



Apple at Work

M1, M1 Pro and M1 Max

Seriously powerful silicon.

Apple's first chips designed specifically for Mac deliver incredible performance, custom technologies and industry-leading power efficiency. And they were designed from the very start to work with macOS, the most advanced desktop operating system in the world. With a giant leap in performance per watt, every Mac with Apple silicon is transformed into a completely different class of product.

M1: Apple's first chip designed specifically for the Mac

M1 is optimized for Mac systems in which small size and power efficiency are critically important. As a system on a chip (SoC), M1 combines numerous powerful technologies into a single chip and features a unified memory architecture for dramatically improved performance and efficiency.

M1 is the first personal computer chip built using cutting-edge 5-nanometre process technology, and is packed with an astounding 16 billion transistors—the most Apple has ever put into a chip. It features the world's fastest CPU core in low-power silicon, the world's best CPU performance per watt, the world's fastest integrated graphics in a personal computer and breakthrough machine learning performance with the Apple Neural Engine.

As a result, M1 delivers up to 3.5x faster CPU performance, up to 6x faster GPU performance and up to 15x faster machine learning, all while enabling battery life up to 2x longer than previous-generation Macs. With its profound increase in performance and efficiency, M1 delivers the biggest leap ever for the Mac.¹

Breakthrough Performance for Key Business Apps

When compared with the latest model of the best-selling PC notebook purchased by businesses in its price range, MacBook Air with M1 offers up to 2x faster Excel performance, up to 50% faster web application responsiveness, up to 2x faster browser graphics performance and up to 2x longer battery life when video conferencing with Zoom on a single charge.²

M1 Pro: A Whole New Level of Performance and Capability

Utilizing the industry-leading 5-nanometre process technology, M1 Pro packs in 33.7 billion transistors, more than 2x the amount in M1. A new 10-core CPU, including eight high-performance cores and two high-efficiency cores, is up to 70 percent faster than M1, resulting in unbelievable pro CPU performance. Compared with the latest 8-core PC laptop chip, M1 Pro delivers up to 1.7x more CPU performance at the same power level and achieves the PC chip's peak performance using up to 70 percent less power.³ Even the most demanding tasks, like high-resolution photo editing, are handled with ease by M1 Pro.

M1 Pro has an up-to-16-core GPU that is up to 2x faster than M1 and up to 7x faster than the integrated graphics on the latest 8-core PC laptop chip.³ Compared to a powerful discrete GPU for PC notebooks, M1 Pro delivers more performance while using up to 70 percent less power.⁴ And M1 Pro can be configured with up to 32GB of fast unified memory, with up to 200GB/s of memory bandwidth, enabling creatives like 3D artists and game developers to do more on the go than ever before.

M1 Max: The World's Most Powerful Chip for a Pro Notebook

M1 Max features the same powerful 10-core CPU as M1 Pro and adds a massive 32-core GPU for up to 4x faster graphics performance than M1. With 57 billion transistors — 70 percent more than M1 Pro and 3.5x more than M1 — M1 Max is the largest chip Apple has ever built. In addition, the GPU delivers performance comparable to a high-end GPU in a compact pro PC laptop while consuming up to 40 percent less power, and performance similar to that of the highest-end GPU in the largest PC laptops while using up to 100 watts less power.⁴ This means less heat is generated, fans run quietly and less often, and battery life is amazing in the new MacBook Pro. M1 Max transforms graphics-intensive workflows, including up to 13x faster complex timeline rendering in Final Cut Pro compared to the previous-generation 13-inch MacBook Pro.

M1 Max also offers a higher-bandwidth on-chip fabric, and doubles the memory interface compared with M1 Pro for up to 400GB/s, or nearly 6x the memory bandwidth of M1. This allows M1 Max to be configured with up to 64GB of fast unified memory. With its unparalleled performance, M1 Max is the most powerful chip ever built for a pro notebook.

Fast, Efficient Media Engine, Now with ProRes

M1 Pro and M1 Max include an Apple-designed media engine that accelerates video processing while maximizing battery life. M1 Pro also includes dedicated acceleration for the ProRes professional video codec, allowing playback of multiple streams of high-quality 4K and 8K ProRes video while using very little power. M1 Max goes even further, delivering up to 2x faster video encoding than M1 Pro, and features two ProRes accelerators. With M1 Max, the new MacBook Pro can transcode ProRes video in Compressor up to a remarkable 10x faster compared with the previous-generation 16-inch MacBook Pro.

macOS and Apps Unleash the Capabilities of Apple Silicon

macOS Monterey is engineered to unleash the power of M1, M1 Pro and M1 Max, delivering breakthrough performance, phenomenal pro capabilities and incredible battery life. By designing Monterey for Apple silicon, the Mac wakes instantly from sleep, and the entire system is fast and incredibly responsive. Developer technologies like Metal let apps take full advantage of the new chips, and optimizations in Core ML utilize the powerful Neural Engine so machine learning models can run even faster. Pro app workload data is used to help optimize how macOS assigns multi-threaded tasks to the CPU cores for maximum performance, and advanced power management features intelligently allocate tasks between the performance and efficiency cores for both incredible speed and battery life.

Find out more about Apple silicon.

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A Huge Step in the Transition to Apple Silicon

The Mac is now one year into its two-year transition to Apple silicon, and M1 Pro and M1 Max represent another huge step forward. These are the most powerful and capable chips Apple has ever created, and together with M1 they form a family of chips that lead the industry in performance, custom technologies and power efficiency.

1. "World's fastest CPU core in low-power silicon": Testing conducted by Apple in October 2020 using preproduction 13-inch MacBook Pro systems with Apple M1 chip and 16GB of RAM measuring peak single thread performance of workloads taken from select industry standard benchmarks, commercial applications and open source applications. Comparison made against the highest-performing CPUs for notebooks, commercially available at the time of testing. Performance tests are conducted using specific computer systems and reflect the approximate performance of MacBook Pro. "World's best CPU performance per watt": Testing conducted by Apple in October 2020 using preproduction 13-inch MacBook Pro systems with Apple M1 chip and 16GB of RAM. Performance per watt refers to the ratio of peak CPU performance to average power consumed using select industry standard benchmarks. Comparison made against high-performing CPUs for notebooks and desktops, commercially available at the time of testing. Performance tests are conducted using specific computer systems and reflect the approximate performance of MacBook Pro. "World's fastest integrated graphics in a personal computer": Testing conducted by Apple in October 2020 using preproduction 13-inch MacBook Pro systems with Apple M1 chip and 16GB of RAM using select industry standard benchmarks. Comparison made against the highest-performing integrated GPUs for notebooks and desktops, commercially available at the time of testing. Integrated GPU is defined as a GPU located on a monolithic silicon die along with a CPU and memory controller, behind a unified memory subsystem. Performance tests are conducted using specific computer systems and reflect the approximate performance of MacBook Pro.

2. "Breakthrough Performance for Key Business Apps": Testing conducted by Apple in May 2021 using production MacBook Air systems with Apple M1 chip, 7-core GPU and macOS Big Sur, as well as production Intel Core i5-based PC systems with Intel Iris Xe Graphics and the latest version of Windows 10 available at the time of testing. Best-selling system based on commercial sales data from indirect B2B resellers in the United States for PC laptops in the same price range from January 2020 to April 2021. Productivity application performance tested using Microsoft Excel for Mac Version 16.48, and Microsoft Excel for Windows Version 2103. Web browsing performance tested using Speedometer 2.0 and prerelease MotionMark 1.2 performance benchmarks tested with Safari 14.1 on macOS Big Sur, and Chrome v.89.0.4389.90 on Windows 10, with WPA2 Wi-Fi network connection. Battery life performance tested using Zoom Version 5.6.1, with equivalent display brightness settings for all units, and microphone and camera enabled. All claims depend on usage, settings, network configuration and many other factors; actual results will vary. Performance tests are conducted using specific computer systems and reflect the approximate performance of MacBook Air and selected PC model.

3. Testing conducted by Apple in August and September 2021 using preproduction 16-inch MacBook Pro systems with Apple M1 Max, 10-core CPU, 32-core GPU and 64GB of RAM, and preproduction 16-inch MacBook Pro systems with Apple M1 Pro, 10-core CPU, 16-core GPU and 32GB of RAM. Performance measured using select industry-standard benchmarks. 8-core PC laptop chip performance data from testing MSI GP66 Leopard (11UG-018). Performance tests are conducted using specific computer systems and reflect the approximate performance of MacBook Pro.

4. Testing conducted by Apple in August and September 2021 using preproduction 16-inch MacBook Pro systems with Apple M1 Max, 10-core CPU, 32-core GPU and 64GB of RAM, and preproduction 16-inch MacBook Pro systems with Apple M1 Pro, 10-core CPU, 16-core GPU and 32GB of RAM. Performance measured using select industry-standard benchmarks. Discrete PC laptop graphics performance data from testing Lenovo Legion 5 (82JW0012US). High-end discrete PC laptop graphics performance data from testing MSI GE76 Raider (11UH-053). PC compact pro laptop performance data from testing Razer Blade 15 Advanced (RZ09-0409CE53-R3U1). Performance tests are conducted using specific computer systems and reflect the approximate performance of MacBook Pro.

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