Maintenance and Service Guide

SUMMARY

This guide provides information about spare parts, removal and replacement of parts, security, backing up, and more.

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Product notice

This guide describes features that are common to most models. Some features may not be available on your computer.

Not all features are available in all editions or versions of Windows. Systems may require upgraded and/or separately purchased hardware, drivers, software or BIOS update to take full advantage of Windows functionality. Windows 10 is automatically updated, which is always enabled. ISP fees may apply and additional requirements may apply over time for updates. Go to http://www.microsoft.com for details.

To access the latest user guides, go to http://www.hp.com/support, and follow the instructions to find your product. Then select **Manuals**.

Software terms

By installing, copying, downloading, or otherwise using any software product preinstalled on this computer, you agree to be bound by the terms of the HP End User License Agreement (EULA). If you do not accept these license terms, your sole remedy is to return the entire unused product (hardware and software) within 14 days for a full refund subject to the refund policy of your seller.

For any further information or to request a full refund of the price of the computer, please contact your seller.

Safety warning notice

Reduce the possibility of heat-related injuries or of overheating the computer by following the practices described.

⚠ **WARNING!** To reduce the possibility of heat-related injuries or of overheating the computer, do not place the computer directly on your lap or obstruct the computer air vents. Use the computer only on a hard, flat surface. Do not allow another hard surface, such as an adjoining optional printer, or a soft surface, such as pillows or rugs or clothing, to block airflow. Also, do not allow the AC adapter to come into contact with the skin or a soft surface, such as pillows or rugs or clothing, during operation. The computer and the AC adapter comply with the user-accessible surface temperature limits defined by applicable safety standards.

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1 Product description

This table provides detailed product information.

Table 1-1 Product components and their descriptions

Category	Description
Product Name	**HP Pavilion 15 Laptop PC**
	Model numbers: 15-cw1000 - 15-cw1999
	CTO model number: 15z-cw100
Processors	**AMD® processors**
	AMD Ryzen™ 7 4700U (2.0 GHz [turbo up to 4.1 GHz], 8 cores, 3200 MHz/8 MB L3 cache, 25 W)
	AMD Ryzen 5 4500U (2.375 GHz [turbo up to 4.0 GHz], 6 cores, 3200 MHz/8 MB L3 cache, 25 W)
	AMD Ryzen 3 4300U (2.7 GHz [turbo up to 3.7 GHz], 4 cores, 3200 MHz/4 MB L3 cache, 15 W)
	AMD Athlon™ Gold 3150U (2.4 GHz [turbo up to 3.3 GHz], 2 cores, 2400 MHz/4 MB L3 cache, 15 W)
Graphics	**Internal graphics**
	AMD Radeon™ Graphics
	Supports HD Decode, DX12, and HDMI
	Supports FreeSync (internal and external)
Display	**15.6 in (39.6 cm), WLED, narrow bezel**
	High-definition (HD) (1366 × 768), BrightView, SVA 45, eDP 1.2 without PSR, ultraslim, 250 nits
	HD, BrightView, SVA 45, eDP 1.2 without PSR, 250 nits, flat, Touch-on Panel (TOP)
	Full high-definition (FHD) (1920 × 1080), antiglare, UWVA, SVA 45, eDP 1.2 without PSR, slim, 220 nits
	FHD, antiglare, SVA 45, eDP 1.2 without PSR, ultraslim, 250 nits
	FHD, antiglare, UWVA 45, eDP 1.2 without PSR, slim, 250 nits
	FHD, BrightView, UWVA 45, eDP, slim, 220 nits
	FHD, BrightView, UWVA 45, eDP 1.2 without PSR, slim, 250 nits
	FHD, BrightView, UWVA 45, slim, 250 nits, Touch-on Panel (TOP)
Memory	Two SODIMM slots, not customer accessible or upgradeable supporting up to 16 GB of RAM
	DDR4-3200 dual-channel support
	DDR4-2400 dual-channel support (DDR4-3200 bridge to DDR4-2666, DDR4-2666 downgrade to DDR-2400)
	Supports the following configurations:
	• 16 GB (8 × 2)
	• 12 GB (8 + 4)
	• 8 GB (8 × 1) or (4 × 2)

Table 1-1 Product components and their descriptions (continued)

Category	Description
	• 4 GB (4 × 1)
Primary storage	**PCIe, NVMe, M.2 2280 solid-state drives**
	1 TB, PCIe
	512 GB, PCIe
	256 GB, PCIe
	128 GB, SATA-3, TLC
Audio and video	**Audio control panel:** B&O Audio Control
	Dual speakers
	Support for HP Audio Boost
	Supports Alexa
	Supports Far Field Cortana
	HP Wide Vision HD Camera: indicator LED, USB 2.0, HD BSI sensor, f2.0, WDR, 88° WFOV
	720p by 30 frames per second
	Dual-array digital microphone with appropriate software: beam forming, echo cancellation, noise suppression
Wireless	Compatible with Miracast® devices
	Turbo Lite WLAN SVTP
	Integrated wireless options with dual antennas (M.2/PCIe)
	Realtek RTL8822CE 802.11ac 2 × 2 Wi-Fi + Bluetooth® 5 (MU-MIMO supported)
	Intel Wi-Fi 6 AX200 + Bluetooth 5 (non-vPro™) (802.11ax 2 × 2, MU-MIMO, supporting gigabit file transfer speeds)
	Integrated wireless options with single antenna (M.2/PCIe)
	Realtek RTL8821CE 802.11ac 1 × 1 Wi-Fi + Bluetooth 4.2 (MU-MIMO supported)
Media card reader	Supports microSD™, SDHC™, SDXC™
	Push-push insertion/removal
Ports	Hot plug/unplug and autodetect for correct output to wide-aspect vs. standard aspect video
	HDMI v2.0 supporting: up to 4096 × 2160 @ 60 Hz
	Audio-out (headphone)/audio-in (microphone) combo jack
	USB 3.2 Gen 1 Type-C (supports data transfer, power delivery, HP Sleep & Charge; left side)
	USB 3.2 Gen 1 Type-A (2)
	AC Smart Pin adapter plug
Keyboard/pointing devices	**Keyboard**
	Full size with numeric keypad
	Backlit, island style with numeric keypad

Table 1-1 Product components and their descriptions (continued)

Category	Description
	Touchpad
	Clickpad with image sensor
	Multitouch gestures enabled
	Precision touchpad support
	Support for modern trackpad gestures
	Taps enabled as default
Power requirements	**Battery**
	3 cell, 41 Whr, polymer, HP Long Life
	HP Fast Charge Technology
	Smart AC adapters (barrel type, 4.5 mm)
	65 W
	65 W, EM
	45 W
	Power cord
	C5, 1 m
Security	Supports Trusted Platform Module (TPM) 2.0, firmware based
	Kensington Nano Security Lock
	Integrated fingerprint reader
Operating system	Windows® 10 Home 64
	Windows 10 Home 64 Chinese Market CPPP
	Windows 10 Home 64 High-end Chinese Market CPPP
	Windows 10 Home 64 Plus
	Windows 10 Home 64 Plus Single Language
	Windows 10 Home 64 Plus Single Language Africa Market
	Windows 10 Home 64 Plus Single Language APAC EM PPP
	Windows 10 Home 64 Plus Single Language India Market
	Windows 10 Home 64 Plus Single Language Indonesia Market
	Windows 10 Home 64 Single Language
	Windows 10 Home 64 Single Language Africa Market
	Windows 10 Home 64 Single Language APAC EM PPP
	Windows 10 Home 64 Single Language India Market
	Windows 10 Home 64 Single Language Indonesia Market
	Windows 10 Home 64 Value Single Language

Table 1-1 Product components and their descriptions (continued)

Category	Description
	Windows 10 Home S 64
	Windows 10 Home S 64 Plus
	Windows 10 Pro 64
	FreeDOS 3.0
Serviceability	**End user replaceable parts**
	AC adapter

2 Getting to know your computer

Your computer features top-rated components. This chapter provides details about your components, where they are located, and how they work.

Right side

Use the illustration and table to identify the components on the right side of the computer.

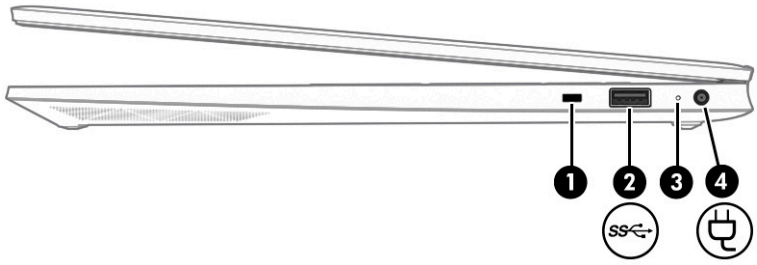


Table 2-1 Right-side components and their descriptions

Component		Description
(1)	Security cable slot	Attaches an optional security cable to the computer. **NOTE:** The security cable is designed to act as a deterrent, but it might not prevent the computer from being mishandled or stolen.
(2)	USB SuperSpeed port	Connects a USB device, provides high-speed data transfer, and (for select products) charges small devices when the computer is on.
(3)	AC adapter and battery light	• White: The AC adapter is connected and the battery is fully charged. • Blinking white: The AC adapter is disconnected and the battery has reached a low battery level. • Amber: The AC adapter is connected and the battery is charging. • Off: The battery is not charging.
(4)	Power connector	Connects an AC adapter.

Left side

Use the illustration and table to identify the components on the left side of the computer.

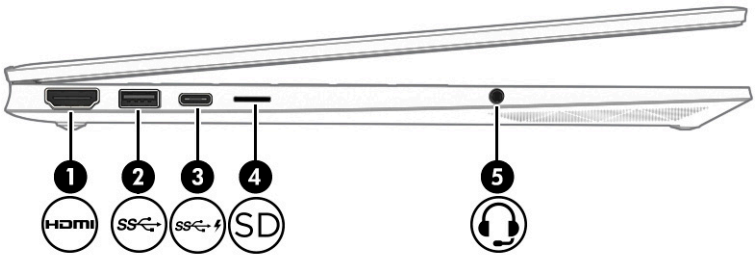


Table 2-2 Left-side components and their descriptions

Component			Description
(1)	HDMI	HDMI port	Connects an optional video or audio device, such as a high-definition television, any compatible digital or audio component, or a high-speed High-Definition Multimedia Interface (HDMI) device.
(2)	SS	USB SuperSpeed port	Connects a USB device, provides high-speed data transfer, and (for select products) charges small devices when the computer is on or in Sleep mode.
(3)	SS	USB Type-C® SuperSpeed port with HP Sleep and Charge	Connects a USB device, provides high-speed data transfer, and charges small devices, even when the computer is off. – and – Connects a display device that has a USB Type-C connector, providing DisplayPort™ output. **NOTE:** Cables, adapters, or both (purchased separately) might be required.
(4)	SD	Memory card reader (select products only)	Reads optional memory cards that enable you to store, manage, share, or access information. To insert a card: 1. Hold the card label-side up, with connectors facing the computer. 2. Insert the card into the memory card reader, and then press in on the card until it is firmly seated. To remove a card: ▲ Press in on the card, and then remove it from the memory card reader.
(5)		Audio-out (headphone)/Audio-in (microphone) combo jack	Connects optional powered stereo speakers, headphones, earbuds, a headset, or a television audio cable. Also connects an optional headset microphone. This jack does not support optional standalone microphones. **WARNING!** To reduce the risk of personal injury, adjust the volume before putting on headphones, earbuds, or a headset. For additional safety information, see the *Regulatory, Safety, and Environmental Notices*. To access this guide: ▲ Type `HP Documentation` in the taskbar search box, and then select **HP Documentation**. **NOTE:** When a device is connected to the jack, the computer speakers are disabled.

Display

The computer display can include essential components such as speakers, antennas, cameras, and microphones.

Low blue light mode (select products only)

Your computer display is shipped from the factory in low blue light mode for improved eye comfort and safety. Also, blue light mode automatically adjusts blue light emissions when you are using the computer at night or for reading.

WARNING! To reduce the risk of serious injury, read the *Safety & Comfort Guide*. It describes proper workstation setup and proper posture, health, and work habits for computer users. The *Safety & Comfort Guide* also provides important electrical and mechanical safety information. The *Safety & Comfort Guide* is available on the web at http://www.hp.com/ergo.

NOTE: Refer to the illustration that most closely matches your computer.

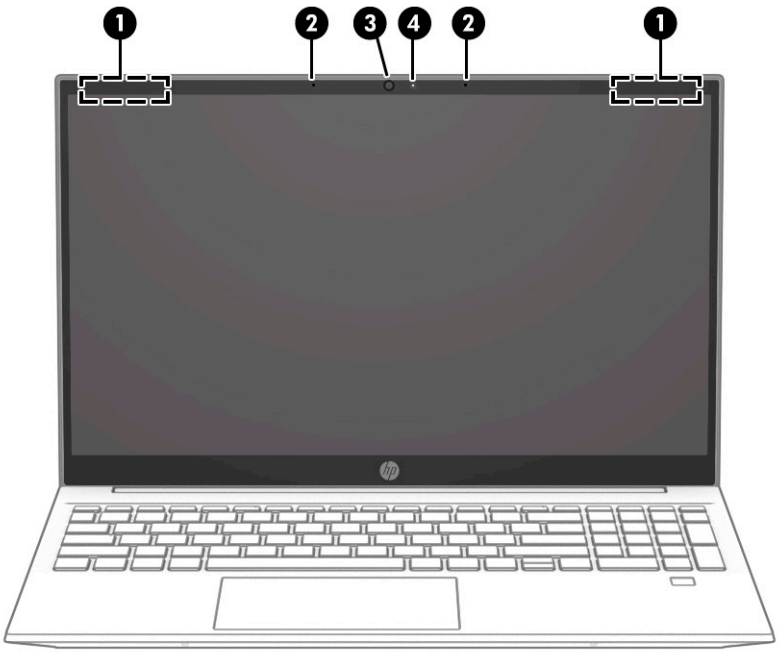


Table 2-3 Display components and their descriptions

Component		Description
(1)	WLAN antennas*	Send and receive wireless signals to communicate with wireless local area networks (WLANs).
(2)	Internal microphones (2)	Record sound.
(3)	Camera	Allows you to video chat, record video, and record still images. Some cameras also allow a facial recognition logon to Windows, instead of a password logon. **NOTE:** Camera functions vary depending on the camera hardware and software installed on your product.
(4)	Camera light	On: The camera is in use.

*The antennas are not visible from the outside of the computer. For optimal transmission, keep the areas immediately around the antennas free from obstructions.

Table 2-3 Display components and their descriptions (continued)

Component	Description
For wireless regulatory notices, see the section of the *Regulatory, Safety, and Environmental Notices* that applies to your country or region. To access this guide: ▲ Type `HP Documentation` in the taskbar search box, and then select **HP Documentation**.	

Keyboard area

Keyboards can vary by language.

Touchpad settings and components

The touchpad settings and components are described here.

Touchpad settings

You learn how to adjust the touchpad settings and components here.

Adjusting touchpad settings

Use these steps to adjust touchpad settings and gestures.

1. Type `touchpad settings` in the taskbar search box, and then press enter.
2. Choose a setting.

Turning on the touchpad

Follow these steps to turn on the touchpad.

1. Type `touchpad settings` in the taskbar search box, and then press enter.
2. Using an external mouse, click the **touchpad** button.

   If you are not using an external mouse, press the Tab key repeatedly until the pointer rests on the **touchpad** button. Then press the spacebar to select the button.

Touchpad components

Use the illustration and table to identify the touchpad components.

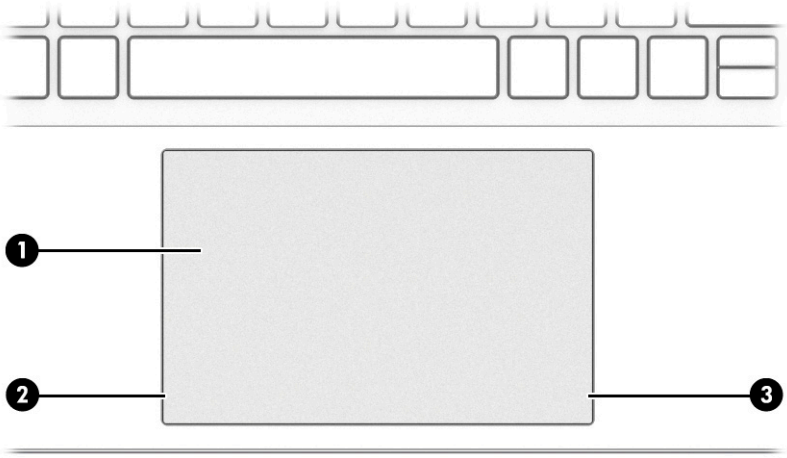


Table 2-4 Touchpad components and their descriptions

Component		Description
(1)	Touchpad zone	Reads your finger gestures to move the pointer or activate items on the screen.
(2)	Left control zone	Textured area that allows you to perform additional gestures.
(3)	Right control zone	Textured area that allows you to perform additional gestures.

Lights

Use the illustration and table to identify the lights on the computer.

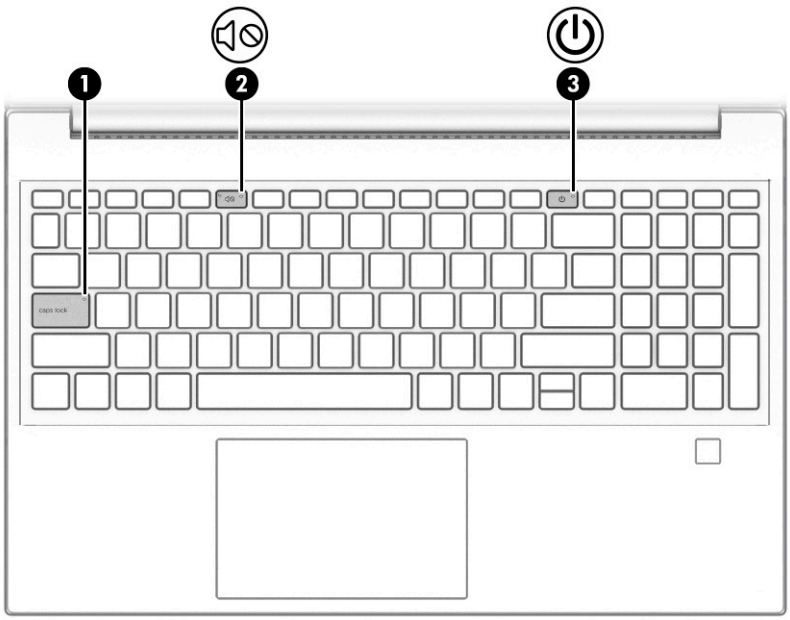


Table 2-5 Lights and their descriptions

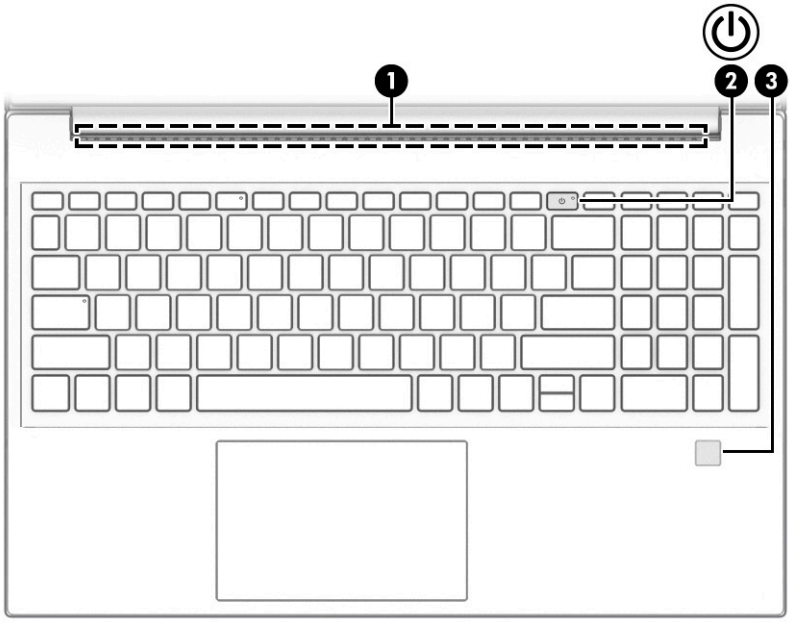
Component		Description
(1)	Caps lock light	On: Caps lock is on, which switches the key input to all capital letters.

Table 2-5 Lights and their descriptions (continued)

Component		Description
(2)	Mute light	• On: Computer sound is off. • Off: Computer sound is on.
(3)	Power light	• On: The computer is on. • Blinking (select products only): The computer is in the Sleep state, a power-saving state. The computer shuts off power to the display and other unnecessary components. • Off: Depending on your computer model, the computer is off, in Hibernation, or in Sleep. Hibernation is the power-saving state that uses the least amount of power.

Button, vent, and fingerprint reader

Use the illustration and table to identify the computer button, vent and fingerprint reader.



Fingerprint readers, which enable a fingerprint logon, can be located on the touchpad, on a side panel of the computer, or on the top cover below the keyboard.

IMPORTANT: To verify that your computer supports fingerprint reader sign-in, type `Sign-in options` in the taskbar search box and follow the on-screen instructions. If **Fingerprint reader** is not listed as an option, then your computer does not include a fingerprint reader.

Table 2-6 Button, vent, and fingerprint reader and their descriptions

Component		Description
(1)	Vent	Enables airflow to cool internal components. **NOTE:** The computer fan starts up automatically to cool internal components and prevent overheating. It is normal for the internal fan to cycle on and off during routine operation.

Table 2-6 Button, vent, and fingerprint reader and their descriptions (continued)

Component		Description
(2)	Power button	• When the computer is off, press the button briefly to turn on the computer. • When the computer is on, press the button briefly to initiate Sleep. • When the computer is in the Sleep state, press the button briefly to exit Sleep (select products only). • When the computer is in Hibernation, press the button briefly to exit Hibernation. **IMPORTANT:** Pressing and holding down the power button results in the loss of unsaved information. If the computer has stopped responding and shutdown procedures are ineffective, press and hold the power button down for at least 10 seconds to turn off the computer. To learn more about your power settings, see your power options: ▲ Right-click the **Power** icon, and then select **Power Options**.
(3)	Fingerprint reader (select products only)	Allows a fingerprint logon to Windows, instead of a password logon. ▲ Touch your finger to the fingerprint reader. **IMPORTANT:** To prevent fingerprint logon issues, make sure when you register your fingerprint that all sides of your finger are registered by the fingerprint reader.

Special keys

Use the illustration and table to identify the special keys.

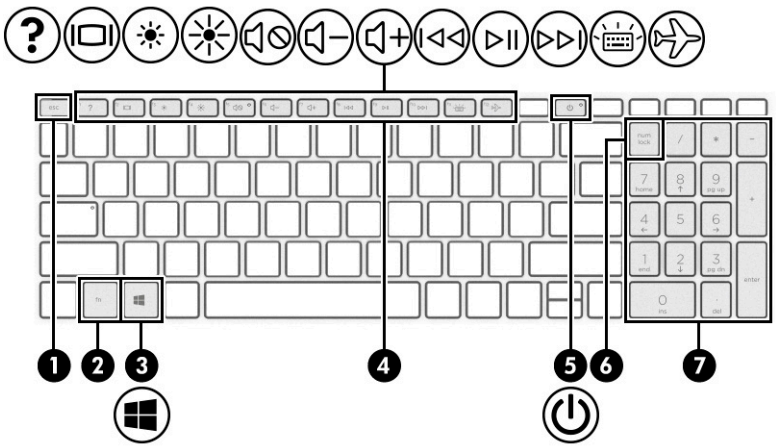


Table 2-7 Special keys and their descriptions

Component		Description
(1)	esc key	Displays system information when pressed in combination with the fn key.
(2)	fn key	Executes specific functions when pressed in combination with another key.
(3)	Windows key	Opens the Start menu. **NOTE:** Pressing the Windows key again will close the Start menu.
(4)	Action keys	Execute frequently used system functions as defined by the icon symbols on f1 through f12 function keys.
(5)	Power button	• When the computer is off, press the button briefly to turn on the computer. • When the computer is on, press the button briefly to initiate Sleep. • When the computer is in the Sleep state, press the button briefly to exit Sleep (select products only). • When the computer is in Hibernation, press the button briefly to exit Hibernation. **IMPORTANT:** Pressing and holding down the power button results in the loss of unsaved information. If the computer has stopped responding and shutdown procedures are ineffective, press and hold the power button down for at least 10 seconds to turn off the computer. To learn more about your power settings, see your power options: ▲ Right-click the **Power** icon, and then select **Power Options**.
(6)	num lock key	Alternates between the navigational and numeric functions on the integrated numeric keypad.
(7)	Integrated numeric keypad	A separate keypad to the right of the alphabet keyboard. When num lock is pressed, the keypad can be used like an external numeric keypad. **NOTE:** If the keypad function is active when the computer is turned off, that function is reinstated when the computer is turned back on.

Bottom

Use the illustration and table to identify the bottom components.

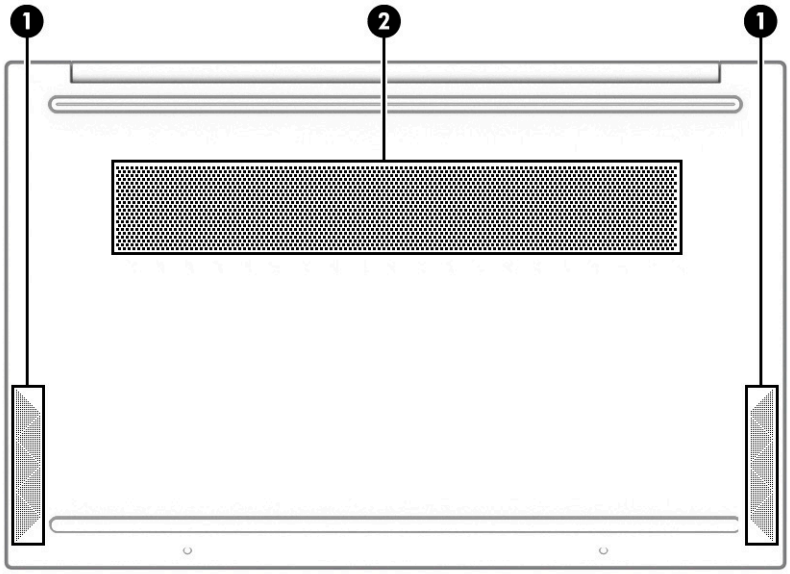


Table 2-8 Bottom components and their descriptions

Component		Description
(1)	Speakers (2)	Produce sound.
(2)	Vent	Enables airflow to cool internal components. **NOTE:** The computer fan starts up automatically to cool internal components and prevent overheating. It is normal for the internal fan to cycle on and off during routine operation.

Labels

The labels affixed to the computer provide information that you might need when you troubleshoot system problems or travel internationally with the computer. Labels can be in paper form or imprinted on the product.

IMPORTANT: Check the following locations for the labels described in this section: the bottom of the computer, inside the battery bay, under the service door, on the back of the display, or on the bottom of a tablet kickstand.

- Service label—Provides important information to identify your computer. When contacting support, you might be asked for the serial number, the product number, or the model number. Locate this information before you contact support.

  Your service label will resemble one of the following examples. Refer to the illustration that most closely matches the service label on your computer.

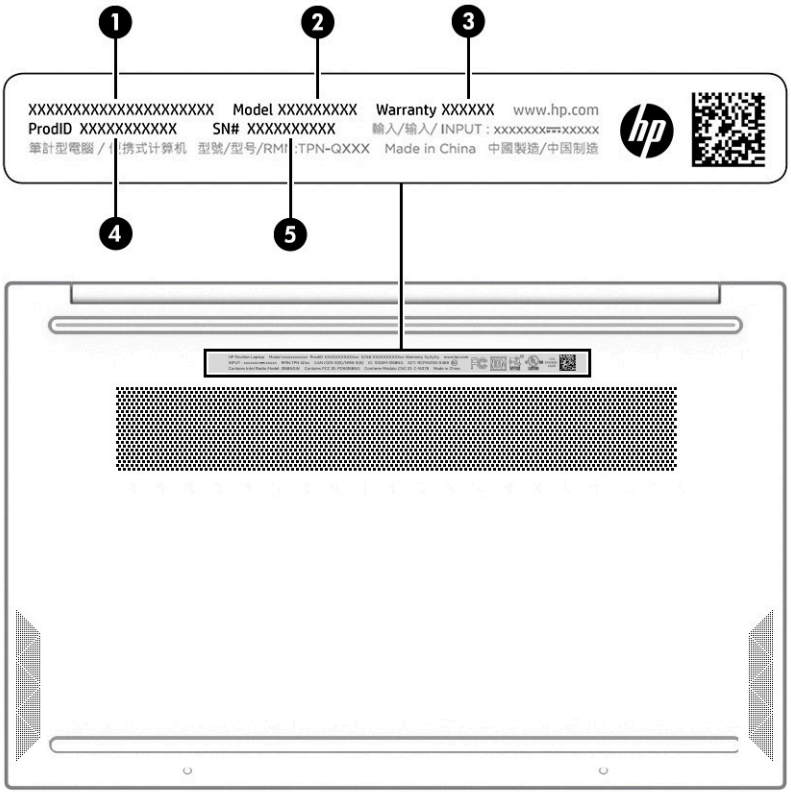


Table 2-9 Service label components

Component	
(1)	HP product name
(2)	Model number
(3)	Warranty period
(4)	Product ID
(5)	Serial number

- Regulatory labels—Provides regulatory information about the computer.
- Wireless certification labels—Provide information about optional wireless devices and the approval markings for the countries or regions in which the devices have been approved for use.

3 Illustrated parts catalog

Use this table to determine the spare parts that are available for the computer.

Computer major components

To identify the computer major components, use this illustration and table.

NOTE: HP continually improves and changes product parts. For complete and current information about supported parts for your computer, go to http://partsurfer.hp.com, select your country or region, and then follow the on-screen instructions.

NOTE: Details about your computer, including model, serial number, product key, and length of warranty, are on the service tag at the bottom of your computer.

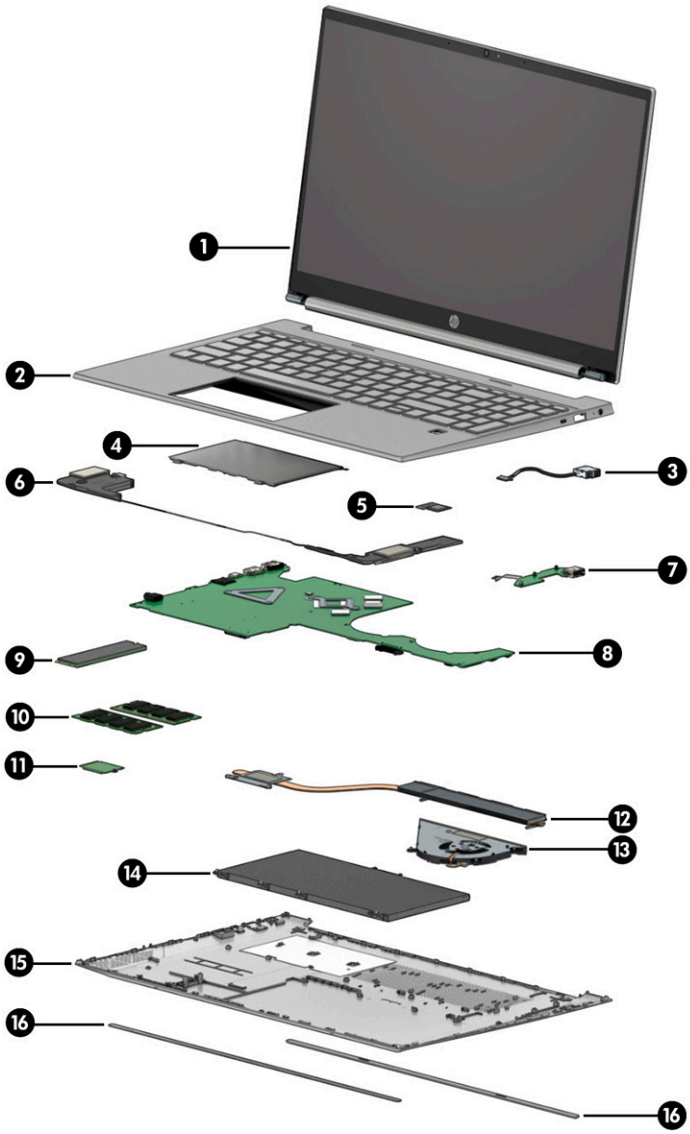


Table 3-1 Computer major component descriptions and part numbers

Item	Component	Spare part number
(1)	**Display assembly** **NOTE:** Display assemblies are offered as spare parts only at a subcomponent level. For more information, see Display assembly subcomponents on page 18.	not available as a spare part
(2)	**Keyboard/top cover** For a detailed list of country codes, see Top cover with keyboard on page 51.	
	Natural silver, fingerprint reader, backlit	M08910-xx1
	Natural silver, fingerprint reader, not backlit	M08911-xx1
	Natural silver, no fingerprint reader, backlit	M08912-xx1
	Natural silver, no fingerprint reader, not backlit	M08913-xx1
	Cloud blue, fingerprint reader, backlit	M08918-xx1
	Cloud blue, fingerprint reader, not backlit	M08919-xx1
	Cloud blue, no fingerprint reader, backlit	M08920-xx1
	Cloud blue, no fingerprint reader, not backlit	M08921-xx1
	Luminous gold, fingerprint reader, backlit	M08922-xx1
	Luminous gold, fingerprint reader, not backlit	M08923-xx1
	Luminous gold, no fingerprint reader, backlit	M08924-xx1
	Luminous gold, no fingerprint reader, not backlit	M08925-xx1
	Light teal, fingerprint reader, backlit	M08926-xx1
	Light teal, fingerprint reader, not backlit	M08927-xx1
	Light teal, no fingerprint reader, backlit	M08928-xx1
	Light teal, no fingerprint reader, not backlit	M08929-xx1
(3)	**Power connector (DC-in) cable**	M08887-001
(4)	**Touchpad** **NOTE:** The touchpad cable is available using spare part number M08876-001.	
	Fog blue	M08872-001
	Forest teal	M08873-001
	Natural silver	M08874-001
	Warm gold	M08875-001
(5)	**Fingerprint reader** **NOTE:** The fingerprint reader cable is available using spare part number M08883-001.	M16090-001
	Fog blue	M08878-001
	Forest teal	M08879-001
	Natural silver	M08880-001
	Warm gold	M08881-001

Table 3-1 Computer major component descriptions and part numbers (continued)

Item	Component	Spare part number
(6)	**Speakers** (left and right)	M08943-001
(7)	**USB board**	M08869-001
	NOTE: The USB board cable is available using spare part number M08870-001.	
(8)	**System board** (includes processor)	
	All system boards use the following part numbers:	
	xxxxxx-001: Non-Windows operating system	
	xxxxxx-601: Windows 10 operating system	
	AMD Ryzen 7-4700U processor	M08868-xx1
	AMD Ryzen 5-4500U processor	M08867-xx1
	AMD Ryzen 3-4300U processor	M08866-xx1
	AMD Athlon Gold 3150U processor	M08865-xx1
(9)	**Solid-state drive**	
	1 TB, PCIe	L85370-005
	512 GB, PCIe	L85364-005
	256 GB, PCIe	L85354-005
	128 GB, SATA-3, TLC	L85346-005
(10)	**Memory modules**	
	8 GB (DDR4-2666)	937236-855
	4 GB (DDR4-2666)	L10598-855
	8 GB (DDR4-3200)	L46598-005
	4 GB (DDR4-3200)	L83673-005
(11)	**WLAN module**	
	Realtek RTL8821CE 802.11ac 1 × 1 Wi-Fi + Bluetooth 4.2	L17365-005
	Intel Wi-Fi 6 AX200 802.11ax 2 × 2 Wi-Fi + Bluetooth 5 (non-vPro)	L35282-005
	Realtek RTL8822CE 802.11ac 2 × 2 Wi-Fi + Bluetooth 5	L44796-005
(12)	**Heat sink** (includes replacement thermal material)	M08944-001
(13)	**Fan**	M08945-001
(14)	**Battery** (3 cell, 41 Whr)	L97300-005
(15)	**Bottom cover**	
	Fog blue	M08889-001
	Forest teal	M08890-001
	Natural silver	M08891-001
	Warm gold	M08892-001
(16)	**Rubber Foot Kit**	

Table 3-1 Computer major component descriptions and part numbers (continued)

Item	Component	Spare part number
	Fog blue	M08894-001
	Forest teal	M08895-001
	Natural silver	M08896-001
	Warm gold	M08897-001

Display assembly subcomponents

To identify the display assembly subcomponents, use this illustration and table.

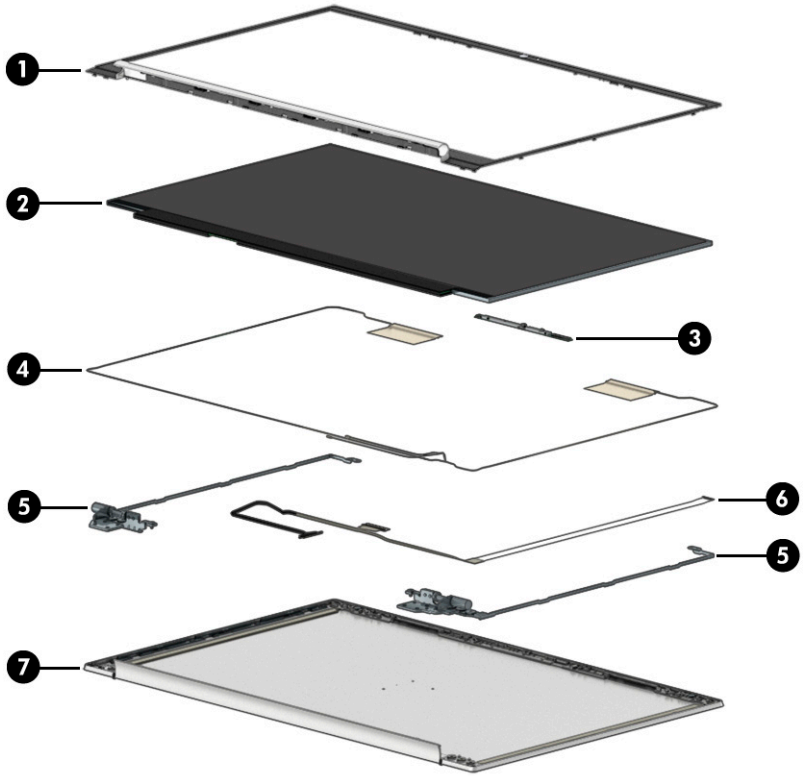


Table 3-2 Display component descriptions and part numbers

Item	Component	Spare part number
(1)	**Display bezel**	
	Ceramic white	M08905-001
	Fog blue	M11934-001
	Forest teal	M11935-001
	Natural silver	M11936-001
	Warm gold	M11937-001
(2)	**Display panel** (includes display panel adhesive and display bezel adhesive)	

Table 3-2 Display component descriptions and part numbers (continued)

Item	Component	Spare part number
	Antiglare, UWVA, FHD	M09819-001
	Antiglare, SVA, FHD	M09820-001
	BrightView, SVA, HD	M09821-001
	BrightView, UWVA, FHD, Touch-On Panel (TOP)	M09822-001
	BrightView, UWVA, HD	M09824-001
	BrightView, SVA, HD, Touch-On Panel (TOP)	M15993-001
(3)	**Camera module** (includes display panel adhesive kit)	M08908-001
(4)	**Wireless antenna kits** (includes display panel adhesive kit)	
	Single antenna	M13002-001
	Dual antennas	M08903-001
(5)	**Hinges** (includes left and right display hinges; includes display bezel adhesive)	M08904-001
(6)	**Display panel cable** (includes display panel adhesive and display bezel adhesive)	
	For use with nontouch panels	M08907-001
	For use with touch screen panels	M08906-001
(7)	**Display back cover** (includes display bezel adhesive)	
	Ceramic white	M08898-001
	Fog blue	M08899-001
	Forest teal	M08900-001
	Natural silver	M08901-001
	Warm gold	M08902-001
	Adhesive tape kit (includes display panel adhesive and display bezel adhesive; not illustrated)	M26981-001

Cables

To identify the cables, use this illustration and table.

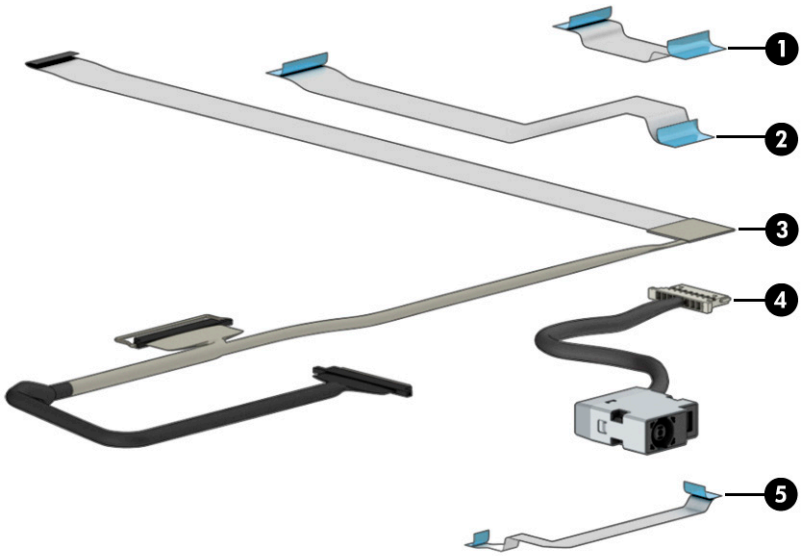


Table 3-3 Cable descriptions and part numbers

Item	Component	Spare part number
(1)	**USB board cable**	M08870-001
(2)	**Touchpad cable**	M08876-001
(3)	**Display/camera cable**	
	Touch	M08906-001
	Nontouch	M08907-001
(4)	**Power connector cable**	M08887-001
(5)	**Fingerprint reader board cable**	M08883-001

Miscellaneous parts

To identify the miscellaneous parts, use this table.

Table 3-4 Miscellaneous part descriptions and part numbers

Component	Spare part number
AC adapters	
65 W HP Smart AC adapter (non-PFC, EM, RC, 4.5 mm)	913691-850
45 W HP Smart AC adapter (non-PFC, RC, 4.5 mm, non-slim)	741727-001
Screw Kit	M08909-001
HP USB-to-Gigabit RJ-45 adapter	829941-001
HP USB-C-to-VGA adapter	831751-001
HP USB-C-to-RJ-45 adapter	855560-001
Hub, HP USB Type-C-to-USB Type-A	916838-001

Table 3-4 Miscellaneous part descriptions and part numbers (continued)

Component	Spare part number
Hub, HP USB-C-to-multiport	919666-001
Hub, HP Elite USB-C multiport	L39572-001
Power adapter (C5)	
Japan	226768-001
Power cords (C5, 1.0 m)	
Argentina	L19357-001
Australia	L19358-001
Denmark	L19360-001
Europe (Austria, Belgium, Finland, France, Germany, the Netherlands, Norway, and Sweden)	L19361-001
India	L19363-001
Italy	L19364-001
Japan	L19365-001
North America	L19367-001
People's Republic of China	L19368-001
South Korea	L19366-001
Switzerland	L19370-001
Taiwan	L19372-001
Thailand	L19371-001
United Kingdom	L19373-001

4 Removal and replacement procedures preliminary requirements

Use this information to properly prepare to disassemble and reassemble the computer.

Tools required

You need the following tools to complete the removal and replacement procedures:

- Tweezers
- Nonconductive, nonmarking pry tool
- Magnetic Phillips P1 screwdriver

Service considerations

The following sections include some of the considerations that you must keep in mind during disassembly and assembly procedures.

NOTE: As you remove each subassembly from the computer, place the subassembly (and all accompanying screws) away from the work area to prevent damage.

Plastic parts

Using excessive force during disassembly and reassembly can damage plastic parts.

Cables and connectors

Handle cables with extreme care to avoid damage.

IMPORTANT: When servicing the computer, be sure that cables are placed in their proper locations during the reassembly process. Improper cable placement can damage the computer.

Apply only the tension required to unseat or seat the cables during removal and insertion. Handle cables by the connector whenever possible. In all cases, avoid bending, twisting, or tearing cables. Be sure that cables are routed so that they cannot be caught or snagged as you remove or replace parts. Handle flex cables with extreme care; these cables tear easily.

Drive handling

Note the following guidelines when handling drives.

IMPORTANT: Drives are fragile components. Handle them with care. To prevent damage to the computer, damage to a drive, or loss of information, observe these precautions:

Before removing or inserting a hard drive, shut down the computer. If you are unsure whether the computer is off or in Hibernation, turn the computer on, and then shut it down through the operating system.

Before handling a drive, be sure that you are discharged of static electricity. While handling a drive, avoid touching the connector.

Before removing an optical drive, be sure that a disc is not in the drive, and be sure that the optical drive tray is closed.

Handle drives on surfaces covered with at least 2.54 cm (1 inch) of shock-proof foam.

Avoid dropping drives from any height onto any surface.

After removing a hard drive or an optical drive, place it in a static-proof bag.

Avoid exposing an internal hard drive to products that have magnetic fields, such as monitors or speakers.

Avoid exposing a drive to temperature extremes or liquids.

If a drive must be mailed, place the drive in a bubble pack mailer or other suitable form of protective packaging, and label the package “FRAGILE.”

Workstation guidelines

Follow these grounding workstation guidelines:

- Cover the workstation with approved static-shielding material.
- Use a wrist strap connected to a properly grounded work surface and use properly grounded tools and equipment.
- Use conductive field service tools, such as cutters, screw drivers, and vacuums.
- When fixtures must directly contact dissipative surfaces, use fixtures made only of static-safe materials.
- Keep the work area free of nonconductive materials, such as ordinary plastic assembly aids and polystyrene foam.
- Handle ESD-sensitive components, parts, and assemblies by the case or PCM laminate. Handle these items only at static-free workstations.
- Avoid contact with pins, leads, or circuitry.
- Turn off power and input signals before inserting or removing connectors or test equipment.

Electrostatic discharge information

A sudden discharge of static electricity from your finger or other conductor can destroy static-sensitive devices or microcircuitry. Often the spark is neither felt nor heard, but damage occurs. An electronic device exposed to electrostatic discharge (ESD) might not appear to be affected at all and can work perfectly throughout a normal cycle. The device might function normally for a while, but it has been degraded in the internal layers, reducing its life expectancy.

Networks built into many integrated circuits provide some protection, but in many cases, the discharge contains enough power to alter device parameters or melt silicon junctions.

IMPORTANT: To prevent damage to the device when you remove or install internal components, observe these precautions:

Keep components in their electrostatic-safe containers until you are ready to install them.

Before touching an electronic component, discharge static electricity by using the guidelines described Personal grounding methods and equipment on page 25.

Avoid touching pins, leads, and circuitry. Handle electronic components as little as possible.

If you remove a component, place it in an electrostatic-safe container.

Generating static electricity

Follow these static electricity guidelines.

- Different activities generate different amounts of static electricity.
- Static electricity increases as humidity decreases.

Table 4-1 Static electricity occurrence based on activity and humidity

	Relative humidity		
Event	**55%**	**40%**	**10%**
Walking across carpet	7,500 V	15,000 V	35,000 V
Walking across vinyl floor	3,000 V	5,000 V	12,000 V
Motions of bench worker	400 V	800 V	6,000 V
Removing DIPs (dual in-line packages) from plastic tube	400 V	700 V	2,000 V
Removing DIPs from vinyl tray	2,000 V	4,000 V	11,500 V
Removing DIPs from polystyrene foam	3,500 V	5,000 V	14,500 V
Removing bubble pack from PCB (printed circuit board)	7,000 V	20,000 V	26,500 V
Packing PCBs in foam-lined box	5,000 V	11,000 V	21,000 V
Multiple electric components can be packaged together in plastic tubes, trays, or polystyrene foam.			

NOTE: As little as 700 V can degrade a product.

Preventing electrostatic damage to equipment

Many electronic components are sensitive to ESD. Circuitry design and structure determine the degree of sensitivity. The following packaging and grounding precautions are necessary to prevent static electricity damage to electronic components.

- To avoid hand contact, transport products in static-safe containers such as tubes, bags, or boxes.
- Protect all electrostatic parts and assemblies with conductive or approved containers or packaging.
- Keep electrostatic-sensitive parts in their containers until they arrive at static-free stations.
- Place items on a grounded surface before removing them from their container.
- Always be properly grounded when touching a sensitive component or assembly.

- Avoid contact with pins, leads, or circuitry.
- Place reusable electrostatic-sensitive parts from assemblies in protective packaging or conductive foam.

Personal grounding methods and equipment

Using certain equipment can prevent static electricity damage to electronic components.

- **Wrist straps** are flexible straps with a maximum of 1 MΩ ±10% resistance in the ground cords. To provide proper ground, a strap must be worn snug against bare skin. The ground cord must be connected and fit snugly into the banana plug connector on the grounding mat or workstation.
- **Heel straps/Toe straps/Boot straps** can be used at standing workstations and are compatible with most types of shoes or boots. On conductive floors or dissipative floor mats, use them on both feet with a maximum of 1 MΩ ±10% resistance between the operator and ground.

Table 4-2 Static shielding protection levels

Static shielding protection levels	
Method	**Voltage**
Antistatic plastic	1,500
Carbon-loaded plastic	7,500
Metallized laminate	15,000

Grounding the work area

To prevent static damage at the work area, follow these precautions.

- Cover the work surface with approved static-dissipative material. Provide a wrist strap connected to the work surface and properly grounded tools and equipment.
- Use static-dissipative mats, foot straps, or air ionizers to give added protection.
- Handle electrostatic sensitive components, parts, and assemblies by the case or PCB laminate. Handle them only at static-free work areas.
- Turn off power and input signals before inserting and removing connectors or test equipment.
- Use fixtures made of static-safe materials when fixtures must directly contact dissipative surfaces.
- Keep work area free of nonconductive materials such as ordinary plastic assembly aids and polystyrene foam.
- Use field service tools, such as cutters, screwdrivers, and vacuums, that are conductive.

Recommended materials and equipment

HP recommends certain materials and equipment to prevent static electricity.

- Antistatic tape
- Antistatic smocks, aprons, or sleeve protectors
- Conductive bins and other assembly or soldering aids
- Conductive foam
- Conductive tabletop workstations with ground cord of 1 MΩ ±10% resistance

- Static-dissipative table or floor mats with hard tie to ground
- Field service kits
- Static awareness labels
- Wrist straps and footwear straps providing 1 MΩ ±10% resistance
- Material handling packages
- Conductive plastic bags
- Conductive plastic tubes
- Conductive tote boxes
- Opaque shielding bags
- Transparent metallized shielding bags
- Transparent shielding tubes

Packaging and transporting guidelines

Follow these grounding guidelines when packaging and transporting equipment.

- To avoid hand contact, transport products in static-safe tubes, bags, or boxes.
- Protect ESD-sensitive parts and assemblies with conductive or approved containers or packaging.
- Keep ESD-sensitive parts in their containers until the parts arrive at static-free workstations.
- Place items on a grounded surface before removing items from their containers.
- Always be properly grounded when touching a component or assembly.
- Store reusable ESD-sensitive parts from assemblies in protective packaging or nonconductive foam.
- Use transporters and conveyors made of antistatic belts and roller bushings. Be sure that mechanized equipment used for moving materials is wired to ground and that proper materials are selected to avoid static charging. When grounding is not possible, use an ionizer to dissipate electric charges.

5 Removal and replacement procedures for authorized service provider parts

This chapter provides removal and replacement procedures for authorized service provider parts.

IMPORTANT: Components described in this chapter should be accessed only by an authorized service provider. Accessing these parts can damage the computer or void the warranty.

NOTE: Details about your computer, including model, serial number, product key, and length of warranty, are on the service tag at the bottom of your computer.

Component replacement procedures

To remove and replace computer components, use these procedures.

NOTE: HP continually improves and changes product parts. For complete and current information about supported parts for your computer, go to http://partsurfer.hp.com, select your country or region, and then follow the on-screen instructions.

You must remove, replace, or loosen as many as 50 screws when you service the parts described in this chapter. Make special note of each screw size and location during removal and replacement.

Preparation for disassembly

To remove and replace computer components, use these procedures.

See Removal and replacement procedures preliminary requirements on page 22 for initial safety procedures.

1. Turn off the computer. If you are unsure whether the computer is off or in Hibernation, turn the computer on, and then shut it down through the operating system.
2. Disconnect the power from the computer by unplugging the power cord from the computer.
3. Disconnect all external devices from the computer.

Bottom cover

To remove the bottom cover, use this procedure and illustration.

Table 5-1 Bottom cover description and part number

Description	Spare part number
Bottom cover, fog blue	M08889-001
Bottom cover, forest teal	M08890-001
Bottom cover, natural silver	M08891-001
Bottom cover, warm gold	M08892-001
Rubber feet, fog blue	M08894-001
Rubber feet, forest teal	M08895-001

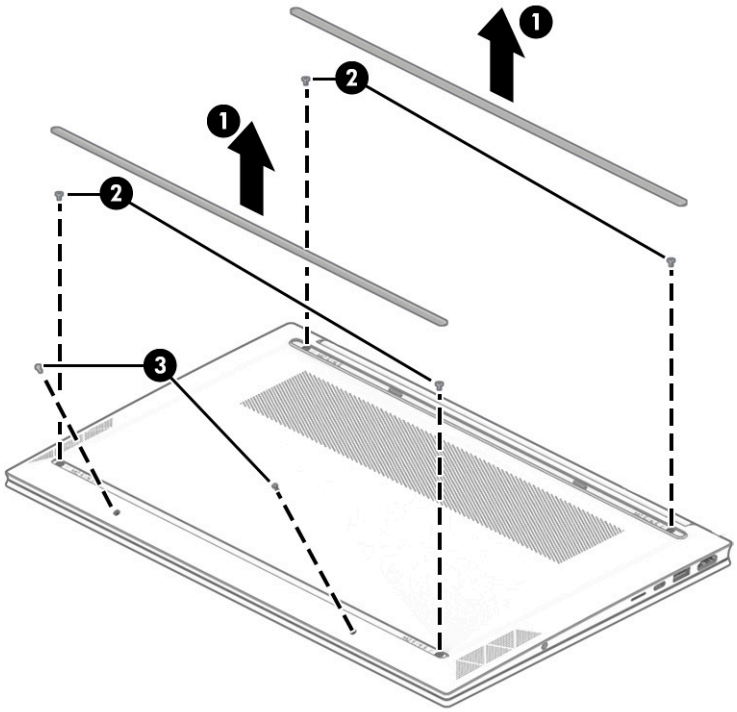
Table 5-1 Bottom cover description and part number (continued)

Description	Spare part number
Rubber feet, natural silver	M08896-001
Rubber feet, warm gold	M08897-001

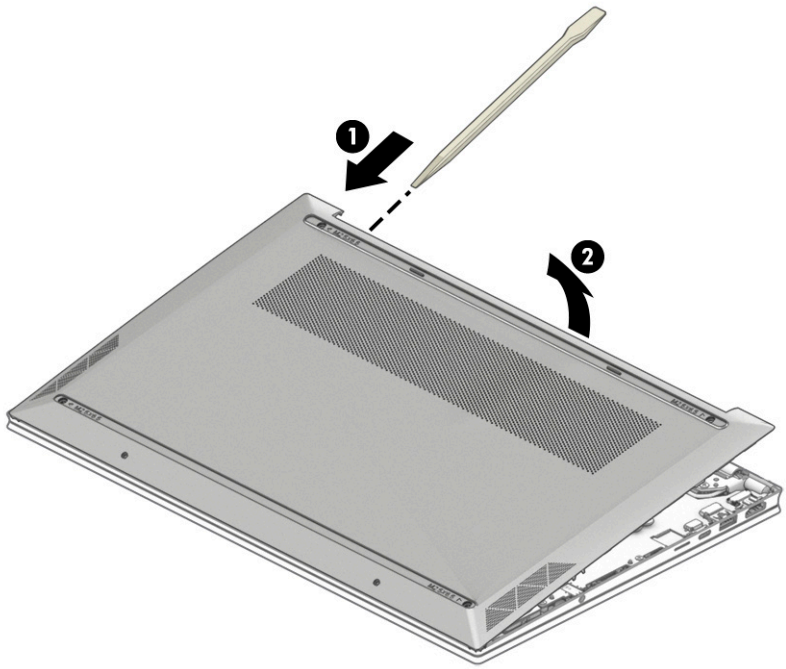
Before removing the bottom cover, prepare the computer for disassembly (Preparation for disassembly on page 27).

Remove the bottom cover:

1. Remove the two rubber feet **(1)**.
2. Remove the four Phillips M2.5 × 6.5 screws **(2)** from under the feet and the two Phillips M2.0 × 5.0 screws **(3)** along the bottom edge of the bottom cover.



3. Starting near the hinges, use a plastic tool **(1)** to release the bottom cover from the computer **(2)**.



To replace the bottom cover, reverse the removal procedures.

Battery

To remove the battery, use this procedure and illustration.

Table 5-2 Battery description and part number

Description	Spare part number
3 cell, 41 Whr, Li-ion battery	L97300-005

⚠ **WARNING!** To avoid personal injury and damage to the product:

- Do *not* puncture, twist, or crack the battery.
- Do *not* cause an external puncture or rupture to the battery. They can cause a short inside the battery, which can result in battery thermal runaway.
- Do *not* handle or touch the battery enclosure with sharp objects such as tweezers or pliers, which might puncture the battery.
- Do *not* compress or squeeze the battery case with tools or heavy objects stacked on top of the case. These actions can apply undue force on the battery.
- Do *not* touch the connectors with any metallic surface or object, such as metal tools, screws, or coins, which can cause shorting across the connectors.

Before removing the battery, follow these steps:

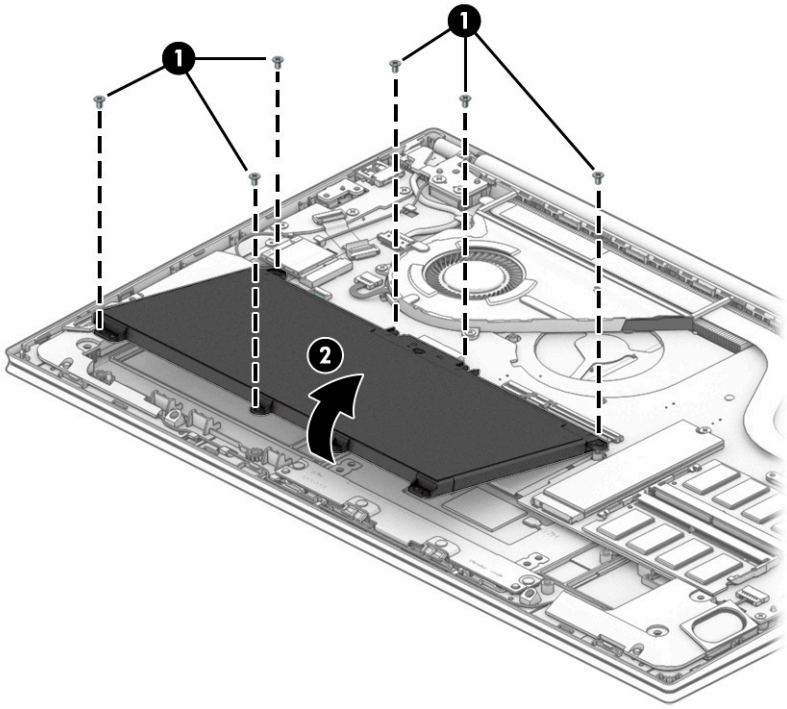
1. Prepare the computer for disassembly (Preparation for disassembly on page 27).
2. Remove the bottom cover (Bottom cover on page 27).

WARNING! To reduce potential safety issues, use only the user-replaceable battery provided with the computer, a replacement battery provided by HP, or a compatible battery purchased from HP.

IMPORTANT: Removing a battery that is the sole power source for the computer can cause loss of information. To prevent loss of information, save your work or shut down the computer through Windows before you remove the battery.

Remove the battery:

1. Remove the six Phillips M2.0 × 4.0 screws **(1)** that secure the battery to the computer.
2. Rotate the bottom of the battery upward, and then remove it from the computer **(2)**.



To replace the battery, reverse the removal procedures.

WLAN module

To remove the WLAN module, use this procedure and illustration.

Table 5-3 WLAN module descriptions and part numbers

Description	Spare part number
Realtek RTL8821CE 802.11ac 1 × 1 Wi-Fi + Bluetooth 4.2	L17365-005
Intel Wi-Fi 6 AX200 802.11ax 2 × 2 Wi-Fi + Bluetooth 5 (non-vPro)	L35282-005
Realtek RTL8822CE 802.11ac 2 × 2 Wi-Fi + Bluetooth 5	L44796-005

IMPORTANT: To prevent an unresponsive system, replace the wireless module only with a wireless module authorized for use in the computer by the governmental agency that regulates wireless devices in your country or region. If you replace the module and then receive a warning message, remove the module to restore device functionality, and then contact technical support.

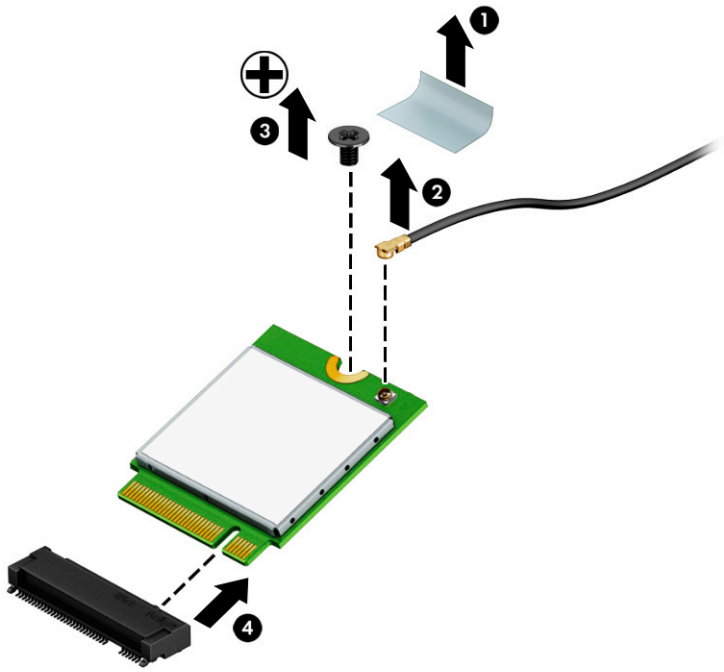
Before removing the WLAN module, follow these steps:

1. Prepare the computer for disassembly (Preparation for disassembly on page 27).
2. Remove the bottom cover (Bottom cover on page 27).
3. Remove the battery (see Battery on page 29).

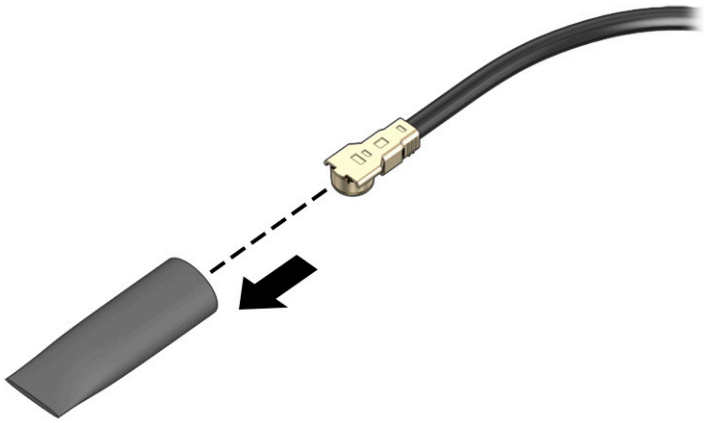
Remove the WLAN module:

1. Remove the plastic protector from the antenna or antennas **(1)**.
2. Carefully disconnect the antenna cable or cables from the module **(2)**.
3. Remove the Phillips M2.0 × 2.5 screw **(3)**, and then remove the WLAN module **(4)**.

NOTE: Models have either one or two WLAN antennas. On models with two antennas, the #1 white WLAN antenna cable connects to the WLAN module #1 Main terminal. The #2 black WLAN antenna cable connects to the WLAN module #1 Aux terminal.



4. If the WLAN antenna is not connected to the terminal on the WLAN module, a protective sleeve must be installed on the antenna connector, as shown in the following illustration.



Reverse this procedure to install the WLAN module.

Solid-state drive

To remove the M.2 solid-state drive, use this procedure and illustration.

Table 5-4 Solid-state drive descriptions and part numbers

Description	Spare part number
1 TB, PCIe	L85370-005
512 GB, PCIe	L85364-005
256 GB, PCIe	L85354-005
128 GB, SATA-3, TLC	L85346-005

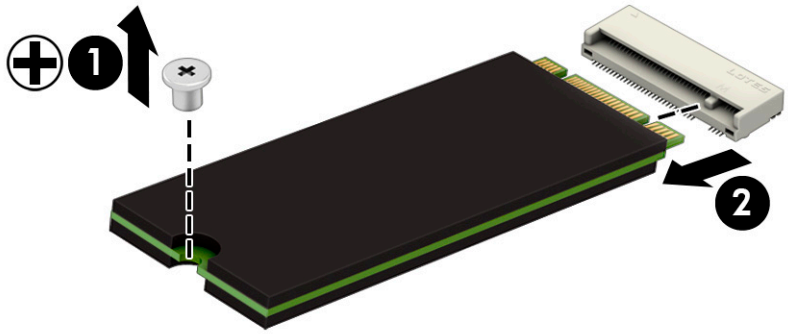
Before removing the solid-state drive, follow these steps:

1. Prepare the computer for disassembly (Preparation for disassembly on page 27).
2. Remove the bottom cover (Bottom cover on page 27).
3. Remove the battery (see Battery on page 29).

Remove the solid-state drive:

1. Remove the Phillips M2.0 × 2.5 screw **(1)** that secures the drive to the computer.

2. Pull the drive away from the socket to remove it **(2)**.



To install the solid-state drive, reverse the removal procedures.

NOTE: Solid-state drives are designed with a notch to prevent incorrect insertion.

Memory modules

To remove the memory modules, use this procedure and illustration.

Table 5-5 Memory module descriptions and part numbers

Description	Spare part number
Memory module, 8 GB (DDR4-2666)	937236-855
Memory module, 4 GB (DDR4-2666)	L10598-855
Memory module, 8 GB (DDR4-3200)	L46598-005
Memory module, 4 GB (DDR4-3200)	L83673-005

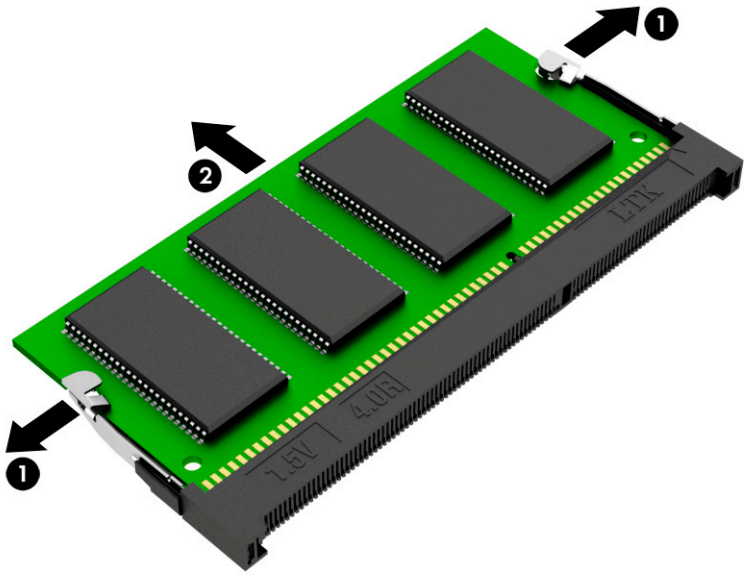
Before removing the memory, follow these steps:

1. Prepare the computer for disassembly (Preparation for disassembly on page 27).
2. Remove the bottom cover (Bottom cover on page 27).
3. Remove the battery (see Battery on page 29).

If you are replacing a memory module, remove the existing memory module:

▲ Spread the two retention clips outward **(1)** until the memory module tilts up at a 45° angle, and then remove the module **(2)**. Use the same procedure to remove all memory modules.

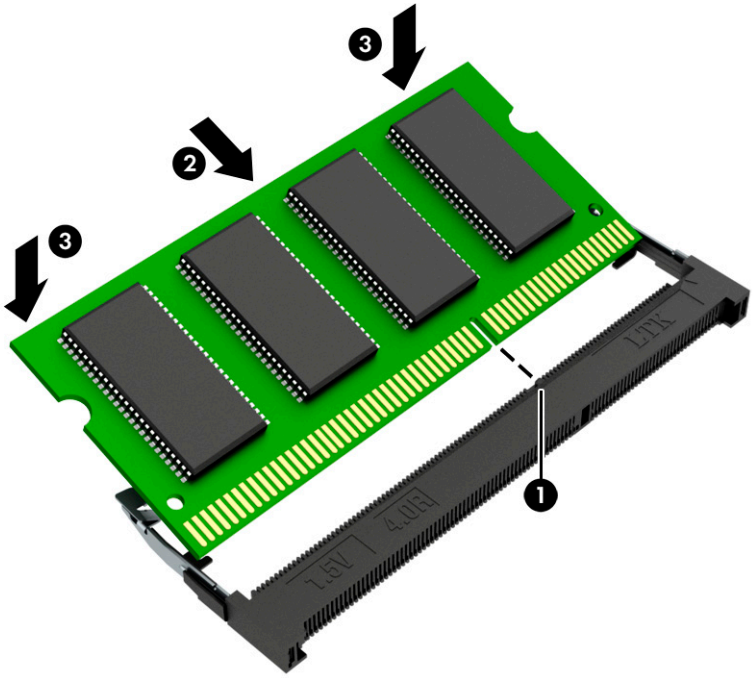
IMPORTANT: To prevent damage to the memory module, hold the memory module by the edges only. Do not touch the components on the memory module.



To protect a memory module after removal, place it in an electrostatic-safe container.

To install a memory module:

1. Align the notched edge of the module with the tab in the slot **(1)**, and then press the module into the slot at an angle until it is seated **(2)**.
2. Press down on the module until the side retention clips snap into place **(3)**.



USB board

To remove the USB board, use this procedure and illustration.

Table 5-6 USB board description and part number

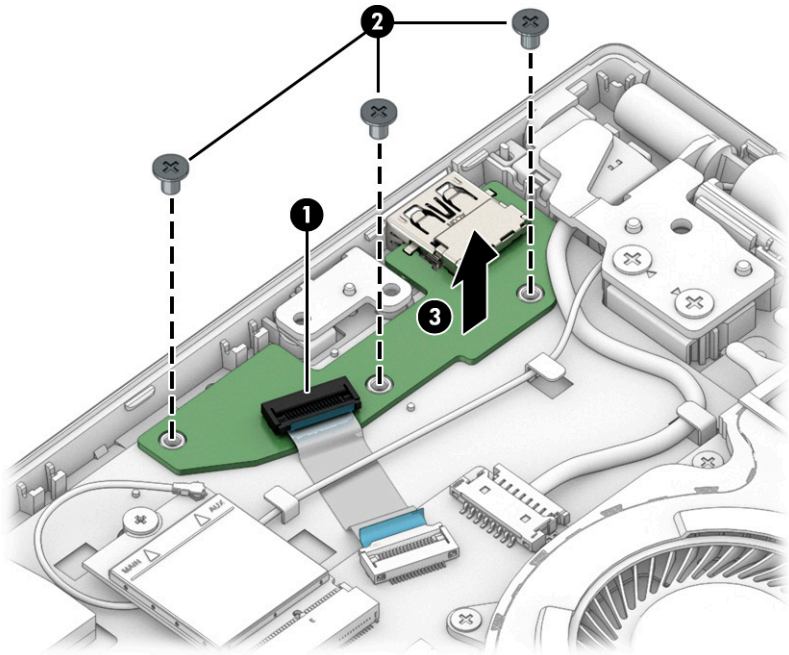
Description	Spare part number
USB board	M08869-001
USB board cable	M08870-001

Before removing the USB board, follow these steps:

1. Prepare the computer for disassembly (Preparation for disassembly on page 27).
2. Remove the bottom cover (Bottom cover on page 27).
3. Remove the battery (see Battery on page 29).

Remove the USB board:

1. Disconnect the cable from the ZIF connector on the USB board **(1)**.
2. Remove the three Phillips M2.0 × 2.0 screws **(2)** that secure the board to the computer.
3. Remove the board from the computer **(3)**.



Reverse this procedure to install the USB board.

Speakers

To remove the speakers, use this procedure and illustration.

Table 5-7 Speaker description and part number

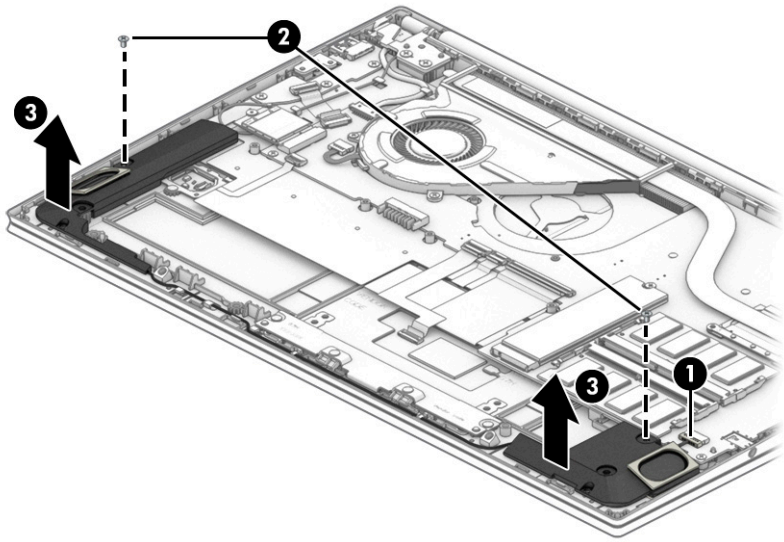
Description	Spare part number
Speaker Kit	M08943-001

Before removing the speakers, follow these steps:

1. Prepare the computer for disassembly (Preparation for disassembly on page 27).
2. Remove the bottom cover (Bottom cover on page 27).
3. Remove the battery (see Battery on page 29).

Remove the speakers:

1. Disconnect the speaker cable from the system board **(1)**.
2. Remove the Phillips M2.0 × 3.0 screw from each speaker **(2)**.
3. Remove the speakers from the computer **(3)** and release the cable from the retention clips along the bottom of the computer.



Reverse this procedure to install the speakers.

Fingerprint reader

To remove the fingerprint reader, use this procedure and illustration.

Table 5-8 Fingerprint reader description and part number

Description	Spare part number
Fingerprint reader, fog blue	M08878-001
Fingerprint reader, forest teal	M08879-001
Fingerprint reader, natural silver	M08880-001
Fingerprint reader, warm gold	M08881-001
Fingerprint reader cable	M08883-001

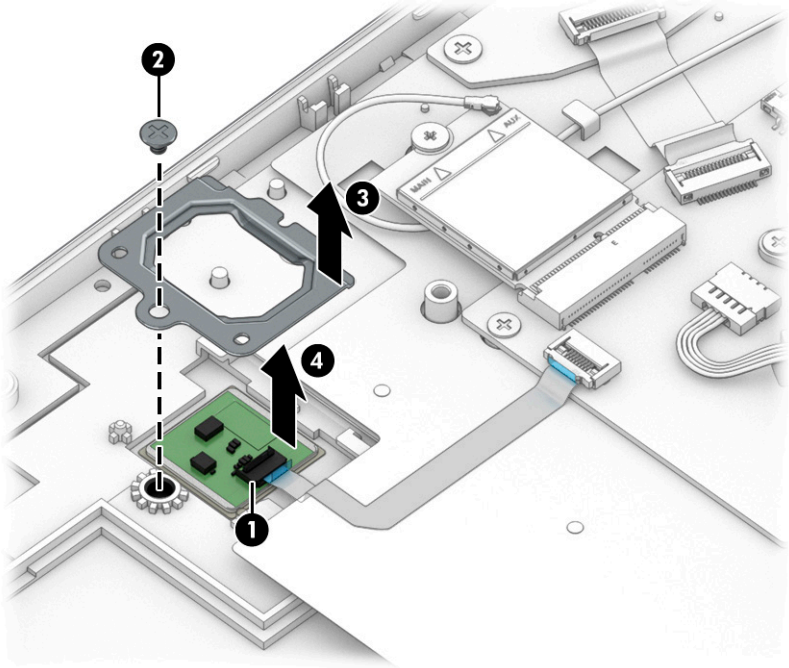
Before removing the fingerprint reader, follow these steps:

1. Prepare the computer for disassembly (Preparation for disassembly on page 27).
2. Remove the bottom cover (Bottom cover on page 27).

3. Remove the battery (see Battery on page 29).
4. Remove the right speaker (see Speakers on page 35).

Remove the fingerprint reader:

1. Disconnect the cable from the ZIF connector on the fingerprint reader board **(1)**.
2. Remove the Phillips M2.0 × 3.0 screw **(2)** that secures the fingerprint reader bracket to the computer.
3. Remove the bracket from on top of the fingerprint reader **(3)**.
4. Remove the fingerprint reader from the computer **(4)**.



Reverse this procedure to install the fingerprint reader.

Fan

To remove the fan, use this procedure and illustration.

Table 5-9 Fan description and part number

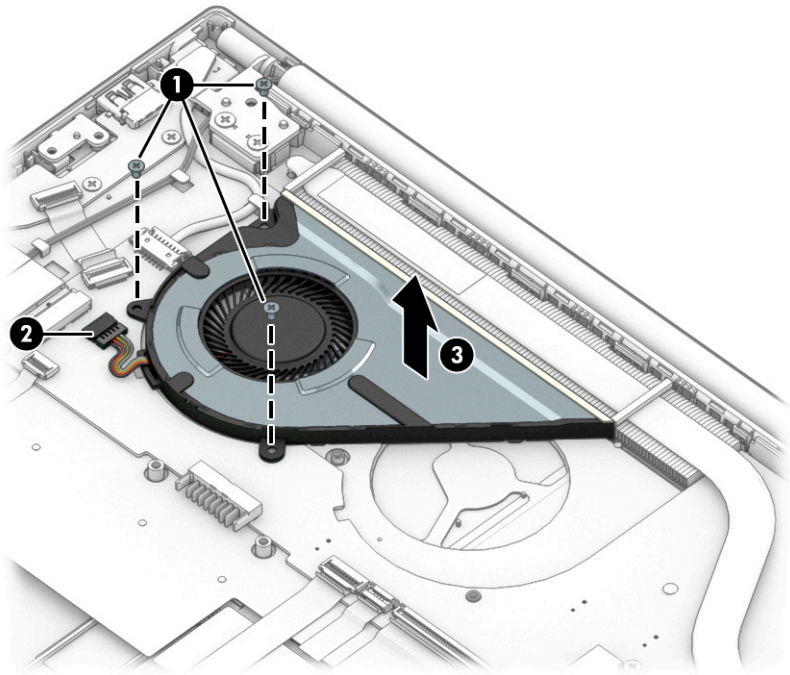
Description	Spare part number
Fan	M08945-001

Before removing the fan, follow these steps:

1. Prepare the computer for disassembly (Preparation for disassembly on page 27).
2. Remove the bottom cover (Bottom cover on page 27).
3. Remove the battery (see Battery on page 29).

Remove the fan:

1. Remove the three Phillips M2.0 × 3.0 screws **(1)** that secure the fan to the computer.
2. Disconnect the fan cable from the system board **(2)**.
3. Remove the fan from the computer **(3)**.



Reverse this procedure to install the fan.

Heat sink

To remove the heat sink, use these procedures and illustrations.

Table 5-10 Heat sink descriptions and part numbers

Description	Spare part number
Heat sink	M08944-001

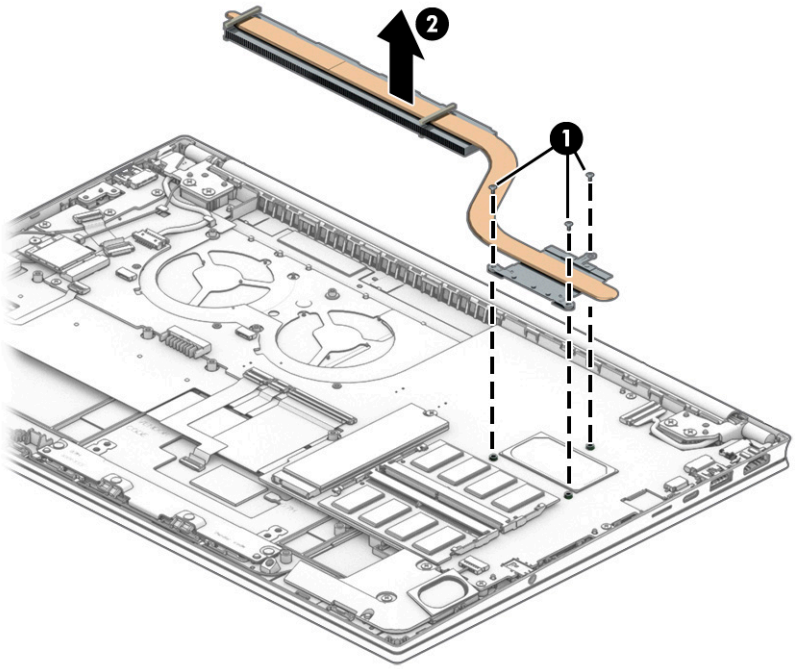
Before removing the heat sink, follow these steps:

1. Prepare the computer for disassembly (Preparation for disassembly on page 27).
2. Remove the bottom cover (Bottom cover on page 27).
3. Remove the battery (see Battery on page 29).

Remove the heat sink:

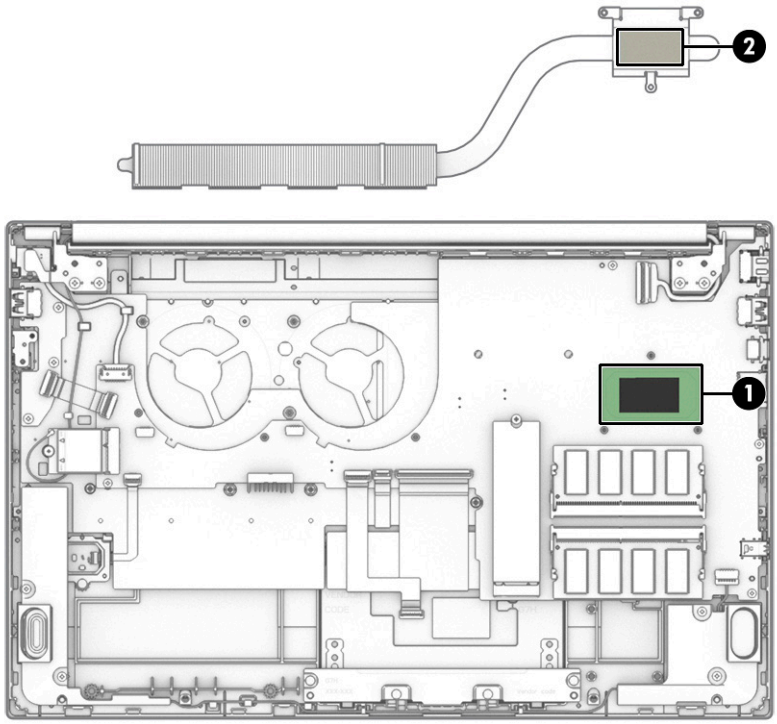
1. In the order indicated on the heat sink, remove the three Phillips M2.0 × 2.0 screws **(1)** that secure the heat sink to the system board.

2. Remove the heat sink **(2)**.



3. Thoroughly clean the thermal material from the surfaces of the heat sink and the system board components each time the heat sink is removed. Replacement thermal material is included with the heat sink and system board spare part kits.

   Thermal paste is used on the integrated system board processor **(1)** and the heat sink **(2)**.



Reverse this procedure to install the heat sink.

System board

To remove the system board, use these procedures and illustrations.

Table 5-11 System board descriptions and part numbers

Description	Spare part number
System board (includes processor):	
All system boards use the following part numbers:	
xxxxxx-001: Non-Windows operating system	
xxxxxx-601: Windows 10 operating system	
AMD Ryzen 7 4700U processor	M08868-xx1
AMD Ryzen 5 4500U processor	M08867-xx1
AMD Ryzen 3 4300U processor	M08866-xx1
AMD Athlon Gold 3150U processor	M08865-xx1

Before removing the system board, follow these steps:

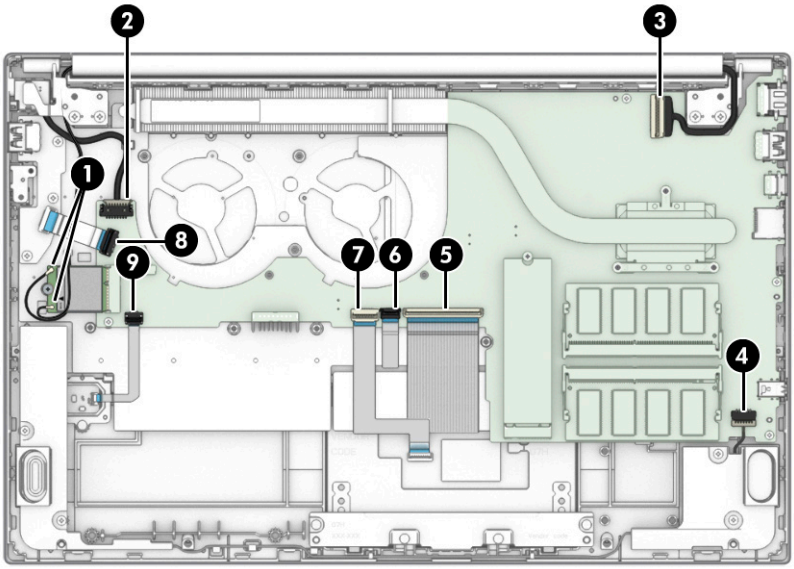
1. Prepare the computer for disassembly (Preparation for disassembly on page 27).
2. Remove the bottom cover (Bottom cover on page 27).
3. Remove the battery (see Battery on page 29).
4. Remove the fan (see Fan on page 37).

When you replace the system board, be sure to remove the following components (as applicable) from the defective system board and install them on the replacement system board:

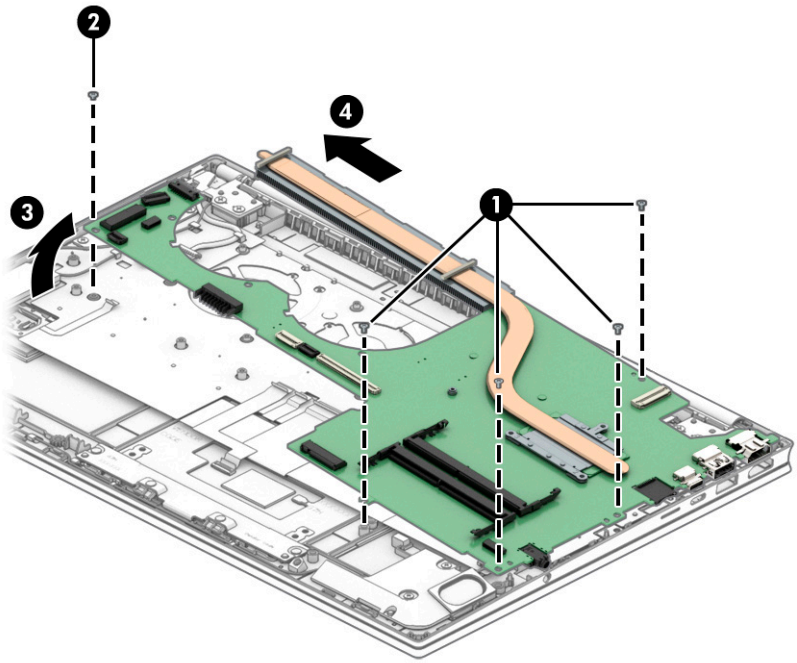
- Memory modules (see Memory modules on page 33).
- WLAN module (see WLAN module on page 30).
- Solid-state drive (see Solid-state drive on page 32).
- Heat sink (see Heat sink on page 38).

Remove the system board:

1. Disconnect the following cables from the system board:
   - WLAN antennas from the WLAN module **(1)**
   - Power connector (DC-in) board cable **(2)**
   - Display cable (ZIF) **(3)**
   - Speaker cable **(4)**
   - Keyboard cable (ZIF) **(5)**
   - Keyboard backlight cable (ZIF) **(6)** (select products only)
   - Touchpad cable (ZIF) **(7)**
   - USB board cable (ZIF) **(8)**
   - Fingerprint reader cable (ZIF) **(9)** (select products only)



2. Remove the four Phillips M2.0 × 4.0 screws **(1)** that secure the system board to the computer.
3. Remove the Phillips M2.0 × 2.0 screw **(2)** that secures the system board to the computer.
4. Lift the left side of system board **(3)**, and then pull the system board left and away from the connectors to remove it from the computer **(4)**.



Reverse this procedure to install the system board.

Touchpad

To remove the touchpad, use this procedure and illustration.

Table 5-12 Touchpad description and part number

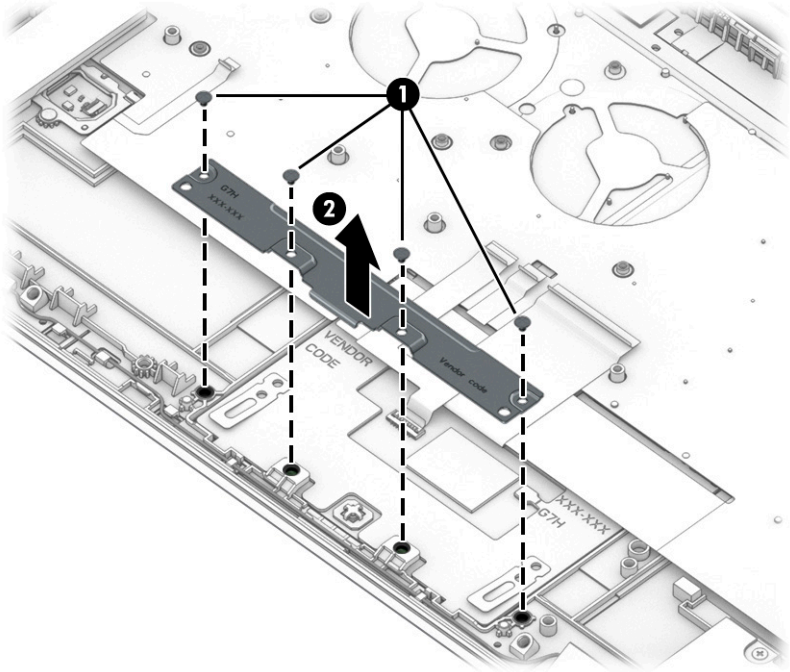
Description	Spare part number
Touchpad, fog blue	M08872-001
Touchpad, forest teal	M08873-001
Touchpad, natural silver	M08874-001
Touchpad, warm gold	M08875-001
Touchpad cable	M08876-001

Before removing the touchpad, follow these steps:

1. Prepare the computer for disassembly (Preparation for disassembly on page 27).
2. Remove the bottom cover (Bottom cover on page 27).
3. Remove the battery (see Battery on page 29).
4. Remove the fan (see Fan on page 37).
5. Remove the system board (see System board on page 40).

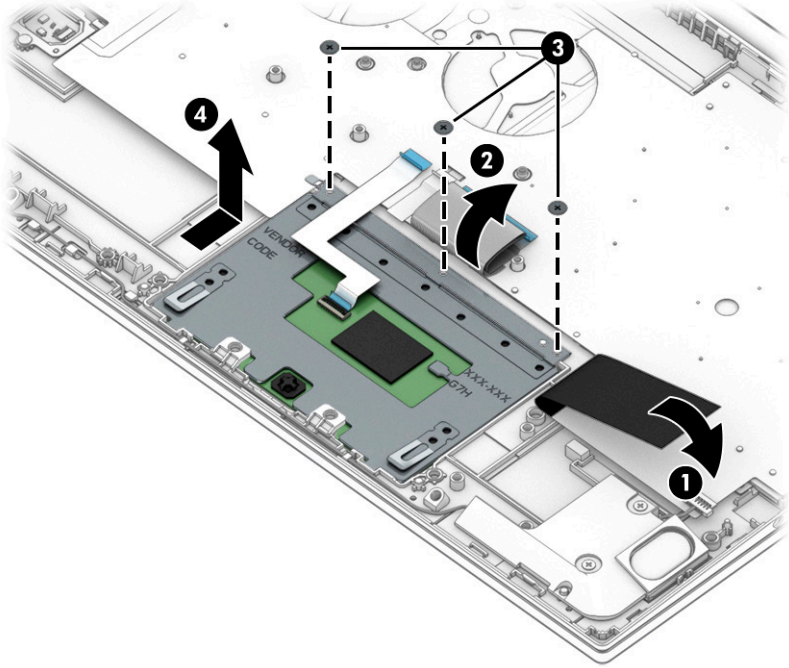
Remove the touchpad:

1. Remove the four Phillips M2.0 × 2.0 screws **(1)** from the touchpad bracket, and then remove the bracket from the computer **(2)**.



2. Remove the black protective tape from on top of the screws **(1)**.
3. Hold the keyboard cable up to allow access to the screws **(2)**.
4. Remove the three broad head Phillips M2.0 × 2.0 screws **(3)** from the touchpad.

5. Lift the top of the touchpad up and into the computer, and then lift it up to remove it **(4)**.



Reverse this procedure to install the touchpad.

Power connector cable

To remove the power connector cable, use this procedure and illustration.

Table 5-13 Power connector cable description and part number

Description	Spare part number
Power connector cable	M08887-001

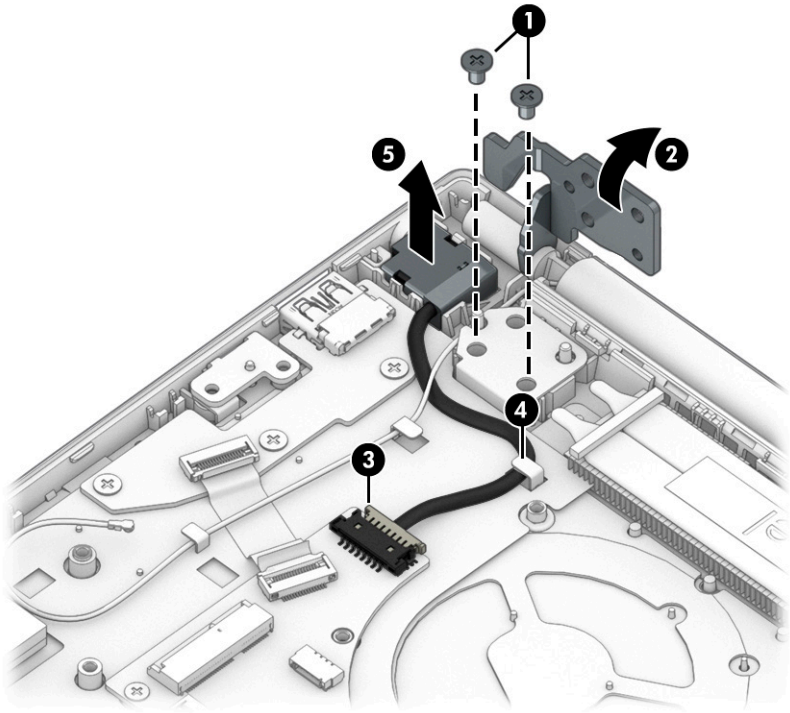
Before removing the power connector cable, follow these steps:

1. Prepare the computer for disassembly (Preparation for disassembly on page 27).
2. Remove the bottom cover (Bottom cover on page 27).
3. Remove the battery (see Battery on page 29).

Remove the power connector cable:

1. Remove the two Phillips M2.0 × 6.5 screws **(1)** from the right hinge.
2. Rotate the hinge off the power connector **(2)**.
3. Disconnect the power connector cable from the system board **(3)**.
4. Release the cable from the retention clip **(4)**.

5. Remove the power connector cable from the computer **(5)**.



Reverse this procedure to install the power connector cable.

Display assembly

To remove and disassemble the display assembly, use these procedures and illustrations.

NOTE: The display assembly is spared at the subcomponent level. For display assembly spare part information, see the individual removal subsections.

Before removing the display panel, follow these steps:

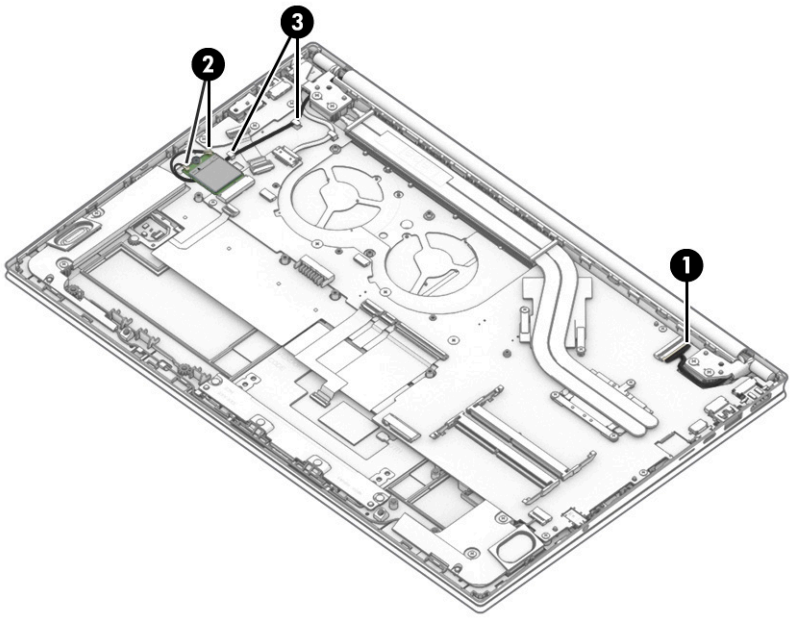
1. Prepare the computer for disassembly (Preparation for disassembly on page 27).
2. Remove the bottom cover (Bottom cover on page 27).
3. Remove the battery (see Battery on page 29).
4. Remove the WLAN module (see WLAN module on page 30).

Remove the display assembly:

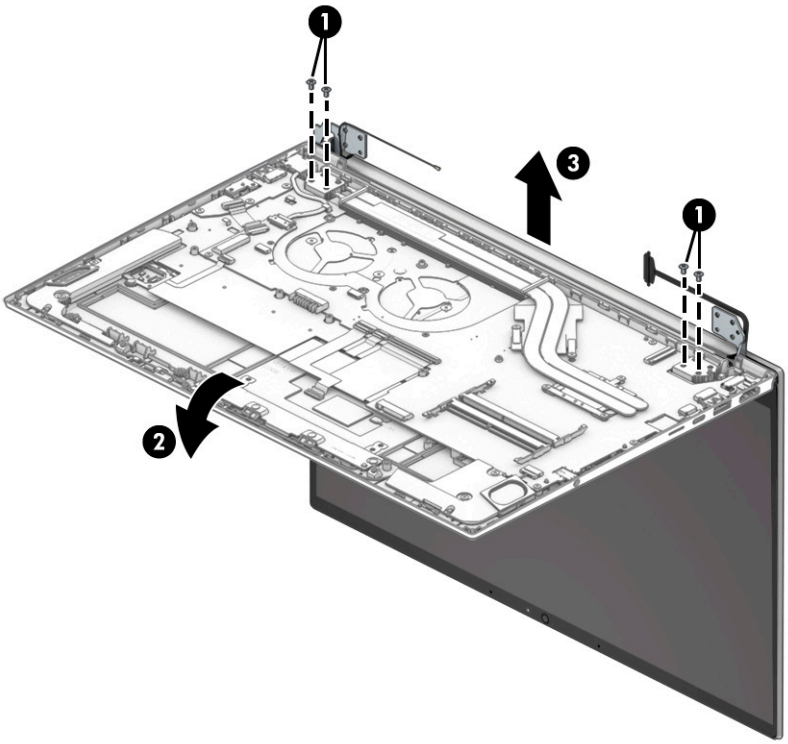
1. Disconnect the display cable from the system board ZIF connector **(1)**.
2. Disconnect the WLAN antenna cables **(2)** from the terminals on the WLAN module.

NOTE: The WLAN antenna cable labeled 1/MAIN connects to the WLAN module Main terminal. The WLAN antenna cable labeled 2/AUX connects to the WLAN module Aux terminal.

3. Release the WLAN antenna cables from the retention clips **(3)**.



4. Remove the four Phillips M2.5 × 6.5 screws **(1)** that secure the display assembly to the computer.
5. Open the display to open the hinges **(2)**.
6. Separate the display from the computer **(3)**.



7. If you need to remove the display bezel:

a. Use a flat, nonmarking tool **(1)** to release the top edge of the display bezel **(2)** from the display assembly.

b. Release the left and right edges of the display bezel **(3)** from the display assembly.

c. Release the bottom edge of the display bezel **(4)** from the display assembly.

d. Remove the display bezel **(5)** from the display assembly.

Bezel adhesive is available in the Adhesive Kit as spare part number M26981-001.

The bezel is available as the following spare part numbers:

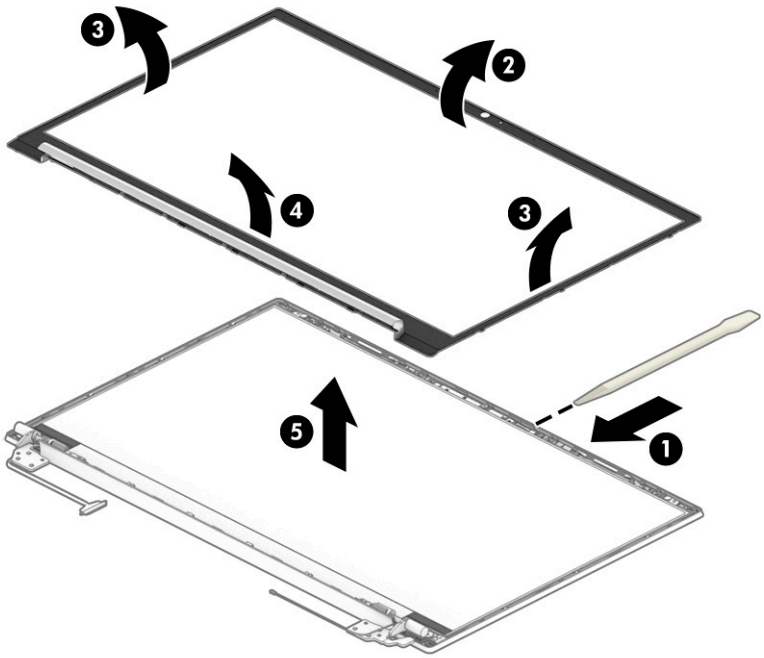
M08905-001: Ceramic white

M11934-001: Fog blue

M11935-001: Forest teal

M11936-001: Natural silver

M11937-001: Warm gold



8. If you need to remove the display panel:

a. The display panel is secured to the display enclosure with tape that is installed under the left and right sides of the panel. To remove the panel, use tweezers to grasp the end of the tape **(1)**. While turning the tweezers, wrap the tape around the tweezers as you continue to pull the tape out from behind the display panel **(2)**. You must pull the tape multiple times before it is completely removed.

b. Rotate the display panel over and place it next to the display enclosure **(3)**.

NOTE: Pull the tape out slowly and evenly to prevent it from breaking prematurely.

Display adhesive is available in the Adhesive Kit as spare part number M26981-001.

Display panels are available as the following spare part numbers:

M09819-001: Antiglare, UWVA, FHD

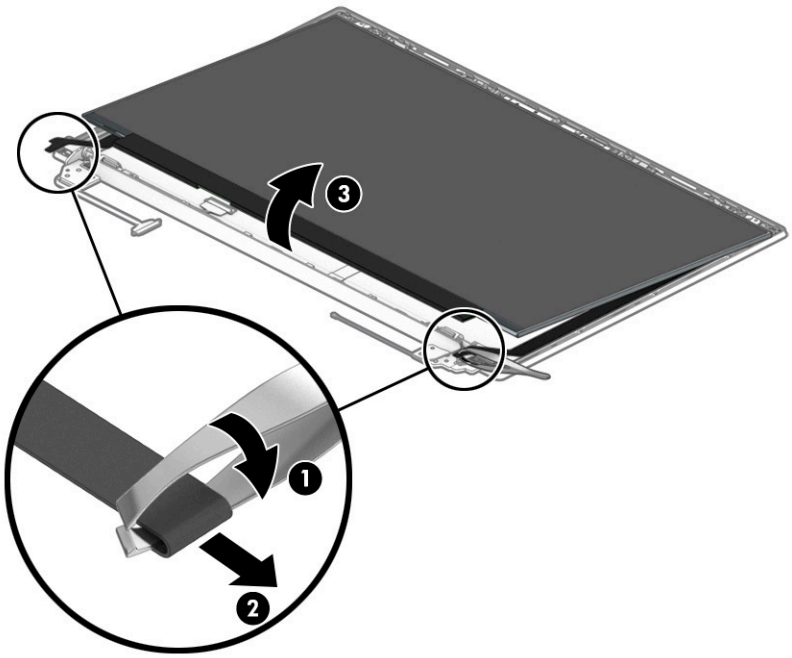
M09820-001: Antiglare, SVA, FHD

M09821-001: BrightView, SVA, HD

M09822-001: BrightView, UWVA, FHD, Touch-On Panel (TOP)

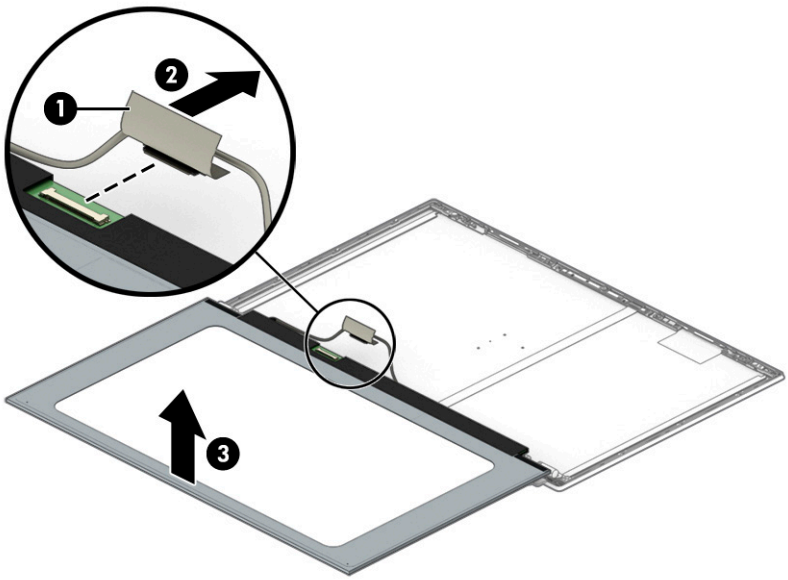
M09824-001: BrightView, UWVA, HD

M15993-001: BrightView, SVA, HD, Touch-On Panel (TOP)



c. Release the adhesive support strip **(1)** that secures the display panel cable connector to the display panel.

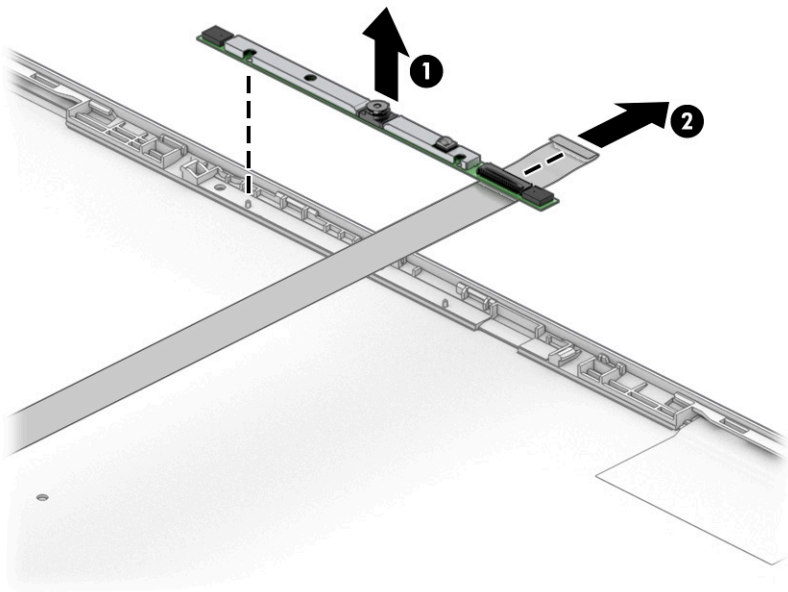
d. Disconnect the display panel cable **(2)** from the display panel, and then remove the display panel **(3)**.



9. If you need to remove the camera module:

   a. Use a tool to detach the camera module **(1)** from the display back cover. (The module is attached with double-sided adhesive.)

   b. Disconnect the cable from the module **(2)**. Note that the cable routes under module. The camera module is available as spare part number M08908-001.

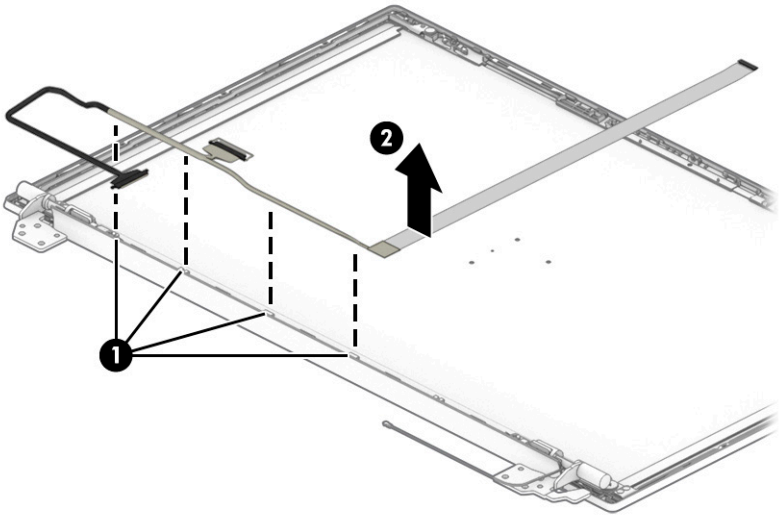


10. If you need to remove the display/camera cable, remove the cable from the routing along the bottom of the display rear cover **(1)**, and then peel the cable off the inside of the display back cover **(2)**.

    Display panel cables are available as the following spare part numbers:

    M08907-001: Nontouch display panels

    M08906-001: Touch display panels



11. If you need to remove the hinges from the display rear cover:

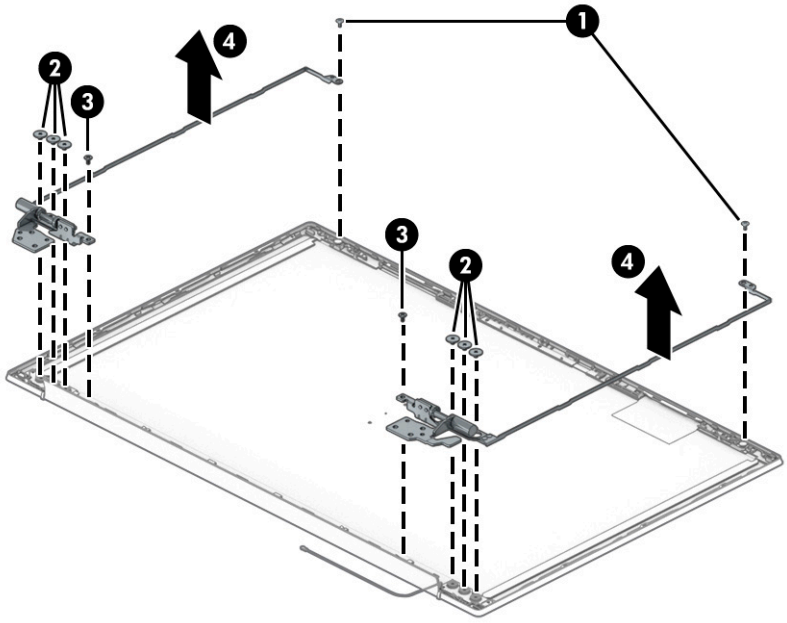
    a. Remove the Phillips M2.0 × 2.5 screw **(1)** from the top of each hinge.

    b. Remove the three Phillips M2.0 × 2.5 screws **(2)** from the bottom of each hinge.

    c. Remove the Phillips M2.0 × 3.0 screw **(3)** from the inside-bottom of each hinge.

    d. Remove the display hinges from the display back cover **(4)**.

    The display hinges are available as spare part number M08904-001.


1
2
3
4
2
3
4

12. Peel the wireless antennas **(1)** off the display back cover. The antennas are secured with adhesive. Release the wireless antenna cables from the retention clips and routing channels built into the sides of the display back cover **(2)**. Note that some models have only one antenna.

    The wireless cables and antennas are available as spare part number M08903-001 for dual antennas or M13002-001 for single antennas.

    Display back covers are available as the following spare part numbers:

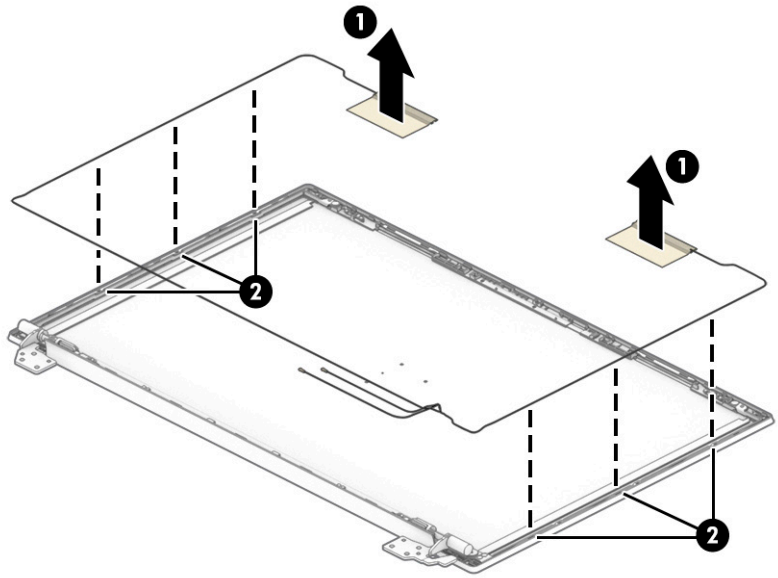
    M08898-001: Ceramic white

    M08899-001: Fog blue

    M08900-001: Forest teal

    M08901-001: Natural silver

    M08902-001: Warm gold



Reverse this procedure to reassemble and replace the display assembly.

Top cover with keyboard

The top cover with keyboard remains after removing all other spare parts from the computer. In this section, the first table provides the main spare part number for the top cover/keyboards. The second table provides the country codes.

Table 5-14 Top cover with keyboard descriptions and part numbers

Description	Spare part number
Top cover with keyboard, natural silver, fingerprint reader, backlit	M08910-xx1
Top cover with keyboard, natural silver, fingerprint reader, not backlit	M08911-xx1
Top cover with keyboard, natural silver, no fingerprint reader, backlit	M08912-xx1
Top cover with keyboard, natural silver, no fingerprint reader, not backlit	M08913-xx1
Top cover with keyboard, cloud blue, fingerprint reader, backlit	M08918-xx1
Top cover with keyboard, cloud blue, fingerprint reader, not backlit	M08919-xx1

Table 5-14 Top cover with keyboard descriptions and part numbers (continued)

Description	Spare part number
Top cover with keyboard, cloud blue, no fingerprint reader, backlit	M08920-xx1
Top cover with keyboard, cloud blue, no fingerprint reader, not backlit	M08921-xx1
Top cover with keyboard, luminous gold, fingerprint reader, backlit	M08922-xx1
Top cover with keyboard, luminous gold, fingerprint reader, not backlit	M08923-xx1
Top cover with keyboard, luminous gold, no fingerprint reader, backlit	M08924-xx1
Top cover with keyboard, luminous gold, no fingerprint reader, not backlit	M08925-xx1
Top cover with keyboard, light teal, fingerprint reader, backlit	M08926-xx1
Top cover with keyboard, light teal, fingerprint reader, not backlit	M08927-xx1
Top cover with keyboard, light teal, no fingerprint reader, backlit	M08928-xx1
Top cover with keyboard, light teal, no fingerprint reader, not backlit	M08929-xx1

Table 5-15 Spare part country codes

For use in country or region	Spare part number	For use in country or region	Spare part number	For use in country or region	Spare part number
Belgium	-A41	Iceland	-DD1	Solvenia	-BA1
Brazil	-201	India	-D61	South Korea	-AD1
Bulgaria	-261	Israel	-BB1	Spain	-071
Chile	-161	Italy	-061	Switzerland	-BG1
Czech Republic/Slovakia	-FL1	Japan	-291	Taiwan	-AB1
Denmark, Finland, and Norway	-DH1	The Netherlands	-B31	Thailand	-281
French Canada	-DB1	Northern Africa	-FP1	Turkey	-141
France	-051	Portugal	-131	Ukraine	-BD1
Germany	-041	Romania	-271	United Kingdom	-031
Greece	-151	Russia	-251	United States	-001
Hungary	-211	Saudi Arabia	-171		

6 Using Setup Utility (BIOS)

Setup Utility, or Basic Input/Output System (BIOS), controls communication between all the input and output devices on the system (such as disk drives, display, keyboard, mouse, and printer). Setup Utility (BIOS) includes settings for the types of devices installed, the startup sequence of the computer, and the amount of system and extended memory.

NOTE: To start Setup Utility on convertible computers, your computer must be in notebook mode and you must use the keyboard attached to your notebook.

Starting Setup Utility (BIOS)

You have several ways to access the Setup Utility (BIOS).

IMPORTANT: Use extreme care when making changes in Setup Utility (BIOS). Errors can prevent the computer from operating properly.

▲ Turn on or restart the computer and quickly press f10.

– or –

Turn on or restart the computer, quickly press esc, and then press f10 when the Start menu is displayed.

Updating Setup Utility (BIOS)

Updated versions of Setup Utility (BIOS) might be available on the HP website. Most BIOS updates on the HP website are packaged in compressed files called *SoftPaqs*. Some download packages contain a file named Readme.txt, which contains information regarding installing and troubleshooting the file.

Determining the BIOS version

To decide whether you need to update Setup Utility (BIOS), first determine the BIOS version on your computer.

To reveal the BIOS version information (also known as *ROM date* and *System BIOS*), use one of these options.

- HP Support Assistant
  1. Type `support` in the taskbar search box, and then select the **HP Support Assistant** app.

     – or –

     Select the question mark icon in the taskbar.
  2. Select **My notebook**, and then select **Specifications**.
- Setup Utility (BIOS)
  1. Start Setup Utility (BIOS) (see Starting Setup Utility (BIOS) on page 53).
  2. Select **Main**, and then make note of the BIOS version.
  3. Select **Exit**, select one of the options, and then follow the on-screen instructions.
- In Windows, press ctrl+alt+s.

To check for later BIOS versions, see Preparing for a BIOS update on page 54.

Preparing for a BIOS update

Be sure to follow all prerequisites before downloading and installing a BIOS update.

IMPORTANT: To reduce the risk of damage to the computer or an unsuccessful installation, download and install a BIOS update only when the computer is connected to reliable external power using the AC adapter. Do not download or install a BIOS update while the computer is running on battery power, docked in an optional docking device, or connected to an optional power source. During the download and installation, follow these instructions:

- Do not disconnect power from the computer by unplugging the power cord from the AC outlet.
- Do not shut down the computer or initiate Sleep.
- Do not insert, remove, connect, or disconnect any device, cable, or cord.

NOTE: If your computer is connected to a network, consult the network administrator before installing any software updates, especially system BIOS updates.

Downloading a BIOS update

After you review the prerequisites, you can check for and download BIOS updates.

1. Type `support` in the taskbar search box, and then select the **HP Support Assistant** app.

   – or –

   Select the question mark icon in the taskbar.

2. Select **Updates**, and then select **Check for updates and messages**.
3. Follow the on-screen instructions.
4. At the download area, follow these steps:

   a. Identify the most recent BIOS update and compare it to the BIOS version currently installed on your computer. If the update is more recent than your BIOS version, make a note of the date, name, or other identifier. You might need this information to locate the update later, after it has been downloaded to your hard drive.

   b. Follow the on-screen instructions to download your selection to the hard drive.

   Make a note of the path to the location on your hard drive where the BIOS update is downloaded. You will need to access this path when you are ready to install the update.

Installing a BIOS update

BIOS installation procedures vary. Follow any instructions that appear on the screen after the download is complete. If no instructions appear, follow these steps.

1. Type `file` in the taskbar search box, and then select **File Explorer**.
2. Select your hard drive designation. The hard drive designation is typically Local Disk (C:).
3. Using the hard drive path you recorded earlier, open the folder that contains the update.
4. Double-click the file that has an .exe extension (for example, *filename*.exe).

   The BIOS installation begins.

5. Complete the installation by following the on-screen instructions.

NOTE: After a message on the screen reports a successful installation, you can delete the downloaded file from your hard drive.

7 Backing up, restoring, and recovering

You can use Windows tools or HP software to back up your information, create a restore point, reset your computer, create recovery media, or restore your computer to its factory state. Performing these standard procedures can return your computer to a working state faster.

IMPORTANT: If you will be performing recovery procedures on a tablet, the tablet battery must be at least 70% charged before you start the recovery process.

IMPORTANT: For a tablet with a detachable keyboard, connect the tablet to the keyboard base before beginning any recovery process.

Backing up information and creating recovery media

These methods of creating recovery media and backups are available on select products only.

Using Windows tools for backing up

HP recommends that you back up your information immediately after initial setup. You can do this task either using Windows Backup locally with an external USB drive or using online tools.

IMPORTANT: Windows is the only option that allows you to back up your personal information. Schedule regular backups to avoid information loss.

NOTE: If computer storage is 32 GB or less, Microsoft System Restore is disabled by default.

Using the HP Cloud Recovery Download Tool to create recovery media (select products only)

You can use the HP Cloud Recovery Download Tool to create HP Recovery media on a bootable USB flash drive.

For details:

- Go to http://www.hp.com/support, search for HP Cloud Recovery, and then select the result that matches the type of computer that you have.

NOTE: If you cannot create recovery media yourself, contact support to obtain recovery discs. Go to http://www.hp.com/support, select your country or region, and then follow the on-screen instructions.

IMPORTANT: HP recommends that you follow the Restoring and recovery methods on page 57 to restore your computer before you obtain and use the HP recovery discs. Using a recent backup can return your machine to a working state sooner than using the HP recovery discs. After the system is restored, reinstalling all the operating system software released since your initial purchase can be a lengthy process.

Restoring and recovering your system

You have several tools available to recover your system both within and outside of Windows if the desktop cannot load.

HP recommends that you attempt to restore your system using the Restoring and recovery methods on page 57.

Creating a system restore

System Restore is available in Windows. The System Restore software can automatically or manually create restore points, or snapshots, of the system files and settings on the computer at a particular point.

When you use System Restore, it returns your computer to its state at the time you made the restore point. Your personal files and documents should not be affected.

Restoring and recovery methods

After you run the first method, test to see whether the issue still exists before you proceed to the next method, which might now be unnecessary.

1. Run a Microsoft System Restore.
2. Run Reset this PC.
3. Recover using HP Recovery media. For more information, see Recovering using HP Recovery media on page 57.

For more information about the first two methods, see the Get Help app:

Select the **Start** button, select the **Get Help** app, and then enter the task you want to perform.

NOTE: You must be connected to the internet to access the Get Help app.

Recovering using HP Recovery media

You can use HP Recovery media to recover the original operating system and software programs that were installed at the factory. On select products, it can be created on a bootable USB flash drive using the HP Cloud Recovery Download Tool.

For details, see Using the HP Cloud Recovery Download Tool to create recovery media (select products only) on page 56.

NOTE: If you cannot create recovery media yourself, contact support to obtain recovery discs. Go to http://www.hp.com/support, select your country or region, and then follow the on-screen instructions.

To recover your system:

- Insert the HP Recovery media, and then restart the computer.

NOTE: HP recommends that you follow the Restoring and recovery methods on page 57 to restore your computer before you obtain and use the HP recovery discs. Using a recent backup can return your machine to a working state sooner than using the HP recovery discs. After the system is restored, reinstalling all the operating system software released since your initial purchase can be a lengthy process.

Changing the computer boot order

If your computer does not restart using the HP Recovery media, you can change the computer boot order, the order of devices listed in BIOS for startup information. You can select an optical drive or a USB flash drive, depending on the location of your HP Recovery media.

IMPORTANT: For a tablet with a detachable keyboard, connect the tablet to the keyboard base before beginning these steps.

To change the boot order:

1. Insert the HP Recovery media.
2. Access the system **Startup** menu.
   - For computers or tablets with keyboards attached, turn on or restart the computer or tablet, quickly press esc, and then press f9 for boot options.
   - For tablets without keyboards, turn on or restart the tablet, quickly press and hold the volume up button, and then select **f9**.

     – or –

     Turn on or restart the tablet, quickly press and hold the volume down button, and then select **f9**.
3. Select the optical drive or USB flash drive from which you want to boot, and then follow the on-screen instructions.

Using HP Sure Recover (select products only)

Select computer models are configured with HP Sure Recover, a PC OS recovery solution built into the hardware and software. HP Sure Recover can fully restore the HP OS image without installed recovery software.

Using HP Sure Recover, an administrator or user can restore the system and install:

- Latest version of the operating system
- Platform-specific device drivers
- Software applications, in the case of a custom image

To access the latest documentation for HP Sure Recover, go to http://www.hp.com/support. Follow the on-screen instructions to find your product and locate your documentation.

8 Using HP PC Hardware Diagnostics

You can use the HP PC Hardware Diagnostics utility to determine whether your computer hardware is running properly. The three versions are HP PC Hardware Diagnostics Windows, HP PC Hardware Diagnostics UEFI (Unified Extensible Firmware Interface), and (for select products only) Remote HP PC Hardware Diagnostics UEFI, a firmware feature.

Downloading the HP PC Hardware Diagnostics Windows from the Microsoft Store

You can download the HP PC Hardware Diagnostics Windows from the Microsoft Store.

1. Select the Microsoft Store app on your desktop or enter `Microsoft Store` in the taskbar search box.
2. Enter `HP PC Hardware Diagnostics Windows` in the **Microsoft Store** search box.
3. Follow the on-screen directions.

The tool downloads to the selected location.

Customizing Remote HP PC Hardware Diagnostics UEFI settings

Using the Remote HP PC Hardware Diagnostics setting in Computer Setup (BIOS), you can perform several customizations.

- Set a schedule for running diagnostics unattended. You can also start diagnostics immediately in interactive mode by selecting **Execute Remote HP PC Hardware Diagnostics**.
- Set the location for downloading the diagnostic tools. This feature provides access to the tools from the HP website or from a server that has been preconfigured for use. Your computer does not require the traditional local storage (such as a hard drive or USB flash drive) to run remote diagnostics.
- Set a location for storing the test results. You can also set the user name and password that you use for uploads.
- Display status information about the diagnostics run previously.

To customize Remote HP PC Hardware Diagnostics UEFI settings, follow these steps:

1. Turn on or restart the computer, and when the HP logo appears, press f10 to enter Computer Setup.
2. Select **Advanced**, and then select **Settings**.
3. Make your customization selections.
4. Select **Main**, and then **Save Changes and Exit** to save your settings.

Your changes take effect when the computer restarts.

9 Specifications

This chapter provides specifications for your computer.

Computer specifications

This section provides specifications for your computer. When traveling with your computer, the computer dimensions and weights, as well as input power ratings and operating specifications, provide helpful information.

Table 9-1 Computer specifications

	Metric	U.S.
Dimensions		
Width	**360.2 mm**	14.18 in
Depth	**234 mm**	9.21 in
Height (front to back)	**17.9 mm**	0.71 in
Weight	**1750 g**	3.86 lb
Input power		
Operating voltage and current	19.5 V dc @ 3.33 A – 65 W	
	19.5 V dc @ 2.31 A – 45 W	
Temperature		
Operating	**5°C to 35°C**	41°F to 95°F
Nonoperating	**–20°C to 60°C**	–4°F to 140°F
Relative humidity (noncondensing)		
Operating	10% to 90%	
Nonoperating	5% to 95%	
Maximum altitude (unpressurized)		
Operating	**–15 m to 3,048 m**	–50 ft to 10,000 ft
Nonoperating	**–15 m to 12,192 m**	–50 ft to 40,000 ft

NOTE: Applicable product safety standards specify thermal limits for plastic surfaces. The device operates well within this range of temperatures.

39.6 cm (15.6 in) display specifications

This section provides specifications for your display.

Table 9-2 Display specifications

	Metric	U.S.
Active diagonal size	**39.6 cm**	15.6 in
Resolution	1368 × 766 (HD) 1920 × 1080 (FHD)	
Surface treatment	Antiglare (FHD panels) BrightView (HD, FHD panel)	
Brightness	220 nits (HD panels) 250 nits (HD, FHD panels)	
Viewing angle	SVA (HD panels) UWVA (HD, FHD panels)	
Backlight	WLED	
Display panel interface	eDP	

Solid-state drive specifications

This section provides specifications for your solid-state drives.

Table 9-3 Solid-state drive specifications

	256 GB*	512 GB*	1 TB*
Dimensions			
Height	1.0 mm	1.0 mm	1.0 mm
Length	50.8 mm	50.8 mm	50.8 mm
Width	28.9 mm	28.9 mm	28.9 mm
Weight	< 10 g	< 10 g	< 10 g
Interface type	PCIe	PCIe	PCIe
Ready time, maximum (to not busy)	1.0 ms	< 1.0 ms	1.0 ms
Access times, logical	0.1 ms	0.1 ms	0.1 ms
Transfer rate			
Sequential read	up to 2150 MB/s	up to 2150 MB/s	up to 2150 MB/s
Random read	Up to 300,000 IOPs	Up to 300,000 IOPs	Up to 300,000 IOPs
Sequential write	up to 1550 MB/s	up to 1550 MB/s	up to 1550 MB/s
Random write	Up to 100,000 IOPs	Up to 100,000 IOPs	Up to 100,000 IOPs
Total logical sectors	468,883,296	1,000,215,216	1,500,336,388
Operating temperature	**0°C to 70°C** (32°F to 158°F)		

Table 9-3 Solid-state drive specifications (continued)

	256 GB*	512 GB*	1 TB*
*1 GB = 1 billion bytes when referring to hard drive storage capacity. Actual accessible capacity is less. Actual drive specifications may differ slightly.			
NOTE: Certain restrictions and exclusions apply. Contact support for details.			

Solid-state drive specifications (SATA-3)

This section provides specifications for your solid-state drive.

Table 9-4 Solid-state drive specifications

	128 GB*
Dimensions	
Height	1.35 mm
Weight	< 10 g
Interface type	SATA-3
Ready time, maximum (to not busy)	1.0 ms
Access times, logical	0.1 ms
Transfer rate	up to 540 MB/s
Total logical sectors	234,441,648
Operating temperature	**0°C to 70°C** (32°F to 158°F)
*1 GB = 1 billion bytes when referring to hard drive storage capacity. Actual accessible capacity is less. Actual drive specifications may differ slightly.	
NOTE: Certain restrictions and exclusions apply. Contact support for details.	

10 Power cord set requirements

This chapter provides power cord requirements for countries and regions.

The wide-range input feature of the computer permits it to operate from any line voltage from 100 V ac to 120 V ac, or from 220 V ac to 240 V ac.

The 3-conductor power cord set included with the computer meets the requirements for use in the country or region where the equipment is purchased.

Power cord sets for use in other countries or regions must meet the requirements of the country and region where the computer is used.

Requirements for all countries

These power cord requirements are applicable to all countries and regions.

- The length of the power cord set must be at least **1.0 m** (3.3 ft) and no more than **2.0 m** (6.5 ft).
- All power cord sets must be approved by an acceptable accredited agency responsible for evaluation in the country or region where the power cord set will be used.
- The power cord sets must have a minimum current capacity of 10 A and a nominal voltage rating of 125 V ac or 250 V ac, as required by the power system of each country or region.
- The appliance coupler must meet the mechanical configuration of an EN 60 320/IEC 320 Standard Sheet C13 connector for mating with the appliance inlet on the back of the computer.

Requirements for specific countries and regions

To determine power cord requirements for specific countries and regions, use this table.

Table 10-1 Power cord requirements for specific countries and regions

Country/region	Accredited agency	Applicable note number
Argentina	IRAM	1
Australia	SAA	1
Austria	OVE	1
Belgium	CEBEC	1
Brazil	ABNT	1
Canada	CSA	2
Chile	IMQ	1
Denmark	DEMKO	1
Finland	FIMKO	1
France	UTE	1
Germany	VDE	1

Table 10-1 Power cord requirements for specific countries and regions (continued)

Country/region	Accredited agency	Applicable note number
India	BIS	1
Israel	SII	1
Italy	IMQ	1
Japan	JIS	3
The Netherlands	KEMA	1
New Zealand	SANZ	1
Norway	NEMKO	1
The People's Republic of China	CCC	4
Saudi Arabia	SASO	7
Singapore	PSB	1
South Africa	SABS	1
South Korea	KTL	5
Sweden	SEMKO	1
Switzerland	SEV	1
Taiwan	BSMI	6
Thailand	TISI	1
The United Kingdom	ASTA	1
The United States	UL	2

1. The flexible cord must be Type H05VV-F, 3-conductor, 0.75 mm² conductor size. Power cord set fittings (appliance coupler and wall plug) must bear the certification mark of the agency responsible for evaluation in the country or region where it will be used.
2. The flexible cord must be Type SVT/SJT or equivalent, No. 18 AWG, 3-conductor. The wall plug must be a two-pole grounding type with a NEMA 5-15P (15 A, 125 V ac) or NEMA 6-15P (15 A, 250 V ac) configuration. CSA or C-UL mark. UL file number must be on each element.
3. The appliance coupler, flexible cord, and wall plug must bear a T mark and registration number in accordance with the Japanese Dentori Law. The flexible cord must be Type VCTF, 3-conductor, 0.75 mm² or 1.25 mm² conductor size. The wall plug must be a two-pole grounding type with a Japanese Industrial Standard C8303 (7 A, 125 V ac) configuration.
4. The flexible cord must be Type RVV, 3-conductor, 0.75 mm² conductor size. Power cord set fittings (appliance coupler and wall plug) must bear the CCC certification mark.
5. The flexible cord must be Type H05VV-F 3-conductor, 0.75 mm² conductor size. KTL logo and individual approval number must be on each element. Approval number and logo must be printed on a flag label.
6. The flexible cord must be Type HVCTF 3-conductor, 1.25 mm² conductor size. Power cord set fittings (appliance coupler, cable, and wall plug) must bear the BSMI certification mark.
7. For 127 V ac, the flexible cord must be Type SVT or SJT 3-conductor, 18 AWG, with plug NEMA 5-15P (15 A, 125 V ac), with UL and CSA or C-UL marks. For 240 V ac, the flexible cord must be Type H05VV-F 3-conductor, 0.75 mm² or 1.00 mm² conductor size, with plug BS 1363/A with BSI or ASTA marks.

11 Recycling

When a nonrechargeable or rechargeable battery has reached the end of its useful life, do not dispose of the battery in general household waste. Follow the local laws and regulations in your area for battery disposal.

HP encourages customers to recycle used electronic hardware, HP original print cartridges, and rechargeable batteries. For more information about recycling programs, see the HP website at http://www.hp.com/recycle.

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