco) Control
 - Customized BIOS output

Ryzen™ 6000 Processor Summary

Perfecting Thinner and Lighter



Tech: TSMC N6 | Transistors: 13.1B | Die size: 210mm²



Energy Efficiency

Extract industry-leading perf/W in x86 design with "Zen 3+" core architecture

1080p

RDNA 2 Graphics

Make 1080p gaming more accessible to everyone, even thin and light designs



All-new Platform

Integrate the newest connectivity technologies for user convenience



Up to

29 Hours of Battery Life

Endnotes

RMB-7: Based on testing by AMD as of 12/14/2021. The integrated graphics performance of Ryzen™ 6000 Series processors can get up to 45 FPS average in the majority of 11 tested PC game titles at 1080p resolution with low settings, a threshold no other integrated graphics processor has reached before, including Intel Iris Xe graphics, and Ryzen™ 5000 Series graphics.

RMB-22: Based on testing by AMD as of 12/14/2021. CPU performance evaluated with a geomean of 9 multi-threaded content creation and CPU tests. GPU performance evaluated with 3DMark® Time Spy. Battery life evaluated with hours of continuous local 1080p video playback using the h.264 video codec. System configuration for Ryzen™ 7 5800U CPU/GPU performance: HP ProBook 635 Aero G8 configured with 2x8GB DDR4-3200 (22-22-22), Windows® 11 22000.282, Samsung 980 Pro 1TB SSD, 15W nominal processor TDP, GPU driver 27.20.21026, BIOS T83. System configuration for Ryzen™ 7 6800U CPU/GPU performance: AMD reference motherboard configured with 4x4GB LPDDR5-6400 (40-39-45-90), Windows® 11 22000.282, Samsung 980 Pro 1TB SSD, 15W nominal processor TDP, GPU driver 30.0, BIOS TRM0081D. System configuration for battery life duration: AMD reference motherboard(s), Ryzen™ 7 5800U @ 15W and 2x8GB LPDDR4, Ryzen™ 7 6800U @ 15W and 2x8GB LPDDR5, 1080p eDP PSR display with Varibright at 150 nits, Samsung 980 Pro 1TB SSD, WLAN enabled and disconnected, Windows 11 22000.282, BIOS 103BRC1 (5800U) and 090RC6INT (6800U). Video file: 1920x1080, 23.976 FPS, h.264.

RMB-23: Based on testing by AMD as of 12/14/2021. CPU performance evaluated with a geomean of 9 multi-threaded content creation and CPU tests. GPU performance evaluated with 3DMark® Time Spy. Battery life evaluated with hours of continuous 1080p local video playback using the h.264 video codec. System configuration for Ryzen™ 7 5800U CPU/GPU performance: HP ProBook 635 Aero G8 configured with 2x8GB DDR4-3200 (22-22-22), Windows® 11 22000.282, Samsung 980 Pro 1TB SSD, 15W nominal processor TDP, GPU driver 27.20.21026, BIOS T83. System configuration for Ryzen™ 7 6800U CPU/GPU performance: AMD reference motherboard configured with 4x4GB LPDDR5-6400 (40-39-45-90), Windows® 11 22000.282, Samsung 980 Pro 1TB SSD, 28W nominal processor TDP, GPU driver 30.0, BIOS TRM0081D. System configuration for battery life duration: AMD reference motherboard(s), Ryzen™ 7 5800U @ 15W and 2x8GB LPDDR4, Ryzen™ 7 6800U @ 28W and 2x8GB LPDDR5, 1080p eDP PSR display with Varibright at 150 nits, Samsung 980 Pro 1TB SSD, WLAN enabled and disconnected, Windows 11 22000.282, BIOS 103BRC1 (5800U) and 090RC6INT (6800U). Video file: 1920x1080, 23.976 FPS, h.264.

RMB-45: Based on testing by AMD and notebookcheck.com as of 02/07/2022 using the Cinebench nT benchmark / Sustained power limit for each system. Configuration for Ryzen™ 9 6900HS system: ASUS G14 configured with 2x8GB DDR5-4800, Windows 11 22000.282, 1TB SSD, Radeon 6800S graphics, sustained processor power limit of 35W. Data for Core i9-12900HK provided by notebookcheck.com: <https://www.notebookcheck.net/Intel-Core-i9-12900HK-Processor-Benchmarks-and-Specs.589165.0.html>. Configuration for Core i9-12900HK: MSI GE76 Raider configured with 2x16GB DDR5-4800, Windows 11, 2x1GB SSD, GeForce GTX 3080 Ti, sustained processor power limit of 110W. Results may vary.

Endnotes

RMP-39: Based on testing by AMD Labs as of 4/11/22. Battery life evaluated in hours of continuous 1080p local video playback with a HP Elitebook 865 G9 configured with an AMD Ryzen 7 PRO 6850U processor with Radeon 680M graphics, 76 WHr battery, 150 nit screen brightness, 256GB HDD, 8GB memory, Win 10 Pro, video resolution of 1920 x 1200 x 60 Hz and the power slider set to “better battery.” Actual battery life will vary based on several factors, including, but not limited to: product configuration and usage, software, operating conditions, wireless functionality, power management settings, screen brightness and other factors. The maximum capacity of the battery will naturally decrease with time and use.

GD-127: AMD FreeSync™ technology requires AMD Radeon™ graphics and a display that supports FreeSync technology as certified by AMD. AMD FreeSync™ Premium technology adds requirements of mandatory low framerate compensation and at least 120 Hz refresh rate at minimum FHD. AMD FreeSync™ Premium Pro technology adds requirements for the display to meet AMD FreeSync Premium Pro compliance tests. See www.amd.com/freesync for complete details. Confirm capability with your system manufacturer before purchase.

GD-149: Wi-Fi™ 6 and Bluetooth® 5.0 availability varies by laptop manufacturer and are system configuration dependent. Check with your laptop manufacturer for compatibility information.

GD-151: Boost Clock Frequency is the maximum frequency achievable on the GPU running a bursty workload. Boost clock achievability, frequency, and sustainability will vary based on several factors, including but not limited to: thermal conditions and variation in applications and workloads.

GD-201: AI-powered noise cancellation and USB4® require OEM enablement. Please check with your PC manufacturer prior to purchase.

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Thank You

to the global AMD teams
that made the Ryzen 6000 Processor possible

AMD 

together we advance_

