MacBook Pro (16-inch, 2023) - Technical Specifications



Finish

- Silver
- Space Gray

Chip
Apple M2 Pro chip

- 12-core CPU with 8 performance cores and 4 efficiency cores
- 19-core GPU
- 16-core Neural Engine
- 200GB/s memory bandwidth
- Media engine
  - Hardware-accelerated H.264, HEVC, ProRes, and ProRes RAW
  - Video decode engine
  - Video encode engine
  - ProRes encode and decode engine
- Configurable to:
  - M2 Max with 12-core CPU and 30-core GPU or M2 Max with 12-core CPU and 38-core GPU

Apple M2 Max chip

- 12-core CPU with 8 performance cores and 4 efficiency cores
- 38-core GPU
- 16-core Neural Engine
- 400GB/s memory bandwidth
- Media engine
  - Hardware-accelerated H.264, HEVC, ProRes and ProRes RAW
  - Video decode engine
  - Two Video encode engines
  - Two ProRes encode and decode engines

Display
Liquid Retina XDR display

- 16.2-inch (diagonal) Liquid Retina XDR display;[1] 3456-by-2234 native resolution at 254 pixels per inch

XDR (Extreme Dynamic Range)

- 1,000,000:1 contrast ratio
- XDR brightness: 1000 nits sustained full-screen, 1600 nits peak[2] (HDR content only)
- SDR brightness: 500 nits

Color

- 1 billion colors
- Wide color (P3)
- True Tone technology

Refresh rates

- ProMotion technology for adaptive refresh rates up to 120Hz
- Fixed refresh rates: 47.95Hz, 48.00Hz, 50.00Hz, 59.94Hz, 60.00Hz

Memory
Apple M2 Pro chip

- 16GB unified memory
  Configurable to: 32GB (M2 Pro or M2 Max), 64GB (M2 Max), or 96GB (M2 Max with 38-core GPU)

Apple M2 Max chip

- 32GB unified memory
  Configurable to: 64GB (M2 Max) or 96GB (M2 Max with 38-core GPU)

Battery and Power[3]

- Up to 22 hours Apple TV app movie playback
- Up to 15 hours wireless web
- 100-watt-hour lithium-polymer battery[3]
- 140W USB-C Power Adapter
- USB-C to MagSafe 3 Cable
- Fast-charge capable with included 140W USB-C Power Adapter

Storage[4]
Apple M2 Pro chip

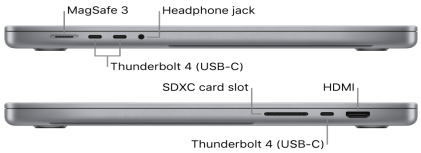
- 512GB SSD
  Configurable to: 1TB, 2TB, 4TB, or 8TB

Apple M2 Max chip

- 1TB SSD
  Configurable to: 2TB, 4TB, or 8TB

Charging and Expansion

- SDXC card slot
- HDMI port
- 3.5 mm headphone jack
- MagSafe 3 port
- Three Thunderbolt 4 (USB-C) ports with support for:
  - Charging
  - DisplayPort
  - Thunderbolt 4 (up to 40Gb/s)
  - USB 4 (up to 40Gb/s)



Display Support
M2 Pro

Simultaneously supports full native resolution on the built-in display at 1 billion colors and:

- Up to two external displays with up to 6K resolution at 60Hz over Thunderbolt, or one external display with up to 6K resolution at 60Hz over Thunderbolt and one external display with up to 4K resolution at 144Hz over HDMI
- One external display supported at 8K resolution at 60Hz or one external display at 4K resolution at 240Hz over HDMI

M2 Max

Simultaneously supports full native resolution on the built-in display at 1 billion colors and:

- Up to four external displays: Up to three external displays with 6K resolution at 60Hz over Thunderbolt and one external display with up to 4K resolution at 144Hz over HDMI
- Up to three external displays: Up to two external displays with 6K resolution at 60Hz over Thunderbolt and one external display with up to 8K resolution at 60Hz or one external display with 4K resolution at 240Hz over HDMI

Thunderbolt 4 digital video output

- Support for native DisplayPort output over USB-C

HDMI digital video output

- Support for one display with up to 8K resolution at 60Hz or 4K resolution at 240Hz

Video Playback

- Supported formats include HEVC, H.264, and ProRes
- HDR with Dolby Vision, HDR10, and HLG

Audio Playback

- Supported formats include AAC, MP3, Apple Lossless, FLAC, Dolby Digital, Dolby Digital Plus, and Dolby Atmos

Keyboard and Trackpad
Backlit Magic Keyboard with:

- 78 (U.S.) or 79 (ISO) keys including 12 full-height function keys and 4 arrow keys in an inverted-T arrangement
- Touch ID
- Ambient light sensor
- Force Touch trackpad for precise cursor control and pressure-sensing capabilities; enables Force clicks, accelerators, pressure-sensitive drawing, and Multi-Touch gestures

Wireless
Wi-Fi

- Wi-Fi 6E (802.11ax)[5]

Bluetooth

- Bluetooth 5.3

Camera

- 1080p FaceTime HD camera
- Advanced image signal processor with computational video

Audio

- High-fidelity six-speaker sound system with force-cancelling woofers
- Wide stereo sound
- Support for Spatial Audio when playing music or video with Dolby Atmos on built-in speakers
- Spatial Audio with dynamic head tracking when using AirPods (3rd generation), AirPods Pro, and AirPods Max
- Studio-quality three-mic array with high signal-to-noise ratio and directional beamforming
- 3.5 mm headphone jack with advanced support for high-impedance headphones
- HDMI port supports multichannel audio output

Operating Requirements

- Line voltage: 100V to 240V AC
- Frequency: 50Hz to 60Hz
- Operating temperature: 50° to 95° F (10° to 35° C)
- Storage temperature: -13° to 113° F (-25° to 45° C)
- Relative humidity: 0% to 90% noncondensing
- Operating altitude: tested up to 10,000 feet
- Maximum storage altitude: 15,000 feet
- Maximum shipping altitude: 35,000 feet

Size and Weight

- Height: 0.66 inch (1.68 cm)
- Width: 14.01 inches (35.57 cm)
- Depth: 9.77 inches (24.81 cm)
- Weight (M2 Pro): 4.7 pounds (2.15 kg)[6]
- Weight (M2 Max): 4.8 pounds (2.16 kg)[6]

Operating System
macOS
macOS is the most advanced desktop operating system in the world. And with macOS Sonoma, work and play on your Mac are even more powerful — with new ways to elevate your video presentations, boost your gaming performance, and personalize your device.
Learn more about latest operating system
macOS User Guide

Accessibility
Accessibility features help people with disabilities get the most out of their new MacBook Pro. With built-in support for vision, hearing, mobility, and learning, you can create and do amazing things.
Learn more about Accessibility

Features include:

- Voice Control
- VoiceOver
- Zoom
- Increase Contrast
- Reduce Motion
- Siri and Dictation
- Switch Control
- Closed Captions

- Text to Speech

Built-in Apps[7]

- App Store
- Books
- Calendar
- Contacts
- FaceTime
- Find My
- Freeform
- GarageBand
- Home
- iMovie
- Keynote
- Mail
- Maps
- Messages
- Music
- News
- Notes
- Numbers
- Pages
- Photo Booth
- Photos
- Podcasts
- Preview
- QuickTime Player
- Reminders
- Safari
- Shortcuts
- Siri
- Stocks
- Time Machine
- TV
- Voice Memos

In the Box

- 16-inch MacBook Pro
- 140W USB-C Power Adapter
- USB-C to MagSafe 3 Cable (2 m)

Configure to Order

- Configure your MacBook Pro with these options at apple.com:
  - M2 Max with 12-core CPU, 30-core GPU, and 16-core Neural Engine
  - M2 Max with 12-core CPU, 38-core GPU, and 16-core Neural Engine
  - 32GB unified memory (M2 Pro and M2 Max)
  - 64GB unified memory (M2 Max)
  - 96GB unified memory (M2 Max with 38-core GPU)
  - 1TB, 2TB, 4TB, or 8TB SSD

MacBook Pro and the Environment
The 16-inch MacBook Pro is designed with the following features to reduce its environmental impact:[8]
See the 16-inch MacBook Pro Product Environmental Report

Made with better materials

- Over 35% recycled content in the entire product,[9] including:
  - 100% recycled aluminum in the enclosure
  - 100% recycled rare earth elements in all magnets
  - 100% recycled tin in the solder of multiple printed circuit boards
  - 100% recycled gold in the plating of multiple printed circuit boards
  - 35% or more recycled plastic in multiple components

Energy efficient

- ENERGY STAR® certified[10]

Smarter chemistry[11]

- Arsenic-free display glass
- Mercury-, BFR-, PVC-, and beryllium-free

Green manufacturing

- Apple's Zero Waste Program helps suppliers eliminate waste sent to landfill
- All final assembly supplier sites are transitioning to 100% renewable energy for Apple production

Responsible packaging

- 100% of virgin wood fiber comes from responsibly managed forests
- 97% fiber-based packaging and no outer plastic wrap[12]

Apple and the Environment
We're committed to making our products without taking from the earth, and to become carbon neutral across our entire business, including products, by 2030.
See Apple's commitment

Acoustic Performance
Declared noise emission values in accordance with ECMA-109

	Sound Power Level $L_{WA,m}$ **(B)**	**Sound Pressure Level Operator Position** $L_{pA,m}$ **(dB)**
Idle	1.3 (K_V = 0.3)	4
Wireless web	1.3 (K_V = 0.3)	4

1. $L_{WA,m}$ is the mean A-weighted sound power level, rounded to the nearest 0.1 B.
2. $L_{pA,m}$ is the mean A-weighted sound pressure level measured at operator position (rounded to the nearest 1 dB).
3. 1 B (bel) = 10 dB (decibel).
4. K_V is the statistical adder for computing upper-limit of A-weighted sound power level.
5. The quantity, $L_{WA,c}$ (formerly called L_{WAd}) may be computed from the sum of $L_{WA,m}$ and K_V.
6. The wireless web test browses 6 tabs with a mix of content including media.
7. Configuration tested: Apple M2 Max chip, 12-core CPU / 38-core GPU, 32GB unified memory, 1TB storage.

1. The displays on the 14-inch and 16-inch MacBook Pro have rounded corners at the top. When measured as a standard rectangular shape, the screens are 14.2 inches and 16.2 inches diagonally (actual viewable area is less).
2. In temperatures less than 25° C.
3. Actual rating of 69.6 watt-hours (14-inch model) or 99.6 watt-hours (16-inch model). Testing conducted by Apple in November and December 2022 using preproduction 14-inch MacBook Pro systems with Apple M2 Pro, 12-core CPU, 19-core GPU, 16GB of RAM, and 1TB SSD; and preproduction 16-inch MacBook Pro systems with Apple M2 Pro, 12-core CPU, 19-core GPU, 16GB of RAM, and 1TB SSD. The wireless web test measures battery life by wirelessly browsing 25 popular websites with display brightness set to 8 clicks from bottom. The Apple TV app movie playback test measures battery life by playing back HD 1080p content with display brightness set to 8 clicks from bottom. Battery life varies by use and configuration. See apple.com/batteries for more information.
4. 1GB = 1 billion bytes and 1TB = 1 trillion bytes; actual formatted capacity less.
5. Wi-Fi 6E connectivity available in countries where supported.
6. Weight varies by configuration and manufacturing process.
7. iMovie, GarageBand, Pages, Numbers, and Keynote are available on the Mac App Store. Downloading apps requires an Apple ID and a device that is compatible with the OS version required for each app.
8. Data accurate as of product launch.
9. Product recycled content is the mass of certified recycled material relative to the overall mass of the device, not including packaging or in-box accessories.
10. ENERGY STAR and the ENERGY STAR mark are registered trademarks owned by the U.S. Environmental Protection Agency.
11. Apple's Regulated Substances Specification describes Apple's restrictions on the use of certain chemical substances in materials in Apple products, accessories, manufacturing processes, and packaging used for shipping products to Apple's end-customers. Restrictions are derived from international laws or directives, regulatory agencies, eco-label requirements, environmental standards, and Apple policies. Every Apple product is free of PVC and phthalates except for AC power cords in India, Thailand (for two-prong AC power cords), and South Korea, where we continue to seek government approval for our PVC and phthalates replacement. Apple products comply with the European Union Directive 2011/65/EU and its amendments, including exemptions for the use of lead such as high-temperature solder. Apple is working to phase out the use of these exempted substances for new products where technically possible.
12. Based on retail packaging as sold by Apple. Fiber content is based on a breakdown of U.S. retail packaging by weight. Adhesives, inks and coatings are excluded from our calculations of plastic content and packaging weight.

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