# HP mt44 Mobile Thin Client

## Maintenance and Service Guide

First Edition: May 2018

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**Product notice**

This user 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 of Windows. This computer may require upgraded and/or separately purchased hardware, drivers and/or software to take full advantage of Windows functionality. Go to http://www.microsoft.com for details.

**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.

## Important Notice about Customer Self-Repair Parts

⚠ **CAUTION:** Your computer includes Customer Self-Repair parts and parts that should only be accessed by an authorized service provider. See Chapter 5, "Removal and replacement procedures for Customer Self-Repair parts," for details. Accessing parts described in Chapter 6, "Removal and replacement procedures for Authorized Service Provider only parts," can damage the computer or void your warranty.

## Safety warning notice

⚠ **WARNING!** To reduce the possibility of heat-related injuries or of overheating the device, do not place the device directly on your lap or obstruct the device air vents. Use the device 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 contact the skin or a soft surface, such as pillows or rugs or clothing, during operation. The device and the AC adapter comply with the user-accessible surface temperature limits defined by the International Standard for Safety of Information Technology Equipment (IEC 60950-1).

# Table of contents

# 1 Product description

| Category | Description |
|---|---|
| **Product Name** | HP mt44 Mobile Thin Client |
| **Processors** | **AMD® Ryzen™ mobile processors with Radeon™ Vega Graphics:** |
| | AMD Ryzen 3 PRO 2300U |
| **Chipset** | AMD Ryzen; integrated with processor |
| **Graphics** | Support HD decode, DX12, HDMI 2.0, HDCP 2.2 via HDMI/DisplayPort up to 4K @ 60 Hz |
| | Supports four independent displays through docking stations as follows: |
| | • HP UltraSlim Docking Station: Maximum resolution - 2K @ 60 Hz (DisplayPort 1) and 2K @ 60 Hz (DisplayPort 2) and 1920 × 1200 @ 60 Hz (VGA) |
| | • HP Elite USB-C Dock G3 and HP USB-C Dock G4: Maximum resolution - 2K @ 60 Hz (DP1) and 2K @ 60 Hz (DisplayPort 2) and 1920 × 1200 @ 60 Hz (HDMI). |
| | • HP Thunderbolt Dock 120 W G2: Maximum resolution - 2560 × 1440 @ 60 Hz (DisplayPort 1) and 1920 × 1080 @ 60 Hz (DisplayPort 2) and 1920 × 1080 @ 60 Hz (VGA) |
| **Panel** | Supports narrow bezel |
| | **35.6-cm (14.0-in), UWVA, non-touch:** |
| | Full high-definition (FHD) (1920×1080), anti glare (AG), 220 nits, 45% CG, eDP, slim, without camera |
| | FHD (1920×1080), anti glare (AG), 220 nits, 45% CG, eDP slim, with HD camera |
| | FHD (1920×1080), anti glare (AG), 220 nits, 45% CG, eDP, slim, with HD + IR camera |
| | FHD (1920×1080), anti glare (AG), 220 nits, 45% CG, eDP, slim, without camera, with WWAN |
| | FHD (1920×1080), anti glare (AG), 220 nits, 45% CG, eDP, slim, with HD camera, with WWAN |
| | FHD (1920×1080), anti glare (AG), 220 nits, 45% CG, eDP, slim, with HD + IR camera, with WWAN |
| | FHD (1920×1080), anti glare (AG), privacy, 700 nits, 72% CG, eDP + PSR, ultra slim, with HD + IR camera, with WWAN |
| | **35.6-cm (14.0-in), UWVA, touch screen:** |
| | FHD (1920×1080), 220 nits, 45% CG, eDP, slim, with HD + IR camera, with WWAN |
| **Memory** | Two memory module slots |
| | Memory is customer accessible/upgradeable |
| | DDR4-2400 dual channel support |
| | Supports up to 8 GB of system RAM in the following configurations: |
| | • 16384 MB (16384 MB×1 or 8192 MB×2) |
| | • 12288 MB (8192 MB×1 + 4096 MB×1) |
| | • 8192 MB (8192 MB×1 or 4096 MB×2) |
| | • 4096 MB (4096 MB×1) |

| Category | Description |
|---|---|
| **Primary storage** | **M.2 solid-state drives (2280):** |
| | 128 GB, SATA-3, SS, TLC |
| **Audio and video** | HP Bang & Olufsen Audio |
| | Multi-array microphone (including World-Facing 3rd microphone) |
| | Stereo speakers (2) (13 mm × 38 mm × 4 mm) |
| | Camera HD RGB 720p (select models only) |
| | Camera HD + IR RGB 720p (select models only) |
| | Camera privacy shutter (only with non-touch camera panels) |
| | Supports WDR (Wide Dynamic Range) |
| **Ethernet** | Realtek PCIe GbE Family Controller 10/100/1000 with DASH Support |
| | RTL8111EPH-CG |
| | The following support S3/S4/ wake on LAN: embedded NIC. |
| | *The following support S3/S5 wake on LAN/HBMA (via out of band): HP Elite USB-C Dock G3, HP USB-C Dock G4, HP USB-C Universal Dock, HP Thunderbolt Dock 120 W, and HP USB-C Mini Dock.<br>* The following support S3 wake on LAN/HBMA (via Windows® operating system): HP Elite USB-C Dock G2, HP Executive Travel Hub, HP 301 Travel Adapter. |
| **Wireless networking** | **WPAN Bluetooth:** |
| | Integrated wireless personal area network (PAN) supported by Bluetooth® 4.2 combo card |
| | **Wireless local area network (WLAN)** (select models only): |
| | Integrated WLAN options with dual antennas (M.2 2230 socket PCIe/USB) |
| | Supports the following WLAN formats: |
| | • Intel Dual band wireless-AC 8265 802.11ac 2×2 WiFi + Bluetooth 4.2 Combo Adapter (non-vPro) |
| | Two WLAN antennas built into bottom of display assembly |
| | Compatible with Miracast-certified devices |
| | Bluetooth Disabled IOPT |
| | Support S3 wake on Wireless LAN |
| | Supports WLAN/LAN/WWAN switching |
| | Support HP Sure Connect with Client Side Load Balancing |
| | **Near-Field Communication (NFC)** (select models only): |
| | NXP NPC300 Near Field Communication Module (NFC Mirage WNC XRAV-1 [NXP NPC300 I2C 10 mm x 17 mm]) |
| | NFC antenna |
| | **Wireless wide area network (WWAN)** (select models only): |
| | Integrated wireless wide area network (WWAN) options by way of wireless module |
| | Two WWAN antennas (world wide 5 band, configured at top of display panel) |
| | Supports the following WWAN formats: |

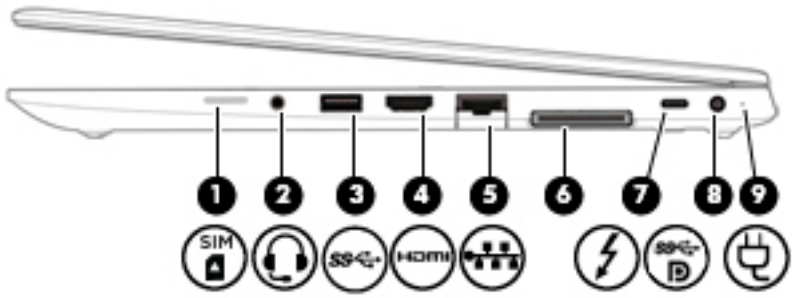
| Category | Description |
|---|---|
| | • LTE CAT4: Huawei HP lt4132, LTE/HSPA+ w/GPS M.2 |
| | • LTE CAT9: Fibocom lt4210 LTE/HSPA+ w/GPS |
| | WWAN modules are compatible with a programmable removable eSIM |
| | Support for WWAN after market option (AMO, select models only) |
| **Ports** | USB Type-C (Alt Mode) |
| | USB 3.1 Gen 1 port |
| | USB 3.1 Gen 1 charging port |
| | HDMI 2.0 |
| | RJ-45/Ethernet |
| | Docking connector |
| | Audio-out (headphone)/audio-in (microphone) combo jack |
| | Power connector |
| | HP Elite USB-C Dock G3 |
| | HP Elite USB-C Dock G4 |
| | HP UltraSlim Docking Station |
| **Keyboard/ pointing devices** | **Keyboard:** |
| | HP Collaboration Keyboard |
| | • Dual point, non-backlit, spill resistant with drain |
| | • Dual point, backlit, spill resistant with drain, with HP Dura Keys |
| | • Dual point, backlit, spill resistant with drain, with HP Dura Keys, privacy |
| | **TouchPad:** |
| | Support for Microsoft Precision TouchPad Default Gestures |
| | Firmware PTP (Point to Point) with Filter Driver |
| | Support for 'No Hybrid Mode' |
| **Power requirements** | **Battery:** |
| | HP Long Life Lithium Polymer Soft Pack Battery, 3-cell, 50 WHr |
| | HP Fast Charge Technology |
| | **AC adapter:** |
| | 65 W "Smart" right angle, 4.5 mm |
| | 65 W "Smart" right angle, 4.5 mm - Argentina |
| | 65 W "Smart" right angle, 4.5 mm - EM |
| | 65 W Straight USB Type-C |
| | 45 W "Smart" right angle, 4.5 mm |
| | 45 W "Smart" right angle, 4.5 mm - Argentina |

| Category | Description |
|---|---|
| | 45 W “Smart” right angle, 4.5 mm, 2-prong (Japan only) |
| | 45 W Straight USB Type-C |
| | **Power cord:** |
| | 2 wire plug (C7), 1 m |
| | 3 wire plug (C5), 1.8 m |
| | 3 wire plug (C5), 1 m |
| | Duckhead power cord (C5), 1.0 m |
| | Duckhead power cord (C5), 1.8 m |
| **Security** | Security lock |
| | Trusted Platform Module (TPM) 2.0 (Infineon, soldered down) |
| | Touch fingerprint sensor (landed, touch with 8 × 8 sensor) (select models only) |
| | Smart card reader (active) (select models only) |
| | Preboot authentication (password, smart card) |
| | Hardware-enforced firmware protection: HP Hardware Root of Trust + HP Sure Start Gen4 |
| **Operating system** | **Operating system version:** |
| | Windows 10 IoT Enterprise |
| **Serviceability** | **End user replaceable parts:** |
| | AC adapter |
| | Solid-state drive |
| | Memory module |
| | WLAN module |
| | WWAN module |
| | Keyboard |

# 2 Components

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

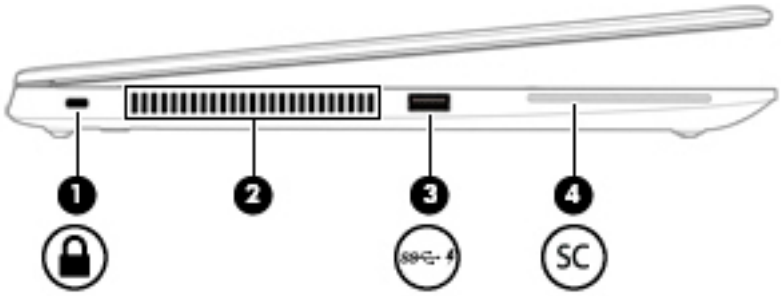
## Right




| Component | | | Description |
|---|---|---|---|
| **(1)** | SIM | SIM card slot or plug | Supports a wireless subscriber identity module (SIM) card or plug.<br><br>**NOTE:** All models have a SIM card slot and icon, but models that do not have the HP Mobile Broadband Module, a wireless wide area network (WWAN) device, installed at the factory are shipped with a non-removable plug inserted into the slot. |
| **(2)** | | 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.<br><br>**WARNING!** To reduce the risk of personal injury, adjust the volume before putting on headphones, earbuds, or a headset. For additional safety information, refer to the *Regulatory, Safety, and Environmental Notices*.<br><br>To access this guide:<br><br>▲ Select the **Start** button, select **HP Help and Support**, and then select **HP Documentation**.<br><br>– or –<br><br>▲ Select the **Start** button, select **HP**, and then select **HP Documentation**.<br><br>**NOTE:** When a device is connected to the jack, the computer speakers are disabled. |
| **(3)** | SS | USB 3.x SuperSpeed port | Connects a USB device, such as a cell phone, camera, activity tracker, or smartwatch, and provides high-speed data transfer. |
| **(4)** | HDMI | HDMI port | Connects an optional video or audio device, such as a high-definition television, any compatible digital or audio |

| Component | | | Description |
|---|---|---|---|
| | | | component, or a high-speed High Definition Multimedia Interface (HDMI) device. |
| **(5)** |  | RJ-45 (network) jack/status lights | Connects a network cable.<br>• Green (left): The network is connected.<br>• Amber (right): Activity is occurring on the network. |
| **(6)** | | Docking connector | Connects an optional docking device. |
| **(7)** |  | USB Type-C power connector and Thunderbolt™ port with HP Sleep and Charge | Connects an AC adapter that has a USB Type-C connector, supplying power to the computer and, if needed, charging the computer battery.<br>– and –<br>Connects and charges most USB devices that have a Type-C connector, such as a cell phone, camera, activity tracker, or smartwatch, and provides high-speed data transfer.<br>– and –<br>Connects a display device that has a USB Type-C connector, providing DisplayPort output.<br>**NOTE:** Your computer may also support a Thunderbolt docking station.<br>**NOTE:** Cables and/or adapters (purchased separately) may be required. |
| **(8)** |  | Power connector | Connects an AC adapter. |
| **(9)** | | Battery light | When AC power is connected:<br>• White: The battery charge is greater than 90 percent.<br>• Amber: The battery charge is from 0 to 90 percent.<br>• Off: The battery is not charging.<br>When AC power is disconnected (battery not charging):<br>• Blinking amber: The battery has reached a low battery level. When the battery has reached a critical battery level, the battery light begins blinking rapidly.<br>• Off: The battery is not charging. |

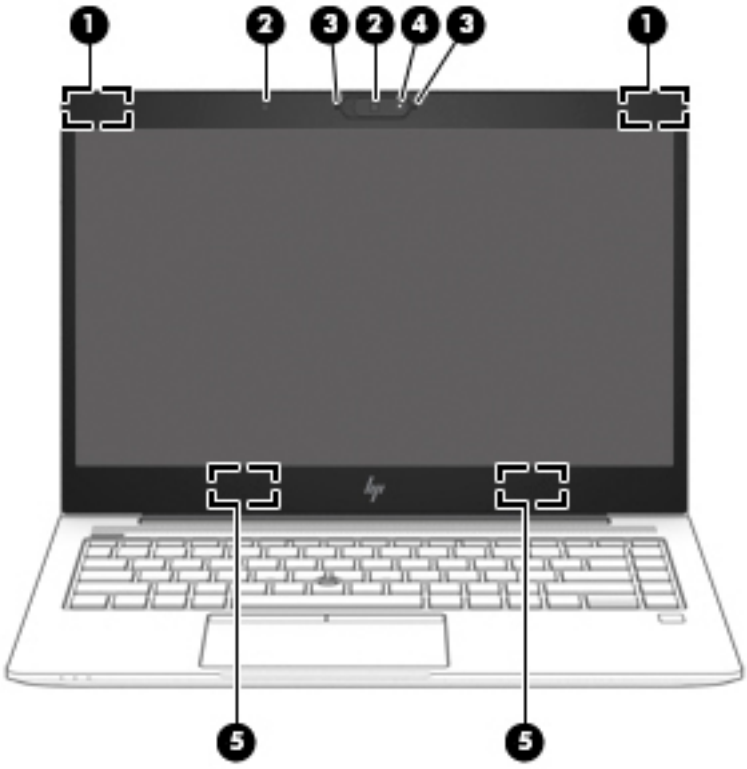
# Left

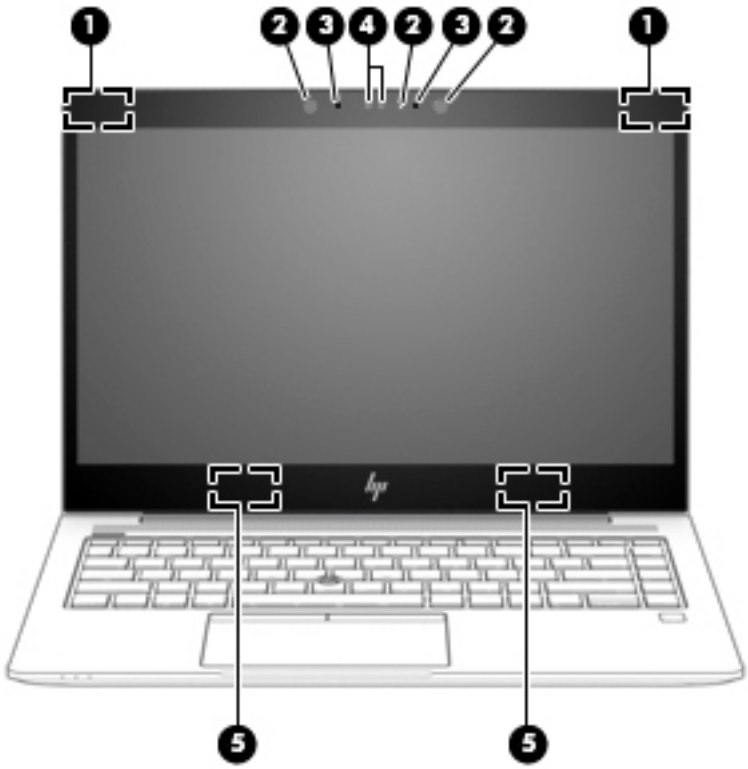



| Component | | | Description |
|---|---|---|---|
| (1) | | Security cable slot | Attaches an optional security cable to the computer.<br><br>**NOTE:** The security cable is designed to act as a deterrent, but it may not prevent the computer from being mishandled or stolen. |
| (2) | | Vent | Enables airflow to cool internal components.<br><br>**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. |
| (3) | | USB 3.x SuperSpeed port with HP Sleep and Charge | Connects a USB device, provides high-speed data transfer, and even when the computer is off, charges most products such as a cell phone, camera, activity tracker, or smartwatch. |
| (4) | SC | Smart card reader | Supports optional smart cards. |

# Display

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






| Component | | Description |
|---|---|---|
| **(1)** | WWAN antennas* (select products only) | Send and receive wireless signals to communicate with wireless wide area networks (WWANs). |
| **(2)** | Camera light(s) (select products only) | On: One or more cameras are in use. |
| **(3)** | Internal microphones | Record sound. |
| **(4)** | Camera(s) (select products only) | Allow(s) you to video chat, record video, and record still images.<br>**NOTE:** Camera functions vary depending on the camera hardware and software installed on your product. |
| **(5)** | WLAN antennas* (select products only) | Send and receive wireless signals to communicate with wireless local area networks (WLANs). |

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

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:

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– or –

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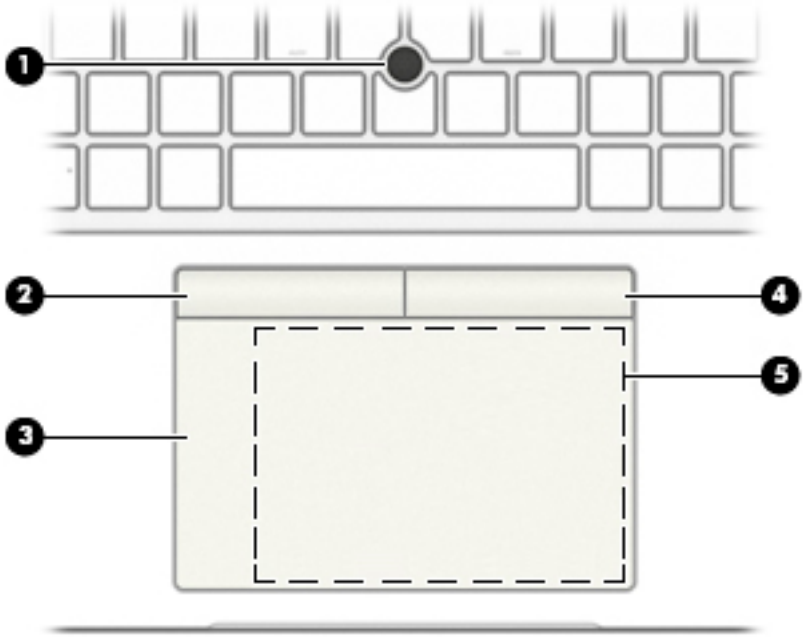
# Keyboard area

## TouchPad




| Component | | Description |
|---|---|---|
| **(1)** | Pointing stick | Moves the pointer on the screen. |
| **(2)** | Left pointing stick button | Functions like the left button on an external mouse. |
| **(3)** | TouchPad zone | Reads your finger gestures to move the pointer or activate items on the screen. |
| **(4)** | Right pointing stick button | Functions like the right button on an external mouse. |
| **(5)** | Near Field Communications (NFC) tapping area and antenna* (select products only) | Allows you to wirelessly share information when you tap it with an NFC-enabled device. |

*The antenna is not visible from the outside of the computer. For optimal transmission, keep the area immediately around the antenna free from obstructions.

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:

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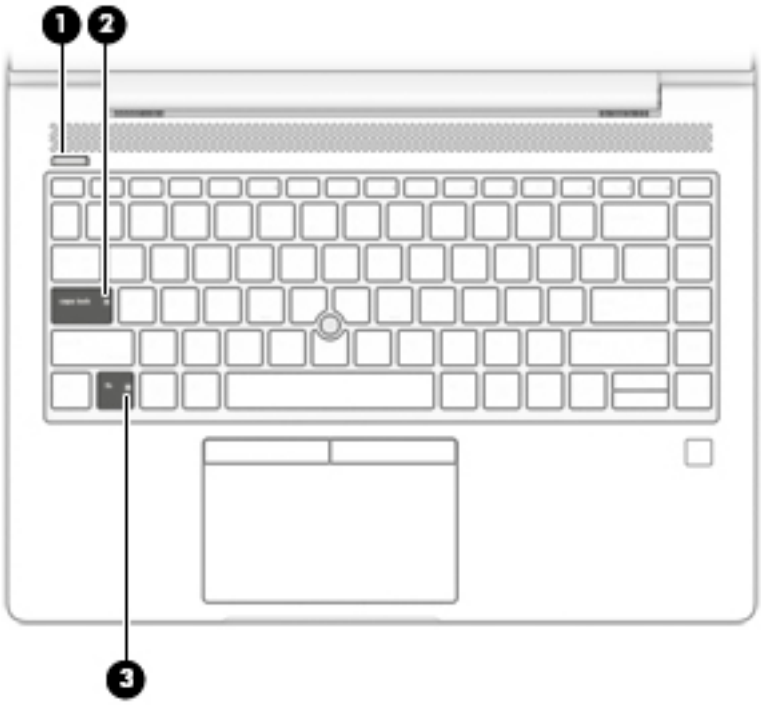
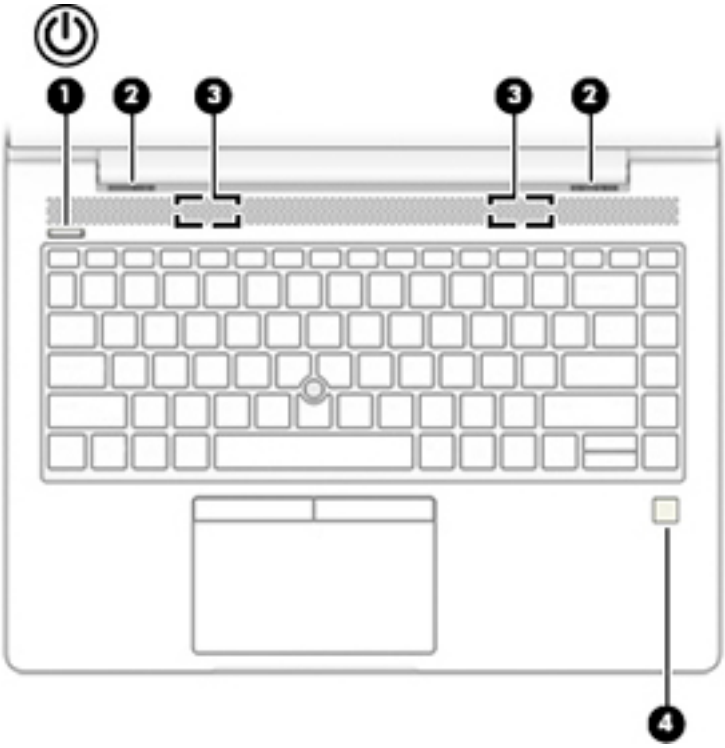
## Lights



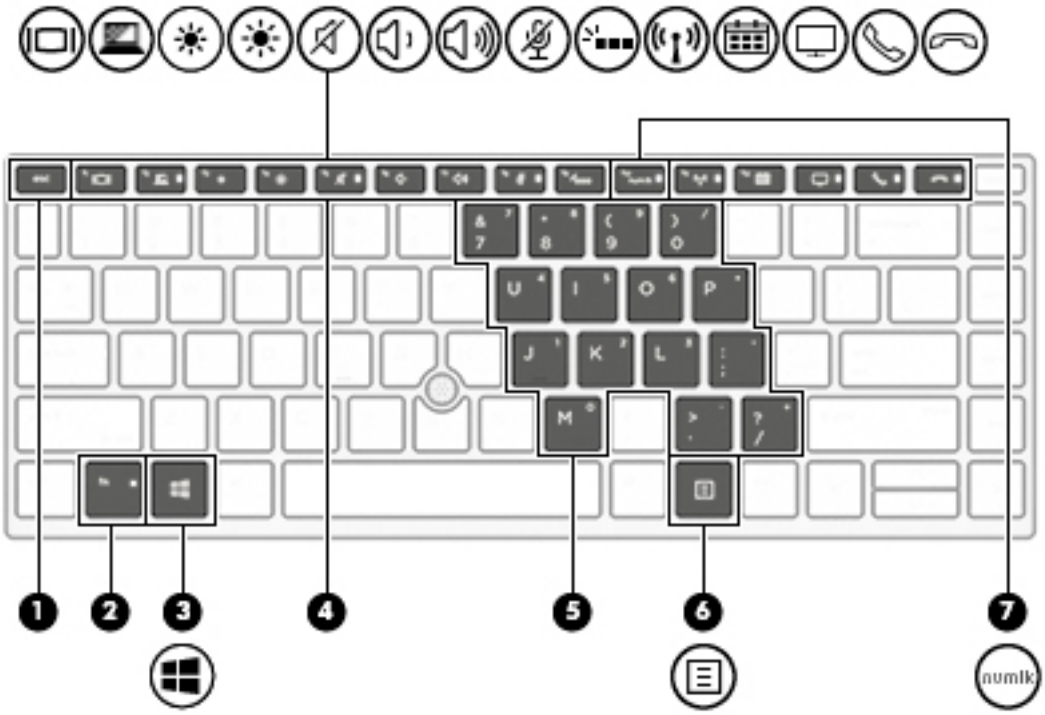

| Component | | Description |
|---|---|---|
| **(1)** | Power light | • On: The computer is on.<br>• Blinking: The computer is in the Sleep state, a power-saving state. The computer shuts off power to the display and other unneeded components.<br>• Off: The computer is off or in Hibernation. Hibernation is a power-saving state that uses the least amount of power. |
| **(2)** | Caps lock light | On: Caps lock is on, which switches the key input to all capital letters. |
| **(3)** | Fn lock light | On: The fn key is locked. For more information, see Hot keys (select products only) on page 15. |

## Buttons, speakers, and fingerprint reader




| Component | | Description |
|---|---|---|
| **(1)** | Power button | • When the computer is off, press the button to turn on the computer.<br>• When the computer is on, press the button briefly to initiate Sleep.<br>• When the computer is in the Sleep state, press the button briefly to exit Sleep.<br>• When the computer is in Hibernation, press the button briefly to exit Hibernation.<br>**CAUTION:** Pressing and holding down the power button results in the loss of unsaved information.<br>If the computer has stopped responding and shutdown procedures are ineffective, press and hold the power button for at least 5 seconds to turn off the computer.<br>To learn more about your power settings, see your power options.<br>▲ Right-click the **Power meter** icon and then select **Power Options**. |
| **(2)** | Vents (2) | Enable airflow to cool internal components.<br>**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. |
| **(3)** | Speakers (2) | Produce sound. |
| **(4)** | Fingerprint reader or plug | Allows a fingerprint logon to Windows, instead of a password logon.<br>**NOTE:** The fingerprint reader and plug look similar. To verify you have a fingerprint reader and not a plug, press the Windows key on your keyboard, select **Settings**, select **Accounts**, and then select **Sign-in options** and follow the on-screen instructions. |

## Special keys

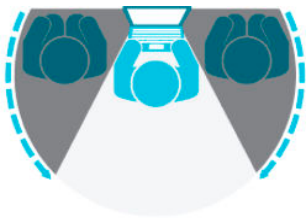



| Component | | | Description |
|---|---|---|---|
| **(1)** | | esc key | Displays system information when pressed in combination with the fn key. |
| **(2)** | | fn key | Executes frequently used system functions when pressed in combination with another key. Such key combinations are called *hot keys*.<br>See Hot keys (select products only) on page 15. |
| **(3)** | | Windows key | Opens the **Start** menu.<br>**NOTE:** Pressing the Windows key again will close the **Start** menu. |
| **(4)** | | Action keys | Execute frequently used system functions.<br>See Action keys on page 14. |
| **(5)** | | Integrated numeric keypad | A separate keypad to the right of the alphabet keyboard. When num lk is pressed, the integrated keypad can be used like an external numeric keypad.<br>**NOTE:** If the keypad function is active when the computer is turned off, that function is reinstated when the computer is turned back on. |
| **(6)** | | Windows application key (select products only) | Displays options for a selected object. |
| **(7)** | | num lk key | Turns the embedded numeric keypad on and off.<br>– or –<br>Alternates between the navigational and numeric functions on the integrated numeric keypad. |

## Action keys

An action key performs the function indicated by the icon on the key. To determine which keys are on your product, see Special keys on page 13.

▲ To use an action key, press and hold the key.

| Icon | Description |
|---|---|
| | Switches the screen image among display devices connected to the system. For example, if a monitor is connected to the computer, repeatedly pressing the key alternates the screen image from computer display to monitor display to simultaneous display on both the computer and monitor. |
| | Helps prevent side-angle viewing from onlookers. If needed, decrease or increase brightness for well-lit or darker environments. Press the key again to turn off the privacy screen.<br>**NOTE:** To quickly turn on the highest privacy setting, press fn+p.<br>  |
| | Decreases the screen brightness incrementally as long as you hold down the key. |
| | Increases the screen brightness incrementally as long as you hold down the key. |
| | Mutes or restores speaker sound. |
| | Decreases speaker volume incrementally while you hold down the key. |
| | Increases speaker volume incrementally while you hold down the key. |
| | Mutes the microphone. |
| | Turns the keyboard backlight off or on.<br>**NOTE:** To conserve battery power, turn off this feature. |
| | Turns the wireless feature on or off.<br>**NOTE:** A wireless network must be set up before a wireless connection is possible. |
| | Provides quick access to your Skype for Business calendar.<br>**NOTE:** This feature requires Skype® for Business or Lync® 2013 running on Microsoft Exchange or Office 365® servers. |
| | Turns the screen sharing function on or off.<br>**NOTE:** This feature requires Skype for Business or Lync 2013 running on Microsoft Exchange or Office 365 servers. |

| Icon | Description |
|---|---|
|  | • Answers a call.<br>• Starts a call during a 1-on-1 chat.<br>• Places a call on hold.<br>**NOTE:** This feature requires Skype for Business or Lync 2013 running on Microsoft Exchange or Office 365 servers. |
|  | • Ends a call.<br>• Declines incoming calls.<br>• Ends screen sharing.<br>**NOTE:** This feature requires Skype for Business or Lync 2013 running on Microsoft Exchange or Office 365 servers. |

**NOTE:** The action key feature is enabled at the factory. You can disable this feature by pressing and holding the fn key and the left shift key. The fn lock light will turn on. After you have disabled the action key feature, you can still perform each function by pressing the fn key in combination with the appropriate action key.

## Hot keys (select products only)

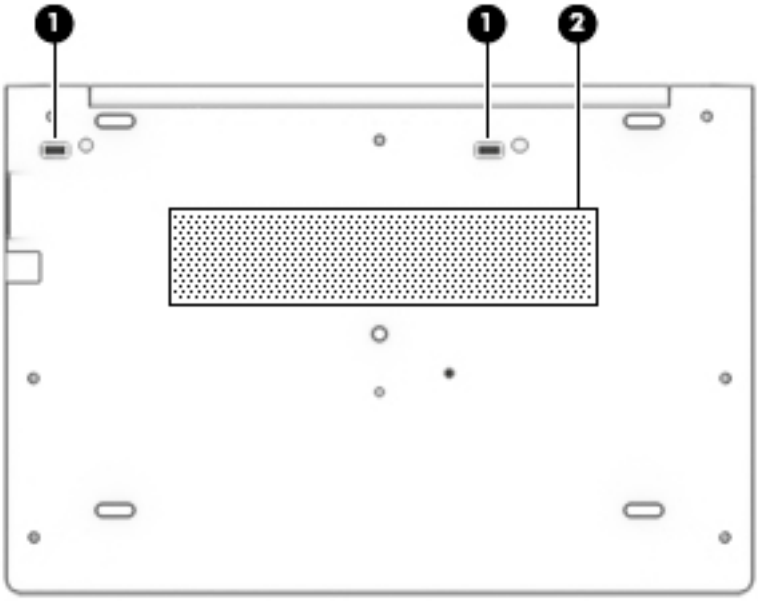
A hot key is the combination of the fn key and another key.

To use a hot key:

▲ Press the fn key, and then press one of the keys listed in the following table.

| Key | Description |
|---|---|
| C | Turns on scroll lock. |
| R | Breaks the operation. |
| S | Sends a programing query. |

# Bottom




| Component | | Description |
|---|---|---|
| **(1)** | Docking connector | Connects an optional docking device. |
| **(2)** | Vent | Enables airflow to cool internal components.<br>**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. |

# Front


| Component | | | Description |
|---|---|---|---|
| (1) | | Power light | • On: The computer is on.<br>• Blinking: The computer is in the Sleep state, a power-saving state. The computer shuts off power to the display and other unneeded components.<br>• Off: The computer is off or in Hibernation. Hibernation is a power-saving state that uses the least amount of power. |
| (2) | | Wireless light | On: An integrated wireless device, such as a wireless local area network (WLAN) device and/or a Bluetooth® device, is on.<br>**NOTE:** On some models, the wireless light is amber when all wireless devices are off. |
| (3) | | Drive light | • Blinking white: The hard drive is being accessed.<br>• Amber: HP 3D DriveGuard has temporarily parked the hard drive. |

# Cover

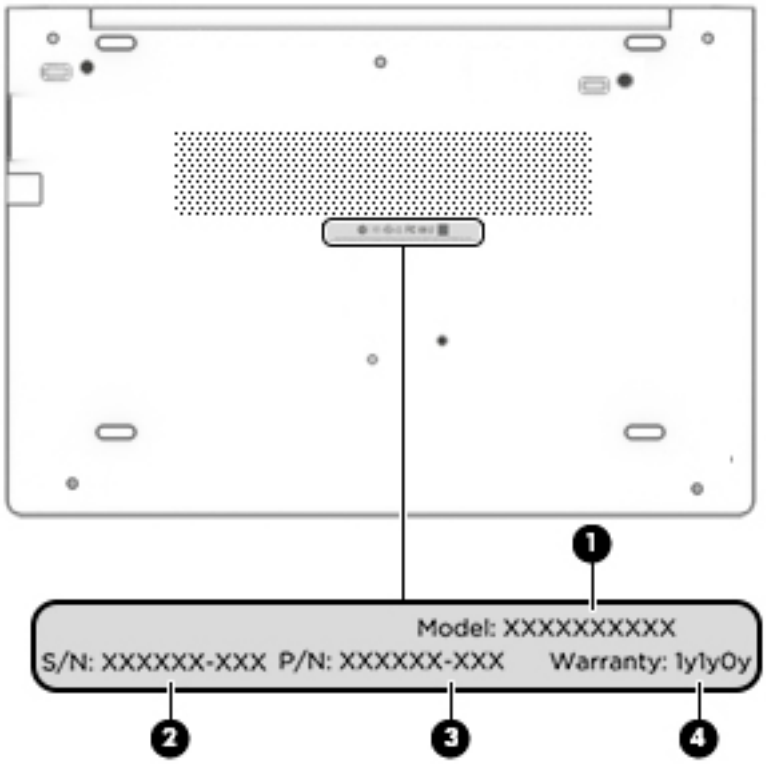
| Component | Description |
|---|---|
| Internal microphone(s) (1 or 2 depending on model, select models only) | Record(s) sound. |

# Labels

The labels affixed to the computer provide information you may need when you troubleshoot system problems or travel internationally with the computer. Labels may 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 may be asked for the serial number, the product number, or the model number. Locate this information before you contact support.




| Component | |
|---|---|
| **(1)** | Model name |
| **(2)** | Serial number |
| **(3)** | Part number |
| **(4)** | Warranty period |

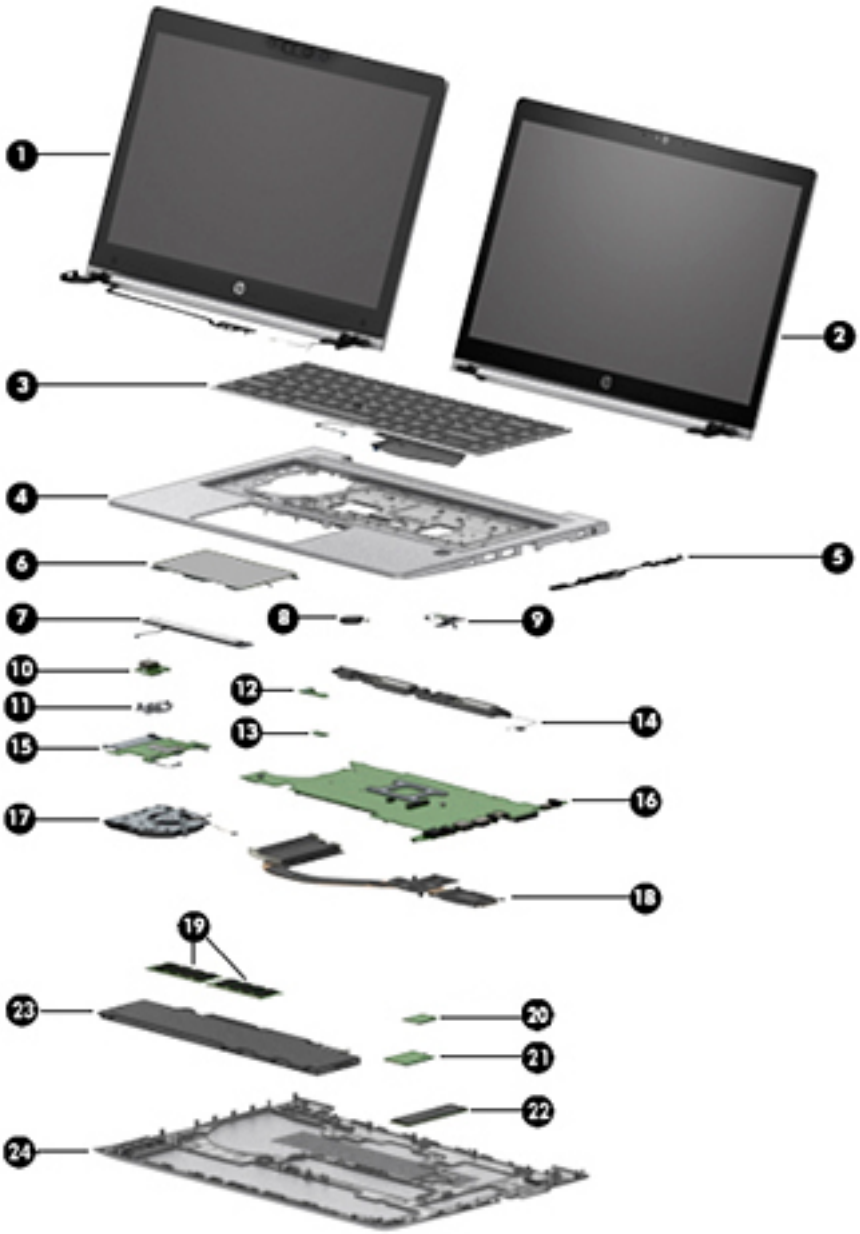
- Regulatory label(s)—Provide(s) regulatory information about the computer.
- Wireless certification label(s)—Provide(s) information about optional wireless devices and the approval markings for the countries or regions in which the devices have been approved for use.

# 3 Illustrated parts catalog

## Computer major components

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

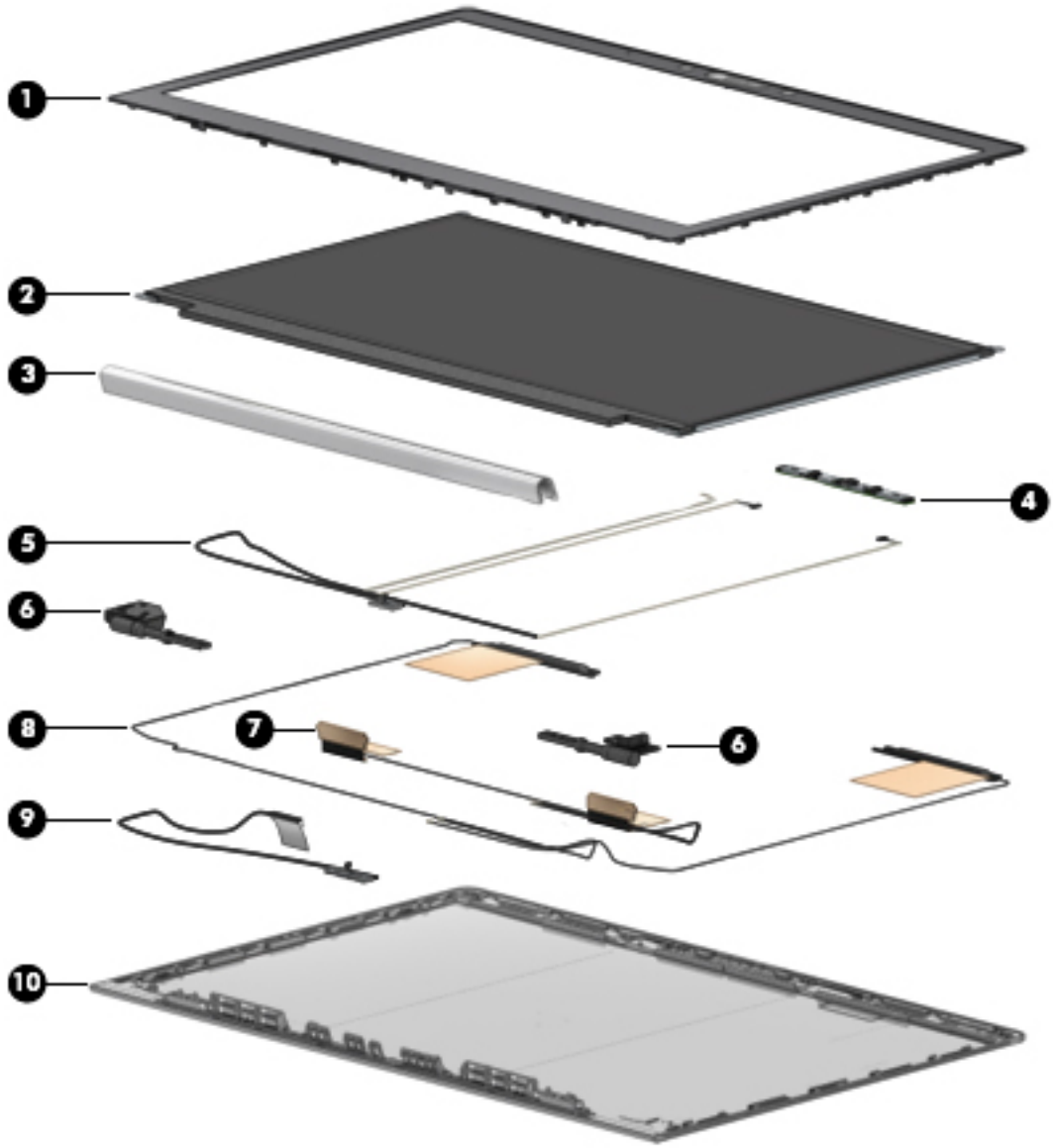
**NOTE:** Details about your computer, including model, serial number, product key, and length of warranty, are on the service tag at the bottom of your computer. See Labels on page 19 for details.



| Item | Component | Spare part number |
|---|---|---|
| **(1)** | **Display assembly**<br>Display assemblies are spared at the subcomponent level only. For more display assembly spare part information, see Display assembly subcomponents on page 22. | not spared as whole hinge-up |
| **(2)** | Touch | not spared as whole hinge-up |
| **(3)** | **Keyboard** (see Keyboard on page 42)<br>For a list of keyboard country codes, see Keyboard on page 42. | |
| | Without a backlight | L14379-xx1 |
| | With a backlight | L14377-xx1 |
| | With a backlight, privacy | L14378-xx1 |
| **(4)** | **Top cover** | L21975-001 |
| **(5)** | **RJ-45 board with bracket** | L14386-001 |
| **(6)** | **TouchPad** | |
| | For use in models without an NFC module | L14381-001 |
| | For use in models with an NFC module | L19417-001 |
| **(7)** | **TouchPad button board** | L18311-001 |
| **(8)** | **RTC battery** | L17255-001 |
| **(9)** | **Power button board** | L14374-001 |
| **(10)** | **USB board** | L14380-001 |
| **(11)** | **USB board bracket** | L14380-001 |
| **(12)** | **Fingerprint reader assembly** (includes cable) | L13681-001 |
| **(13)** | **NFC module** (includes antenna and TouchPad foam) | L14385-001 |
| **(14)** | **Speakers** (includes cable) | L13684-001 |
| **(15)** | **Smart card reader board** | L18312-001 |
| **(16)** | **System board** (includes processor and replacement thermal material, see System board on page 63) | |
| | AMD Ryzen 3 PRO 2300U Mobile Processor | L29298-301 |
| **(17)** | Fan | L22306-001 |
| **(18)** | **Heat sink** | L14372-001 |
| **(19)** | **Memory module** (DDR-2400) | |
| | 4-GB | 862397-850 |
| **(20)** | **WLAN/Bluetooth combo card** | |
| | Intel Dual band wireless-AC 8265 802.11AC 2x2 WiFi + Bluetooth 4.2 Combo Adaptor (non-vPro) | 851594-001 |
| **(21)** | **WWAN module** | |
| | LTE CAT4: Huawei HP lt4132, LTE/HSPA+ w/GPS | 845710-003 |
| | LTE CAT9: Fibocom lt4210 LTE/HSPA+ w/GPS | 917823-001 |

| Item | Component | Spare part number |
|---|---|---|
| **(22)** | **Solid-state drive (SSD)** | |
| | 128 GB, SATA-3, TLC | L22308-001 |
| **(23)** | **Battery** (3 cell, 50 WHr, 4.33 Ah) | 933321-855 |
| **(24)** | **Bottom cover** | L14371-001 |

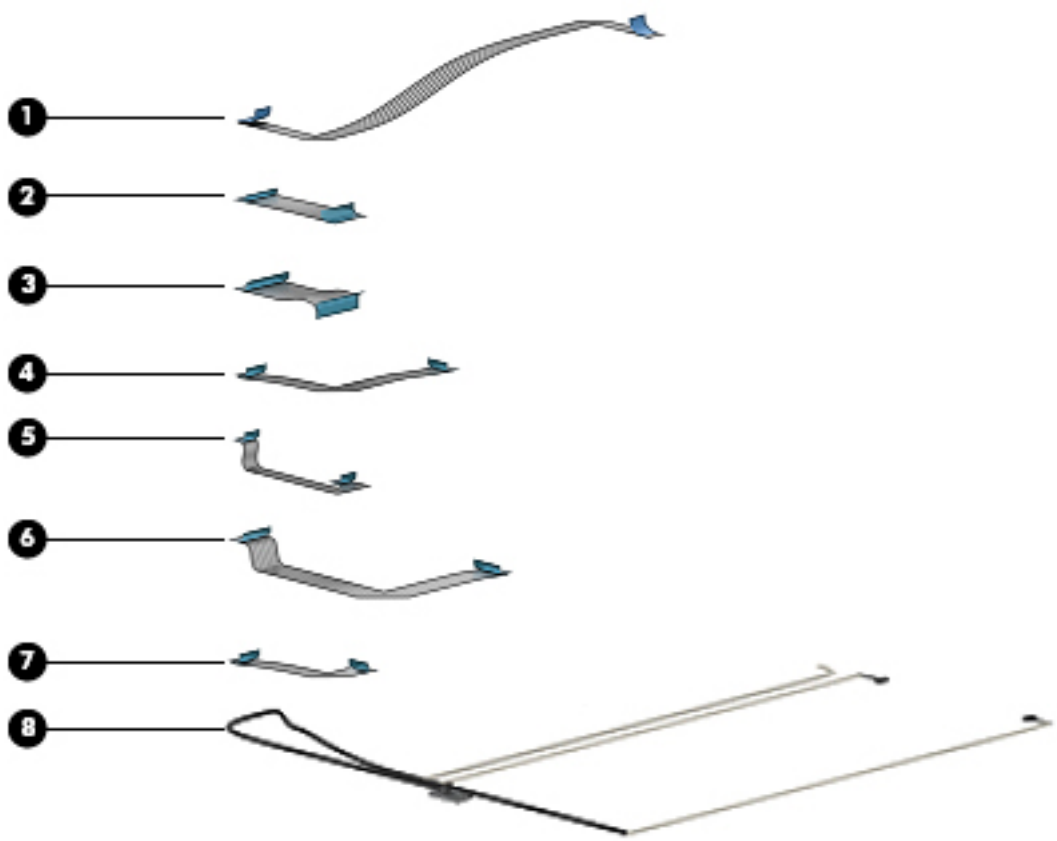
# Display assembly subcomponents




| Item | Component | Spare part number |
|---|---|---|
| **(1)** | **Bezel** | |
| | For use in models with microphone modules | L15505-001 |

| Item | Component | Spare part number |
|---|---|---|
| | For use in models with an HD camera (includes camera shutter) | L15506-001 |
| | For use in models with an IR camera (includes camera shutter) | L15507-001 |
| | **Camera shutters** (IR and HD cameras; not illustrated) | L15503-001 (Plastics Kit) |
| **(2)** | **Raw panel** | |
| | FHD, non-touch | L22310-001 |
| | FHD, non-touch, models with IR and HD cameras and WWAN modules | L22309-001 |
| | FHD, touch, models with IR and HD cameras and WWAN modules | L22311-001 |
| **(3)** | **Hinge cover** | |
| | For use in models with touch displays | L14375-001 (Hinge Kit) |
| | For use in models with non-touch displays | L14376-001 (Hinge Kit) |
| **(4)** | **Camera module** | |
| | HD camera | L28405-001 |
| | IR camera | L28404-001 |
| | **Microphone module** (includes double-sided tape; not shown) | L15512-001 |
| **(5)** | **Camera cable** (HD and IR models) | L14370-001 (Cable Kit) |
| **(6)** | **Hinges (left and right)** (for use in models with touch displays) | L14375-001 (Hinge Kit) |
| | **Hinges (left and right)** (for use in models with non-touch displays) | L14376-001 (Hinge Kit) |
| **(7)** | **WLAN antenna** (spared with display enclosure) | |
| **(8)** | **WWAN antenna** (spared with display enclosure) | |
| **(9)** | **Display cable** | L14370-001 (Cable Kit) |
| **(10)** | **Display enclosure** (includes tape, gasket, and foam for display) | |
| | For use in models without a WWAN module | L15501-001 |
| | For use in models with a WWAN module | L15502-001 |

# Cable Kit




| Item | Description | Spare part number |
|---|---|---|
| | **Cable Kit** | L14370-001 |
| **(1)** | Pointing stick cable | |
| **(2)** | USB board cable | |
| **(3)** | Card reader cable | |
| **(4)** | TouchPad cable | |
| **(5)** | Fingerprint reader cable | |
| **(6)** | NFC cable | |
| **(7)** | Power board cable | |
| **(8)** | Display cables | |

# Miscellaneous parts

| Component | Spare part number |
|---|---|
| **AC adapter**, non-PFC, 4.5 mm | |
| 65 W HP Smart AC adapter, 3 prong | 710412-001 |
| 65 W HP Smart AC Adapter for use in Argentina | 710340-850 |
| 65 W HP Smart AC adapter, EM | 913691-850 |
| 65 W, wall mount, 3 pin, USB-C | 860209-850 |
| 45 W HP Smart AC adapter, 2 prong | 742436-001 |
| 45 W HP Smart AC Adapter | 741553-850 |
| 45 W HP Smart AC Adapter for use in Argentina | 741553-852 |
| 45 W, wall mount, 3 pin, USB-C | 860210-850 |
| **Power cord** (3-pin, black, C5, 1.0 m, premium): | |
| Argentina | L19339-001 |
| Brazil | L19341-001 |
| Denmark | L19342-001 |
| Europe (Austria, Belgium, Finland, France, Germany, the Netherlands, Norway and Sweden) | L19343-001 |
| Israel | L19344-001 |
| India | L19345-001 |
| North America | L19348-001 |
| South America | L19350-001 |
| Switzerland | L19351-001 |
| Thailand | L19352-001 |
| Taiwan | L19353-001 |
| United Kingdom | L19354-001 |
| **Power cord** (3-pin, black, C5, 1.8 m, premium): | |
| Argentina | L19339-002 |
| Brazil | L19341-002 |
| Denmark | L19342-002 |
| Europe (Austria, Belgium, Finland, France, Germany, the Netherlands, Norway and Sweden) | L19343-002 |
| Israel | L19344-002 |
| India | L19345-002 |
| North America | L19348-002 |
| South America | L19350-002 |
| Switzerland | L19351-002 |
| Taiwan | L19353-002 |

| Component | Spare part number |
|---|---|
| United Kingdom | L19354-002 |
| **Power cord** (3-pin, black, C5, 1.0 m): | |
| Argentina | L19357-001 |
| Australia | L19358-001 |
| Brazil | L19359-001 |
| Denmark | L19360-001 |
| Europe (Austria, Belgium, Finland, France, Germany, the Netherlands, Norway and Sweden) | L19361-001 |
| Israel | L19362-001 |
| India | L19363-001 |
| Japan | L19365-001 |
| Korea | L19366-001 |
| North America | L19367-001 |
| People's Republic of China | L19368-001 |
| South America | L19369-001 |
| Switzerland | L19370-001 |
| Thailand | L19371-001 |
| Taiwan | L19372-001 |
| United Kingdom | L19373-001 |
| **Power cord** (3-pin, black, C5, 1.8 m): | |
| Argentina | L19357-002 |
| Australia | L19358-002 |
| Brazil | L19359-002 |
| Denmark | L19360-002 |
| Europe (Austria, Belgium, Finland, France, Germany, the Netherlands, Norway and Sweden) | L19361-002 |
| Israel | L19362-002 |
| India | L19363-002 |
| Japan | L19365-002 |
| Korea | L19366-002 |
| North America | L19367-002 |
| People's Republic of China | L19368-002 |
| South America | L19369-002 |
| Switzerland | L19370-002 |
| Thailand | L19371-002 |
| Taiwan | L19372-002 |

| Component | Spare part number |
|---|---|
| United Kingdom | L19373-002 |
| **Power cord** (3-pin, black, C7, 1.0 m): | |
| Japan | L19375-001 |
| **Power cord** (duck head, black): | |
| North America | L27467-001 |
| China | L27468-001 |
| Australia | L27469-001 |
| United Kingdom | L27470-001 |
| **HP USB Type-C Universal Dock** | L16130-001 |
| **HP Elite USB-C Desk Dock G3** | 920131-001 |
| **Plastics Kit** (includes SIM card insert, fingerprint reader insert, smart card reader insert, smart card insert, IR camera shutter, HD camera shutter) | L15503-001 |
| **Screw Kit** | L14352-001 |
| **Pointing stick covers, quantity of 20** | L15396-001 |

# 4 Removal and replacement procedures preliminary requirements

## Tools required

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

- Phillips P0 screwdriver
- Torx T8 screwdriver
- Non-marking plastic pry tool

## 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

**CAUTION:** Using excessive force during disassembly and reassembly can damage plastic parts. Use care when handling the plastic

## Cables and connectors

⚠ **CAUTION:** 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.

Cables must be handled with extreme care to avoid damage. 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 in such a way that they cannot be caught or snagged by parts being removed or replaced. Handle flex cables with extreme care; these cables tear easily.

## Drive handling

⚠ **CAUTION:** Drives are fragile components that must be handled 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 a diskette drive or optical drive, be sure that a diskette or disc is not in the drive and be sure that the optical drive tray is closed.

Handle drives on surfaces covered with at least one inch of shock-proof foam.

Avoid dropping drives from any height onto any surface.

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

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.”

# Grounding guidelines

## Electrostatic discharge damage

Electronic components are sensitive to electrostatic discharge (ESD). Circuitry design and structure determine the degree of sensitivity. Networks built into many integrated circuits provide some protection, but in many cases, ESD contains enough power to alter device parameters or melt silicon junctions.

A discharge of static electricity from a finger or other conductor can destroy static-sensitive devices or microcircuitry. Even if the spark is neither felt nor heard, damage may have occurred.

An electronic device exposed to ESD may not be affected at all and can work perfectly throughout a normal cycle. Or the device may function normally for a while, then degrade in the internal layers, reducing its life expectancy.

⚠ **CAUTION:** To prevent damage to the computer when you are removing or installing 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 in this section.

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.

The following table shows how humidity affects the electrostatic voltage levels generated by different activities.

⚠ **CAUTION:** A product can be degraded by as little as 700 V.

**Typical electrostatic voltage levels**

| | Relative humidity | | |
|---|---|---|---|
| **Event** | **10%** | **40%** | **55%** |
| Walking across carpet | 35,000 V | 15,000 V | 7,500 V |
| Walking across vinyl floor | 12,000 V | 5,000 V | 3,000 V |
| Motions of bench worker | 6,000 V | 800 V | 400 V |
| Removing DIPS from plastic tube | 2,000 V | 700 V | 400 V |
| Removing DIPS from vinyl tray | 11,500 V | 4,000 V | 2,000 V |
| Removing DIPS from Styrofoam | 14,500 V | 5,000 V | 3,500 V |
| Removing bubble pack from PCB | 26,500 V | 20,000 V | 7,000 V |
| Packing PCBs in foam-lined box | 21,000 V | 11,000 V | 5,000 V |

## 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.

## 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, screwdrivers, 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 Styrofoam.
- 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.

## Equipment guidelines

Grounding equipment must include either a wrist strap or a foot strap at a grounded workstation.

- When seated, wear a wrist strap connected to a grounded system. Wrist straps are flexible straps with a minimum of one megohm ±10% resistance in the ground cords. To provide proper ground, wear a strap snugly against the skin at all times. On grounded mats with banana-plug connectors, use alligator clips to connect a wrist strap.
- When standing, use foot straps and a grounded floor mat. Foot straps (heel, toe, or 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 foot straps on both feet with a minimum of one megohm resistance between the operator and ground. To be effective, the conductive must be worn in contact with the skin.

The following grounding equipment is recommended to prevent electrostatic damage:

- Antistatic tape
- Antistatic smocks, aprons, and sleeve protectors
- Conductive bins and other assembly or soldering aids
- Nonconductive foam
- Conductive tabletop workstations with ground cords of one megohm resistance
- Static-dissipative tables or floor mats with hard ties to the ground
- Field service kits
- Static awareness labels
- Material-handling packages
- Nonconductive plastic bags, tubes, or boxes
- Metal tote boxes
- Electrostatic voltage levels and protective materials

The following table lists the shielding protection provided by antistatic bags and floor mats.

| Material | Use | Voltage protection level |
|---|---|---|
| Antistatic plastics | Bags | 1,500 V |
| Carbon-loaded plastic | Floor mats | 7,500 V |
| Metallized laminate | Floor mats | 5,000 V |

# 5 Removal and replacement procedures for Customer Self-Repair parts

This chapter provides removal and replacement procedures for Customer Self-Repair parts.

**NOTE:** The Customer Self-Repair program is not available in all locations. Installing a part not supported by the Customer Self-Repair program may void your warranty. Check your warranty to determine if Customer Self-Repair is supported in your location.

## Component replacement procedures

**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. See Labels on page 19 for details.

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

There are as many as 12 screws that must be removed, replaced, and/or loosened when servicing Customer Self-Repair parts. Make special note of each screw size and location during removal and replacement.

### Bottom cover

| Description | Spare part number |
|---|---|
| Bottom cover | L14371-001 |

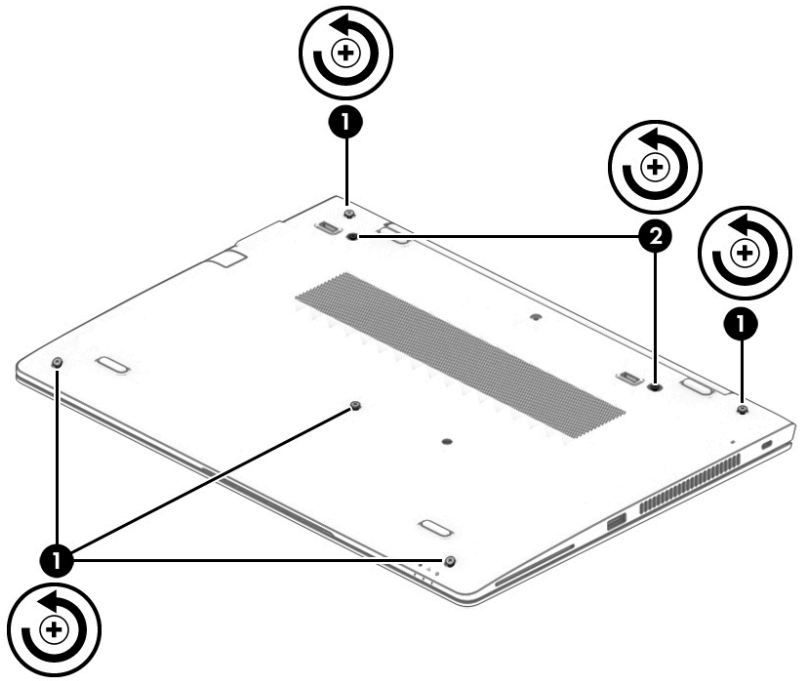
Before removing the bottom cover, follow these steps:

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.

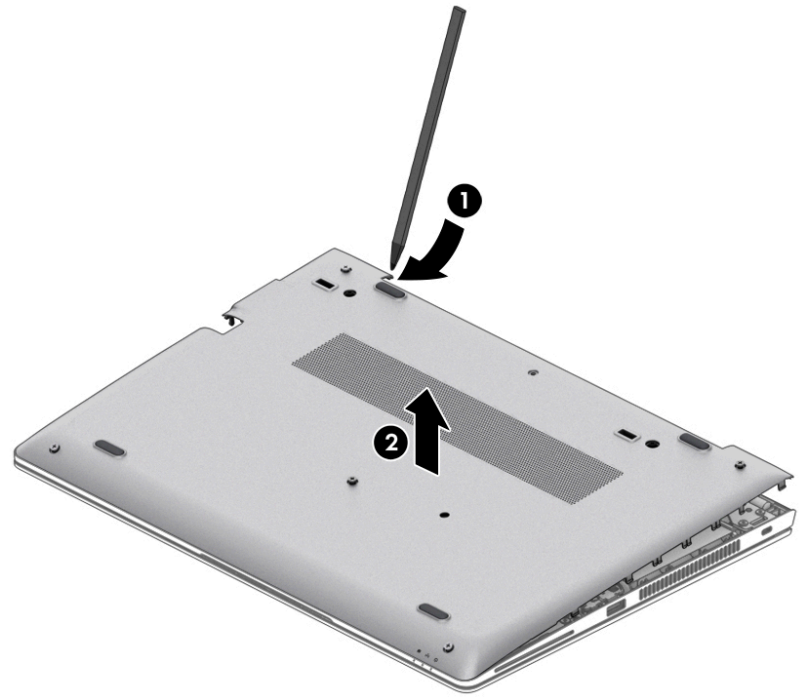
Remove the bottom cover:

1. Turn the computer upside down on a flat surface.

2. Loosen the five captive screws **(1)** and the two inset captive screws **(2)** that secure the bottom cover.



3. Starting under the display in the upper left corner, pry **(1)** and lift the bottom cover off the computer **(2)**.



Reverse the removal procedures to install the bottom cover.

## Solid-state drive (SSD)

| Description | Spare part number |
|---|---|
| 128 GB, SATA-3, TLC | L22308-001 |

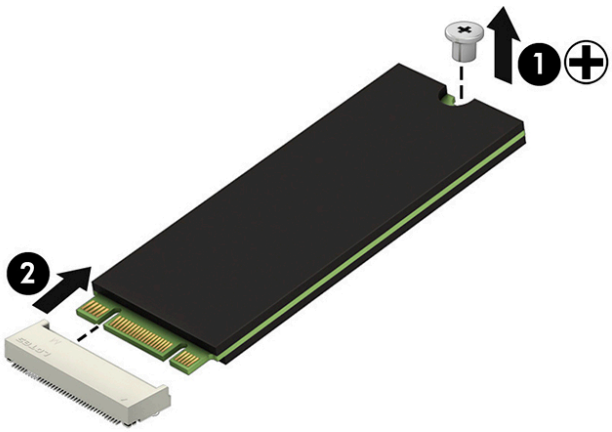
Before removing the solid-state drive, follow these steps:

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.
4. Remove the bottom cover (see Bottom cover on page 33).
5. Disconnect the battery cable from the system board (see Battery on page 46).

Remove the solid-state drive:

1. Remove the Phillips M2.0×2.0 screw **(1)** that secures the drive to the system board.
2. Remove the drive by pulling it away from the connector **(2)**.

**NOTE:** M.2 solid-state drives are designed with notches to prevent incorrect insertion.




Reverse this procedure to install the solid-state drive.

## Memory modules

**NOTE:** Primary and expansion memory is installed in a side-by-side configuration in the bottom of the computer.

If only one memory module is installed, it must be installed in the socket labeled '1'.

| Description | Spare part number |
|---|---|
| 4-GB (DDR-2400) | 862397-850 |

### Update BIOS before adding memory modules

Before adding new memory, make sure you update the computer to the latest BIOS.

**CAUTION:** Failure to update the computer to the latest BIOS prior to installing new memory may result in various system problems.

To update BIOS:

1. Navigate to www.hp.com.
2. Click **Support & Drivers >** click **Drivers & Software**.
3. In the **Enter a product name/number** box, type the computer model information, and then click **Search**.
4. Click the link for the computer model.
5. Select the operating system, and then click **Next**.
6. Under **Step 2: Select a Download**, click the **BIOS** link.
7. Click the link for the most recent BIOS.
8. Click the **Download** button, and then follow the on-screen instructions.

Before removing the memory module, follow these steps:

1. 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.
2. Disconnect all external devices connected to the computer.
3. Disconnect the power from the computer by first unplugging the power cord from the AC outlet, and then unplugging the AC adapter from the computer.
4. Remove the bottom cover (see Bottom cover on page 33).
5. Disconnect the battery cable from the system board (see Battery on page 46).

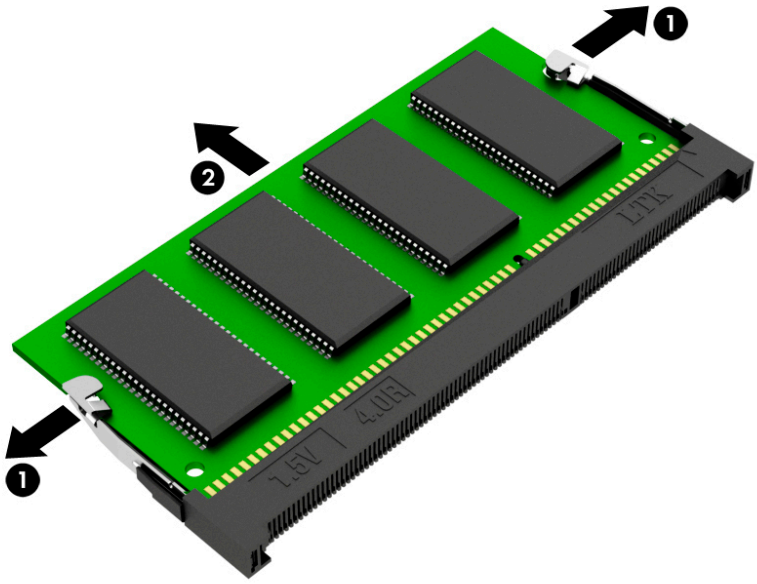
Remove the memory module:

1. Spread the retaining tabs **(1)** on each side of the memory module slot to release the memory module. (The edge of the module opposite the slot rises away from the computer.)

2. Remove the memory module **(2)** by pulling the module away from the slot at an angle.

**NOTE:** Memory modules are designed with a notch to prevent incorrect insertion into the memory module slot.

**NOTE:** The computer uses two memory sockets. The socket labeled ‘2’ houses the expansion memory module and the socket labeled ‘1’ houses the primary memory module. The removal procedure is the same for both memory sockets.




Reverse this procedure to install a memory module.

## WLAN/Bluetooth combo card

The computer uses a card that provides both WLAN and Bluetooth functionality.

The WLAN module and WWAN module are not interchangeable.

| Description | Spare part number |
|---|---|
| Intel Dual Band Wireless-AC 8260NGW 802.11a/g/g/n+ac 2x2 WiFi + BT 4.2 combo adapter | 851594-001 |

Before removing the WLAN module, follow these steps:

1. 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.
2. Disconnect all external devices connected to the computer.
3. Disconnect the power from the computer by first unplugging the power cord from the AC outlet, and then unplugging the AC adapter from the computer.
4. Remove the bottom cover (see Bottom cover on page 33).
5. Disconnect the battery cable from the system board (see Battery on page 46).

Remove the WLAN module:

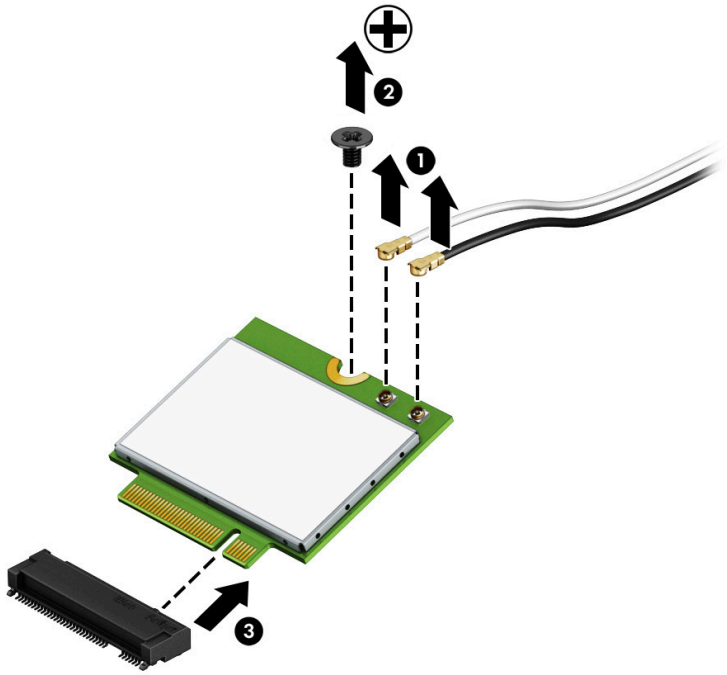
1. Disconnect the WLAN antenna cables **(1)** from the terminals on the WLAN module.

**NOTE:** The WLAN antenna cable labeled ‘1’ connects to the WLAN module “Main” terminal labeled ‘1’. The WLAN antenna cable labeled ‘2’ connects to the WLAN module ‘Aux’ terminal labeled ‘2’. If the computer is equipped with an 802.11a/b/g/n WLAN module, the yellow WLAN antenna cable connects to the middle terminal on the WLAN module.

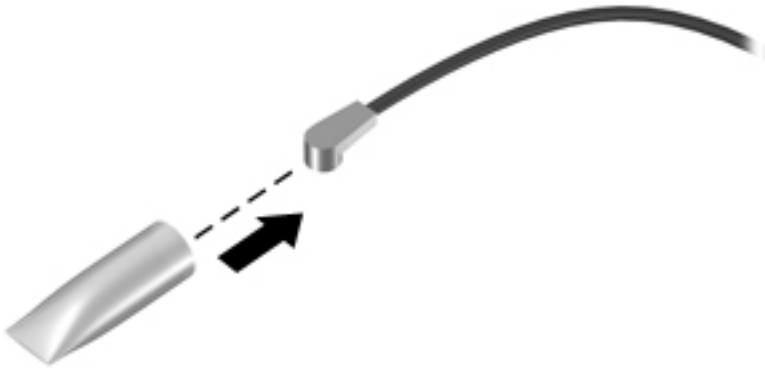
2. Remove the Phillips M2.0×2.0 screw **(2)** that secures the WLAN module to the computer. (The edge of the module opposite the slot rises away from the computer.)

3. Remove the WLAN module by pulling the module away from the slot at an angle **(3)**.

**NOTE:** WLAN modules are designed with a notch to prevent incorrect insertion.




**NOTE:** If the WLAN antennas are not connected to the terminals on the WLAN module, the protective sleeves must be installed on the antenna connectors, as shown in the following illustration.



Reverse this procedure to install the WLAN module.

## WWAN module

The WLAN module and WWAN module are not interchangeable.

The WWAN module is available on select models only.

| Description | Spare part number |
|---|---|
| LTE CAT4: Huawei HP lt4132, LTE/HSPA+ w/GPS | 845710-003 |
| LTE CAT9: Fibocom lt4210 LTE/HSPA+ w/GPS | 917823-001 |

Before removing the WWAN module, follow these steps:

1. 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.
2. Disconnect all external devices connected to the computer.
3. Disconnect the power from the computer by first unplugging the power cord from the AC outlet, and then unplugging the AC adapter from the computer.
4. Remove the bottom cover (see Bottom cover on page 33).
5. Disconnect the battery cable from the system board (see Battery on page 46).

Remove the WWAN module:

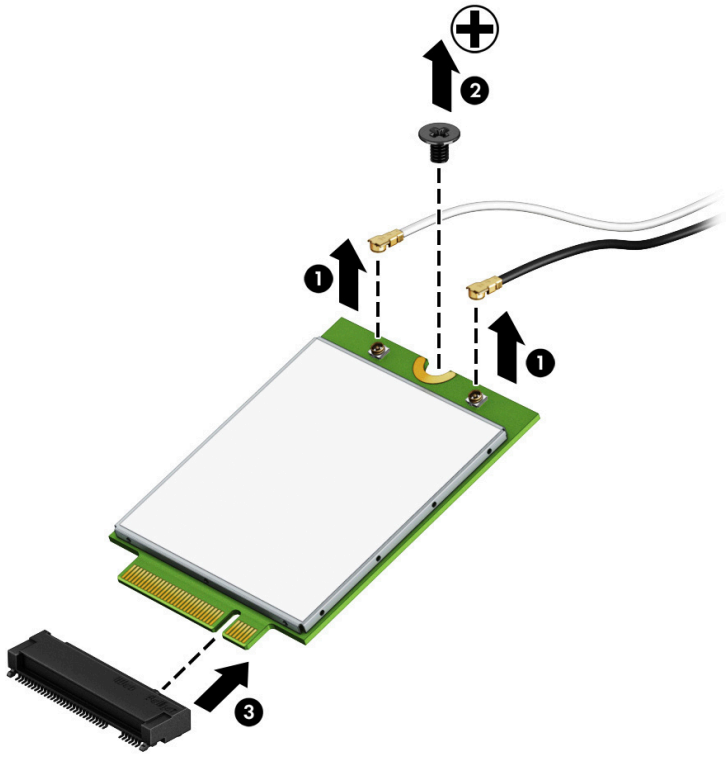
1. Position the computer upside-down.
2. Disconnect the WWAN antenna cables **(1)** from the terminals on the WWAN module.

**NOTE:** The red WWAN antenna cable is connected to the WWAN module 'Main' terminal. The blue WWAN antenna cable is connected to the WWAN module 'Aux' terminal.

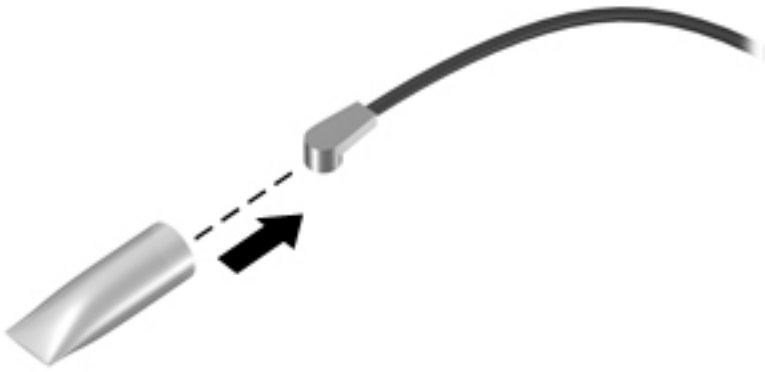
3. Remove the Phillips M2.0×2.0 screw **(2)** that secures the WWAN module to the computer. (The edge of the module opposite the slot rises away from the computer.)

4. Remove the WWAN module **(3)** by pulling the module away from the slot at an angle.

**NOTE:** WWAN modules are designed with a notch to prevent incorrect insertion.




**NOTE:** If the WWAN antennas are not connected to the terminals on the WWAN module, the protective sleeves must be installed on the antenna connectors, as shown in the following illustration.



Reverse this procedure to install the WWAN module.

## Keyboard

In this section, the first table provides the main spare part number for the keyboards. The second table provides the country codes.

| Description | Spare part number |
|---|---|
| Keyboard, no backlight | L14379-xx1 |
| Keyboard, backlit | L14377-xx1 |
| Keyboard, backlit, privacy | L14378-xx1 |
| Pointing stick covers, quantity of 20 | L15396-001 |

| 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 | India | -D61 | Slovenia | -BA1 |
| Brazil | -201 | Israel | -BB1 | South Korea | -AD1 |
| Bulgaria | -261 | Italy | -061 | Spain | -071 |
| Canada | -DB1 | Japan | -291 | Sweden and Finland | -B71 |
| Czech Republic and Slovakia | -FL1 | Latin America | -161 | Switzerland | -BG1 |
| Denmark | -081 | The Netherlands | -B31 | Taiwan | -AB1 |
| Denmark, Finland, and Norway | -DH1 | Northern Africa | -FP1 | Thailand | -281 |
| France | -051 | Norway | -091 | Turkey | -141 |
| Germany | -041 | Portugal | -131 | Turkey F | -541 |
| Greece | -151 | Romania | -271 | United Kingdom | -031 |
| Hungary | -211 | Russia | -251 | United States | -001 |
| Iceland | -DD1 | Saudi Arabia | -171 | | |

Before removing the keyboard, follow these steps:

1. 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.
2. Disconnect all external devices connected to the computer.
3. Disconnect the power from the computer by first unplugging the power cord from the AC outlet, and then unplugging the AC adapter from the computer.
4. Remove the bottom cover (see Bottom cover on page 33).
5. Disconnect the battery cable from the system board (see Battery on page 46).

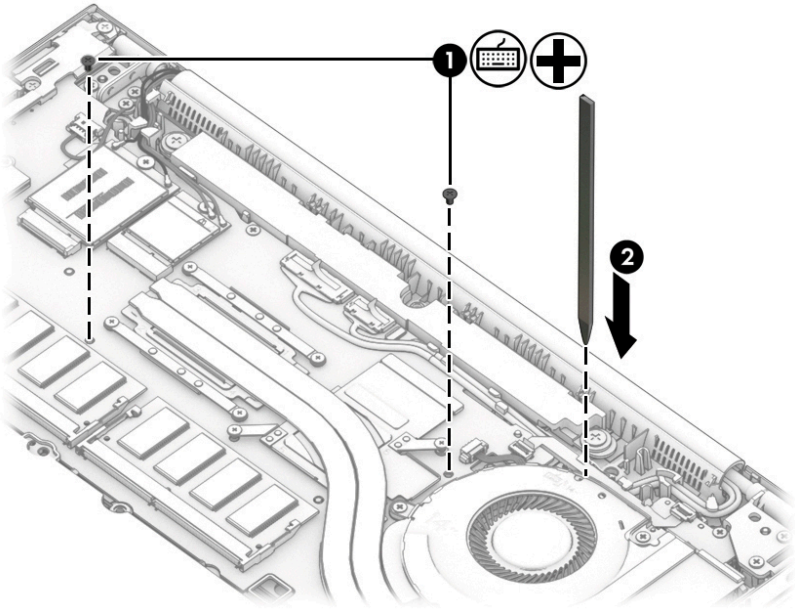
Remove the keyboard:

1. Remove the two Phillips M2.0×3.0 screws that secure the keyboard to the computer **(1)**.

**NOTE:** The screws are labeled with a keyboard symbol.

2. Insert a screwdriver or similar thin tool into the release hole near the fan, and then press on the back of the keyboard until it disengages from the computer **(2)**.

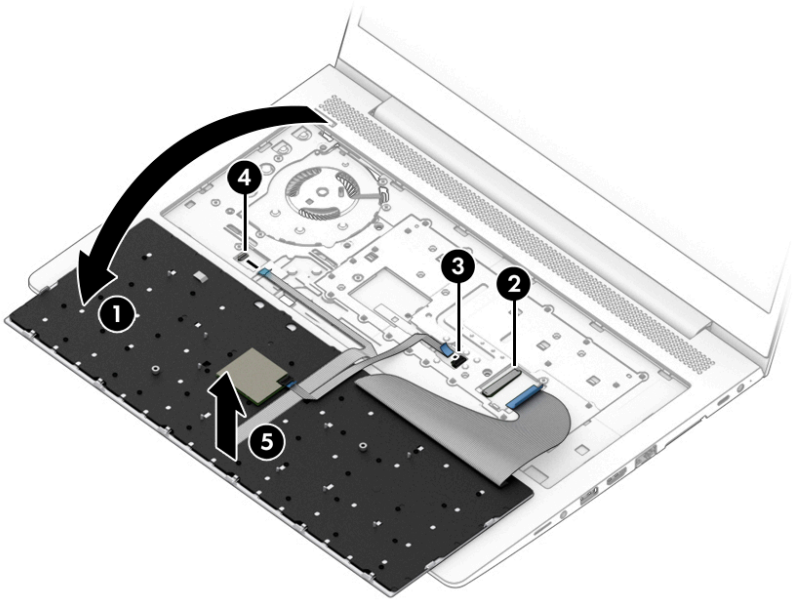
**NOTE:** Cables connect the bottom of the keyboard to the system board. Make sure not to prematurely pull the keyboard cables out of the system board connectors.




3. Position the computer upright with the front toward you, and then open the computer as far as possible.
4. Lift to disengage the top of the keyboard **(1)**, and then lift the top of the keyboard **(2)**.


5. Rotate the keyboard onto the palm rest **(1)**.
6. Disconnect the main keyboard cable from the system board ZIF connector **(2)**.
7. Disconnect the pointing stick cable from the system board ZIF connector **(3)**.
8. Disconnect the keyboard backlight cable from the system board ZIF connector **(4)** (select models only).

9. Remove the keyboard **(5)**.




Reverse this procedure to install the keyboard.

# 6 Removal and replacement procedures for Authorized Service Provider parts

This chapter provides removal and replacement procedures for Authorized Service Provider only parts.

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

**CAUTION:** Only HP authorized service providers should perform the removal and replacement procedures described here. Accessing the internal part could damage the computer or void the warranty.

## Component replacement procedures

**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. See Labels on page 19 for details.

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

There are as many as 81 screws that must be removed, replaced, and/or loosened when servicing Authorized Service Provider only parts. Make special note of each screw size and location during removal and replacement.

## Battery

| Description | Spare part number |
|---|---|
| Battery, 3 cell, 50 WHr, 4.33 Ah | 933321-855 |

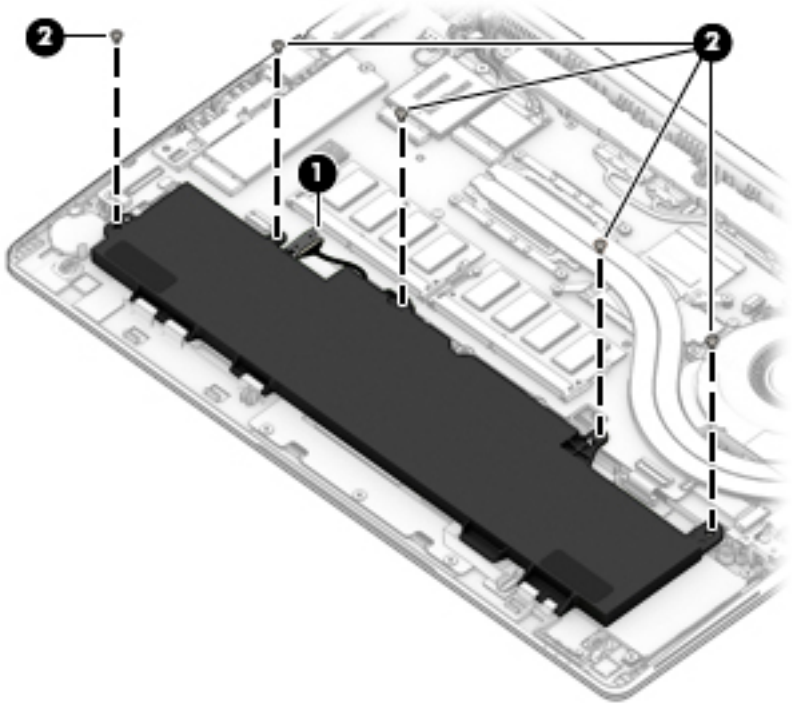
Before removing the battery, follow these steps:

1. 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.
2. Disconnect all external devices connected to the computer.
3. Disconnect the power from the computer by first unplugging the power cord from the AC outlet, and then unplugging the AC adapter from the computer.
4. Remove the bottom cover (see Bottom cover on page 33).

To remove the battery:

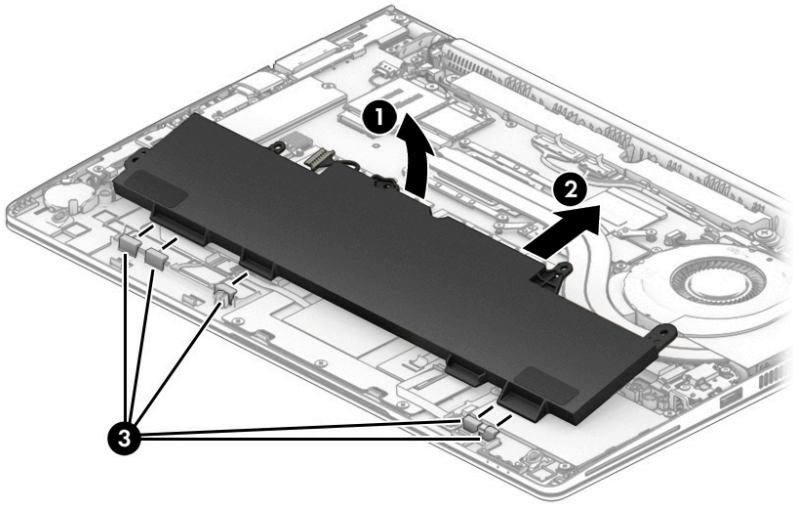
⚠ **CAUTION:** Removing a battery that is the sole power source for the computer can cause loss of information. To prevent loss of information, save your work and shut down the computer through Windows before removing the battery.

1. Disconnect the battery cable from the system board **(1)**.
2. Remove the five Torx T8 2.0×4.0 screws **(2)**.



3. Rotate the top of the battery upward **(1)**, and then lift the battery out of the computer **(2)**.

**IMPORTANT:** When installing the battery, insert the tabs on the bottom of battery into the clips built into the computer **(3)**, and then rotate the battery into place




Reverse the removal procedures to install the battery.

## Heat sink assembly

**NOTE:** The heat sink assembly spare part kit includes replacement thermal material.

| Description | Spare part number |
|---|---|
| Heat sink | L14372-001 |

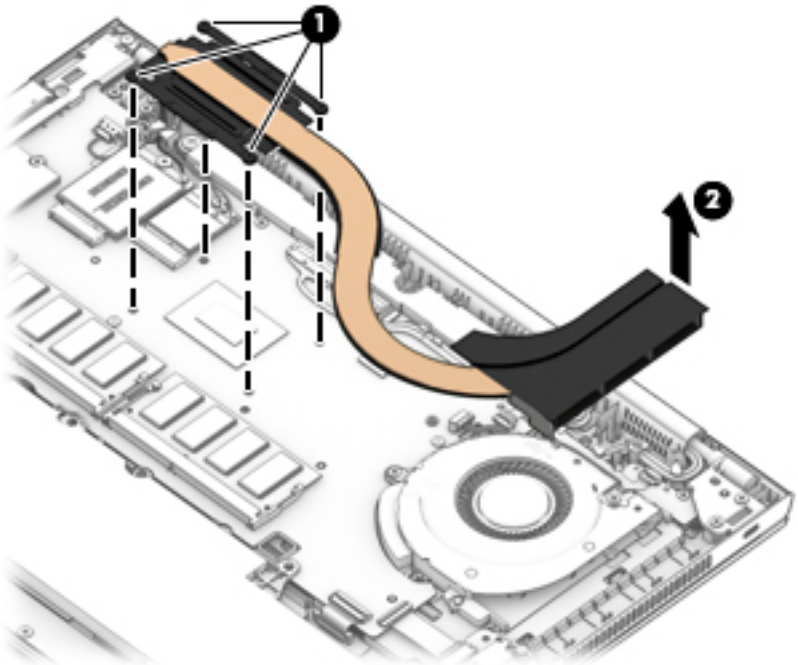
Before removing the heat sink assembly, follow these steps:

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.
4. Remove the bottom cover (see Bottom cover on page 33).
5. Disconnect the battery cable from the system board (see Battery on page 46).

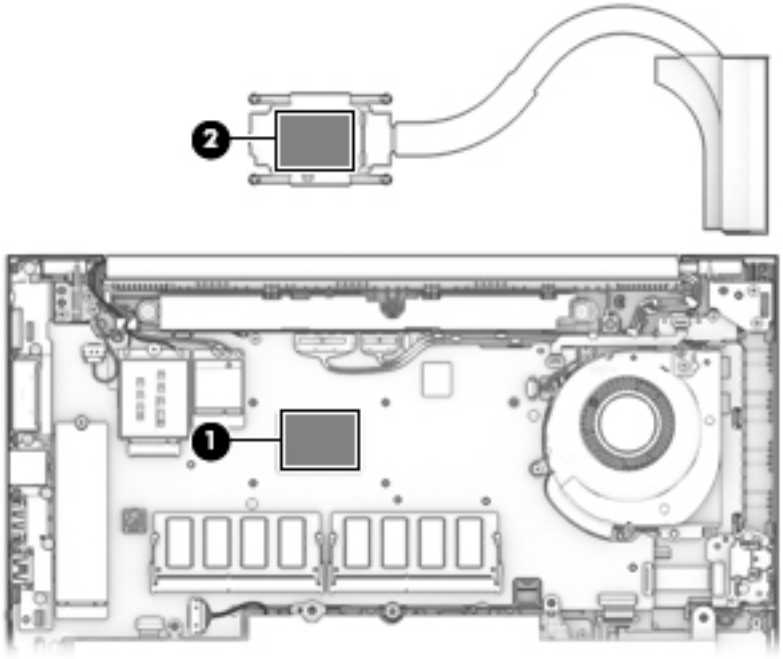
Remove the heat sink assembly:

1. Loosen the four captive screws on the heat sink following the sequence stamped on the heat sink **(1)**, and then remove the heat sink from the system board **(2)**.

**CAUTION:** Take extreme care when removing the heat sink and fan assembly. The heatpipe is very fragile and can be easily damaged and bent during removal.



2. Thoroughly clean the thermal material from the surfaces of the system board component **(1)** and the heat sink **(2)** each time the heat sink is removed. Replacement thermal material is included with the heat sink and system board spare part kits.




Reverse this procedure to install the heat sink.

## RTC battery

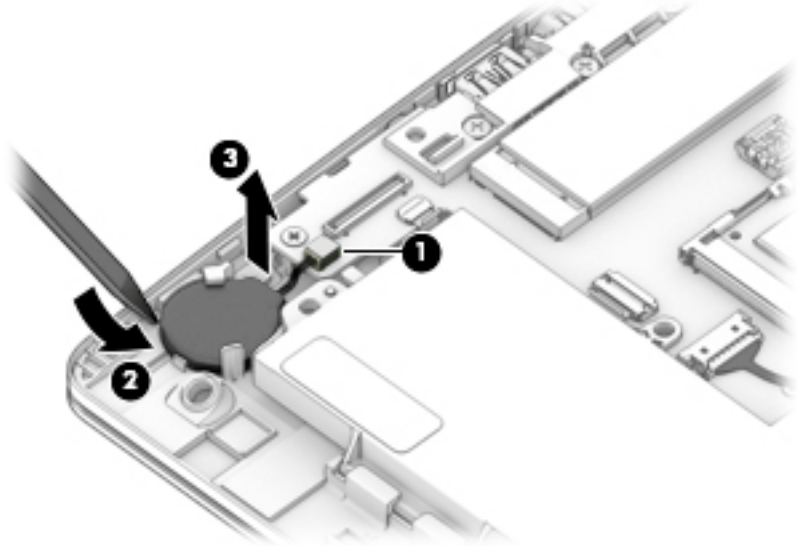
| Description | Spare part number |
|---|---|
| RTC battery | L17255-001 |

Before removing the RTC battery, follow these steps:

1. 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.
2. Disconnect all external devices connected to the computer.
3. Disconnect the power from the computer by first unplugging the power cord from the AC outlet, and then unplugging the AC adapter from the computer.
4. Remove the bottom cover (see Bottom cover on page 33).
5. Disconnect the battery cable from the system board (see Battery on page 46).

Remove the RTC battery:

1. Disconnect the RTC battery cable from the system board **(1)**.
2. Using a flat tool, pry the battery from the holder **(2)**, and then remove the battery from the computer **(3)**.




Reverse this procedure to install the RTC battery.

## USB board

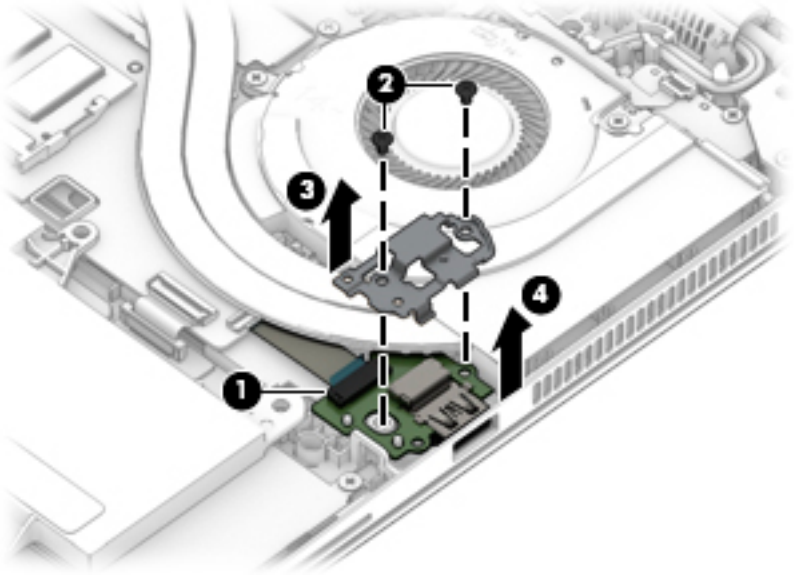
| Description | Spare part number |
|---|---|
| USB board (includes bracket) | L14380-001 |

Before removing the USB board, follow these steps:

1. 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.
2. Disconnect all external devices connected to the computer.
3. Disconnect the power from the computer by first unplugging the power cord from the AC outlet, and then unplugging the AC adapter from the computer.
4. Remove the bottom cover (see Bottom cover on page 33).
5. Disconnect the battery cable from the system board (see Battery on page 46).

Remove the USB board:

1. Disconnect the cable from the USB board **(1)**.
2. Remove the two Phillips M2.0×3.0 screws **(2)** that secure the board to the computer.
3. Lift the bracket from atop the board **(3)**.
4. Remove the board from the computer **(4)**.




Reverse this procedure to install the USB board.

## RJ-45 board with bracket

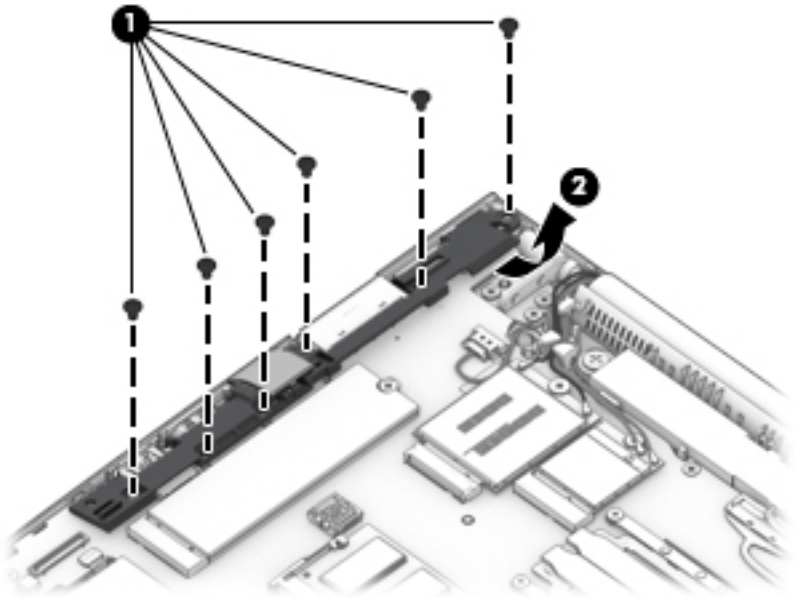
| Description | Spare part number |
|---|---|
| RJ-45 board with bracket | L14386-001 |

Before removing the RJ-45 board and bracket, follow these steps:

1. 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.
2. Disconnect all external devices connected to the computer.
3. Disconnect the power from the computer by first unplugging the power cord from the AC outlet, and then unplugging the AC adapter from the computer.
4. Remove the bottom cover (see Bottom cover on page 33).
5. Disconnect the battery cable from the system board (see Battery on page 46).

Remove the RJ-45 board and bracket:

1. Remove the six Phillips M2.5×5.0 screws **(1)** that secure the assembly to the computer.
2. Rotate the assembly out of the computer **(2)**.




Reverse this procedure to install the RJ-45 assembly.

## Power button board

| Description | Spare part number |
|---|---|
| Power button board assembly | L14374-001 |

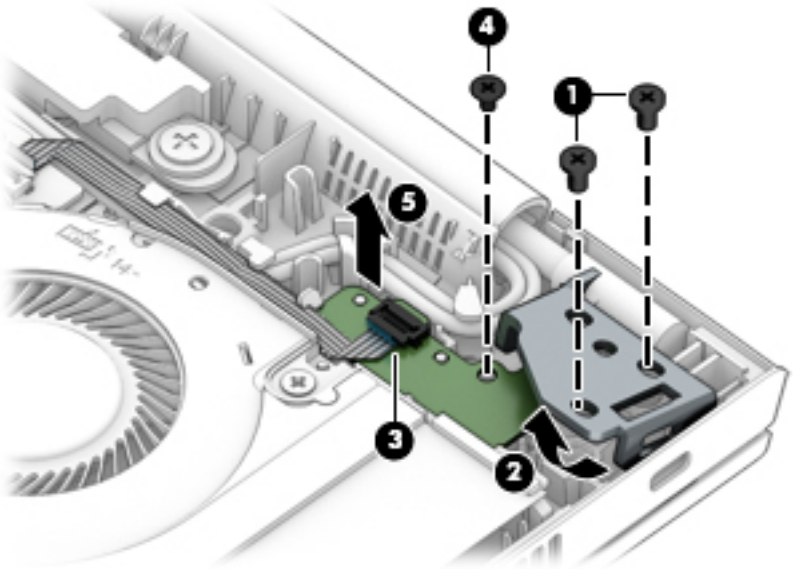
Before removing the power button board, follow these steps:

1. 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.
2. Disconnect all external devices connected to the computer.
3. Disconnect the power from the computer by first unplugging the power cord from the AC outlet, and then unplugging the AC adapter from the computer.
4. Remove the bottom cover (see Bottom cover on page 33).
5. Disconnect the battery cable from the system board (see Battery on page 46).

Remove the power button board:

**NOTE:** The power button board sits under the right display hinge. You do not have to remove the display to remove the board, but you do have to rotate the right display hinge upward to gain access.

1. Remove the two Phillips M2.5×5.0 screws **(1)** that secure the right display hinge, and then rotate the hinge upward from atop the power button board **(2)**.
2. Disconnect the cable from the power button board **(3)**.
3. Remove the Phillips M2.0×3.0 screw **(4)** that secures the power button board to the computer.
4. Remove the power button board from the computer **(5)**.




Reverse this procedure to install the power button board.

## Speaker assembly

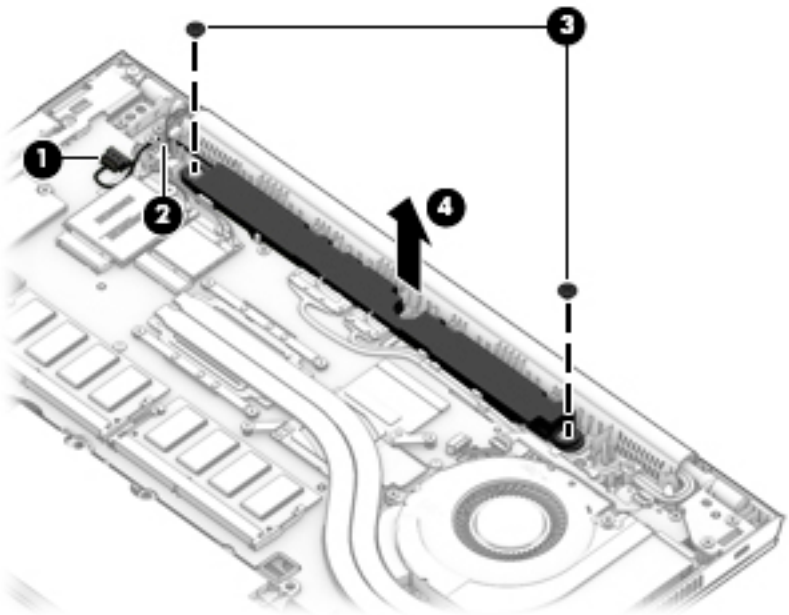
| Description | Spare part number |
|---|---|
| Speaker assembly (includes cable) | L13684-001 |

Before removing the speaker assembly, follow these steps:

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.
4. Remove the bottom cover (see Bottom cover on page 33).
5. Disconnect the battery cable from the system board (see Battery on page 46).

Remove the speaker assembly:

1. Disconnect the speaker cable from the system board **(1)**, and then remove the cable from the clip **(2)**.
2. Remove the two Phillips M2.0×2.5 screws **(3)** that secure the speaker to the computer.
3. Remove the speaker from the computer **(4)**.




Reverse this procedure to install the speaker.

## Fingerprint reader assembly

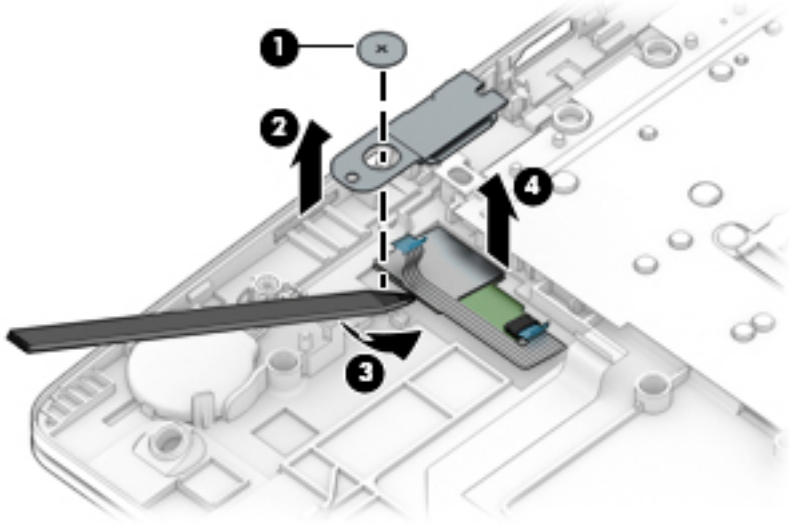
| Description | Spare part number |
|---|---|
| Fingerprint reader assembly (includes cable) | L13681-001 |
| Fingerprint reader insert (for use in models without a fingerprint reader) | L15503-001 (Plastics Kit) |

Before removing the fingerprint reader assembly, follow these steps:

1. 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.
2. Disconnect all external devices connected to the computer.
3. Disconnect the power from the computer by first unplugging the power cord from the AC outlet, and then unplugging the AC adapter from the computer.
4. Remove the bottom cover (see Bottom cover on page 33).
5. Remove the battery (see Battery on page 46).

Remove the fingerprint reader assembly:

1. Remove the Phillips M2.0×3.0 screw **(1)** that secures the fingerprint reader bracket to the computer.
2. Lift the bracket from atop the fingerprint reader assembly **(2)**.
3. Use a tool to pry the fingerprint reader board free from the computer **(3)**, and then remove the assembly from the computer **(4)**.




Reverse this procedure to install the fingerprint reader assembly.

## TouchPad

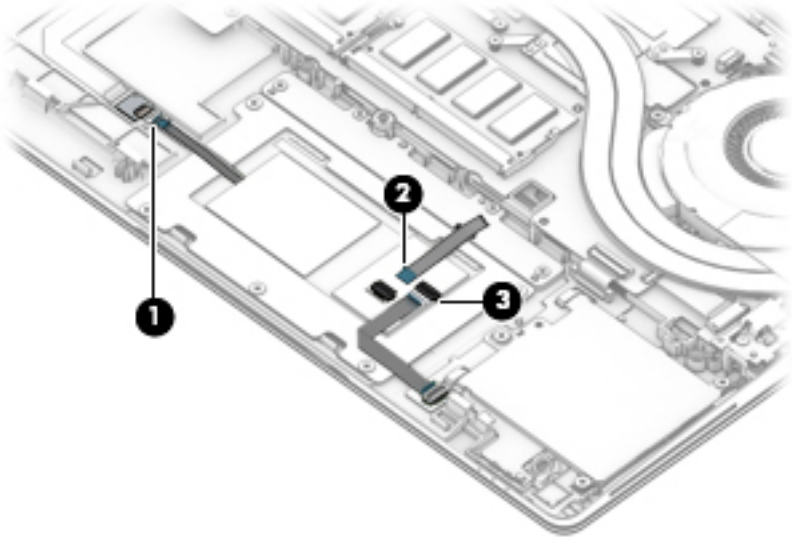
| Description | Spare part number |
|---|---|
| TouchPad for use in models without an NFC module | L14381-001 |
| TouchPad for use in models with an NFC module | L19417-001 |

Before removing the TouchPad, follow these steps:

1. 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.
2. Disconnect all external devices connected to the computer.
3. Disconnect the power from the computer by first unplugging the power cord from the AC outlet, and then unplugging the AC adapter from the computer.
4. Remove the bottom cover (see Bottom cover on page 33).
5. Remove the battery (see Battery on page 46).

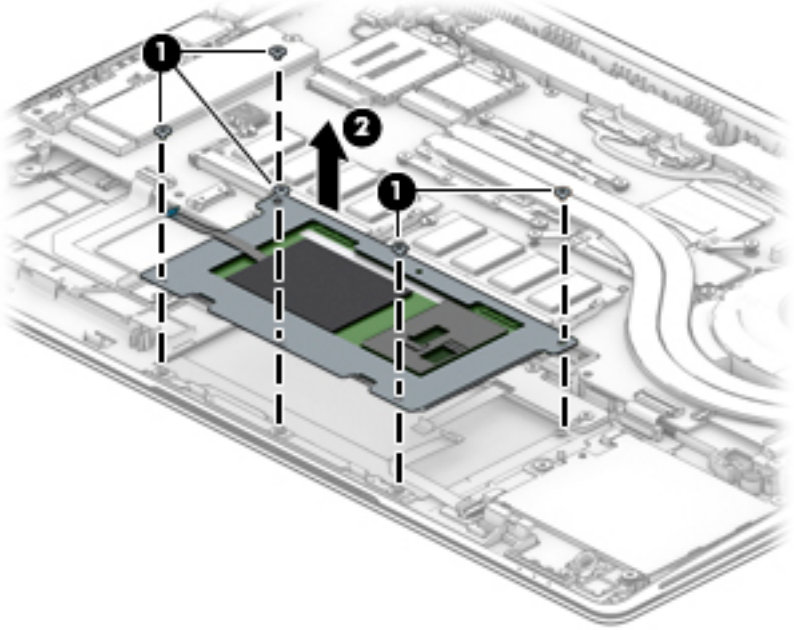
Remove the TouchPad:

1. Disconnect the NFC module cable from the ZIF connector on the NFC module **(1)**.
2. Disconnect the TouchPad button board cable from the ZIF connector on the TouchPad **(2)**.
3. Disconnect the card reader cable from the ZIF connector on the TouchPad **(3)**.




4. Remove the five Phillips M2.0x2.5 screws **(1)** that secure the TouchPad to the computer.

5. Remove the TouchPad from the computer **(2)**.




Reverse this procedure to install the TouchPad.

## TouchPad button board

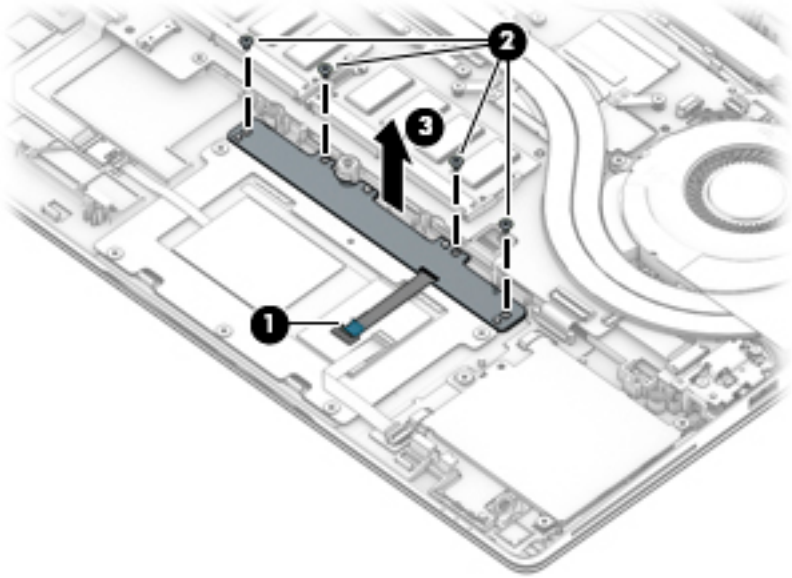
| Description | Spare part number |
|---|---|
| TouchPad button board | L18311-001 |

Before removing the TouchPad button board, follow these steps:

1. 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.
2. Disconnect all external devices connected to the computer.
3. Disconnect the power from the computer by first unplugging the power cord from the AC outlet, and then unplugging the AC adapter from the computer.
4. Remove the bottom cover (see Bottom cover on page 33).
5. Remove the battery (see Battery on page 46).

Remove the TouchPad button board:

1. Disconnect the TouchPad button board cable from the ZIF connector on the TouchPad **(1)**.
2. Remove the four Phillips M2.0x3.0 screws **(2)** that secure the board to the computer, and then remove the TouchPad button board from the computer **(3)**.




Reverse this procedure to install the TouchPad button board.

## NFC module

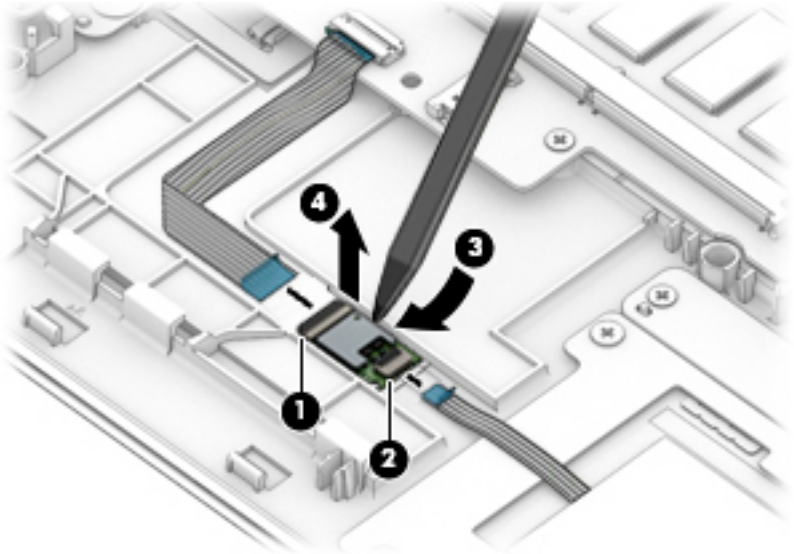
| Description | Spare part number |
|---|---|
| NFC module (includes antenna and TouchPad foam) | L14385-001 |

Before removing the NFC module, follow these steps:

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.
4. Remove the bottom cover (see Bottom cover on page 33).
5. Remove the battery (see Battery on page 46).

Remove the NFC module:

1. Disconnect the system board cable **(1)** and the NFC antenna **(2)** from the ZIF connectors on the NFC module.
2. Use a tool to release the NFC module from the adhesive securing it to the computer **(3)**, and then remove the module from the computer **(4)**.




Reverse the removal procedures to install the NFC module.

## Smart card reader

| Description | Spare part number |
|---|---|
| Smart card reader | L18312-001 |
| Smart card reader cable (available in Cable Kit) | L14370-001 (Cable Kit) |
| Smart card reader insert (for use in models without a smart card reader) | L15503-001 (Plastics Kit) |

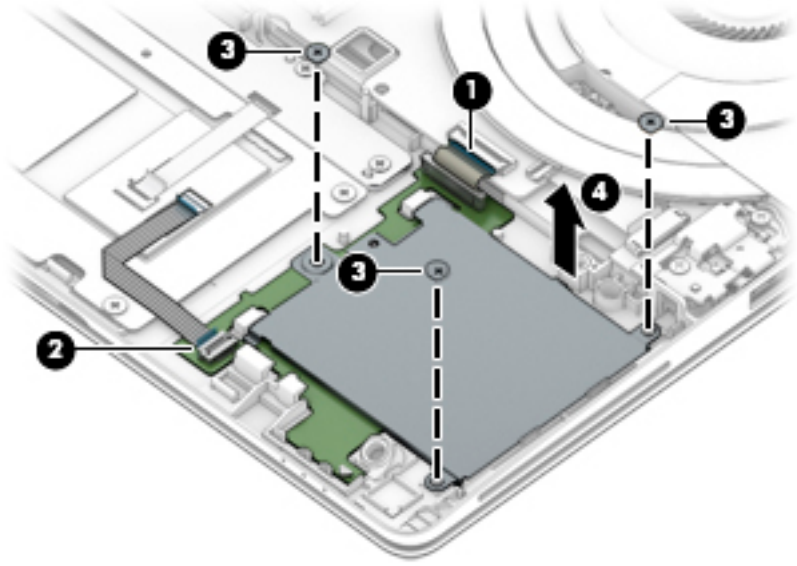
Before removing the card reader, follow these steps:

1. 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.
2. Disconnect all external devices connected to the computer.
3. Disconnect the power from the computer by first unplugging the power cord from the AC outlet, and then unplugging the AC adapter from the computer.
4. Remove the bottom cover (see Bottom cover on page 33).
5. Remove the battery (see Battery on page 46).

Remove the smart card reader:

**NOTE:** Before you remove the smart card reader, make sure nothing (memory card or plastic insert) in inserted in the reader.

1. Disconnect the system board cable from the connector on the smart card reader board **(1)**.
2. Disconnect the TouchPad cable from the ZIF connector on the smart card reader board **(2)**.
3. Remove the three Phillips M2.0x2.5 screws **(3)** that secure the smart card reader to the computer.
4. Remove the smart card reader from the computer **(4)**.




Reverse this procedure to install the smart card reader.

# Fan

| Description | Spare part number |
|---|---|
| Fan | L22306-001 |

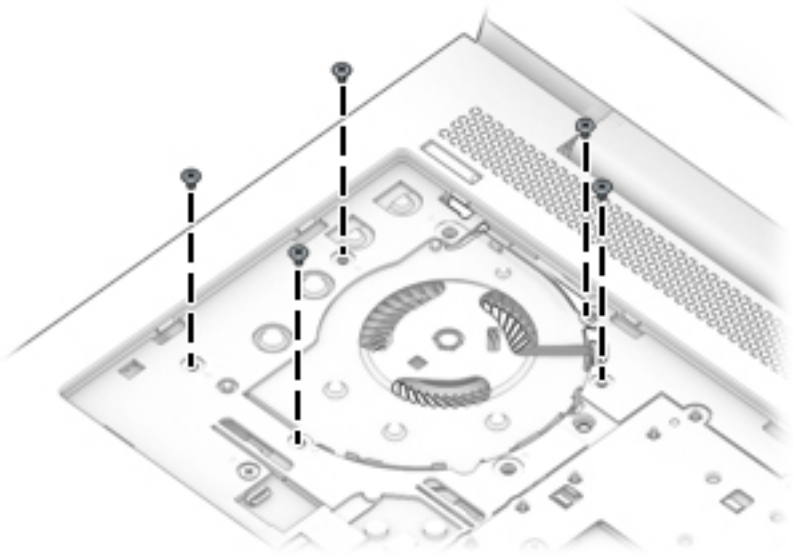
Before removing the fan, follow these steps:

1. 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.
2. Disconnect all external devices connected to the computer.
3. Disconnect the power from the computer by first unplugging the power cord from the AC outlet, and then unplugging the AC adapter from the computer.
4. Remove the bottom cover (see Bottom cover on page 33).
5. Remove the battery (see Battery on page 46).
6. Remove the keyboard (see Keyboard on page 42).

Remove the fan:

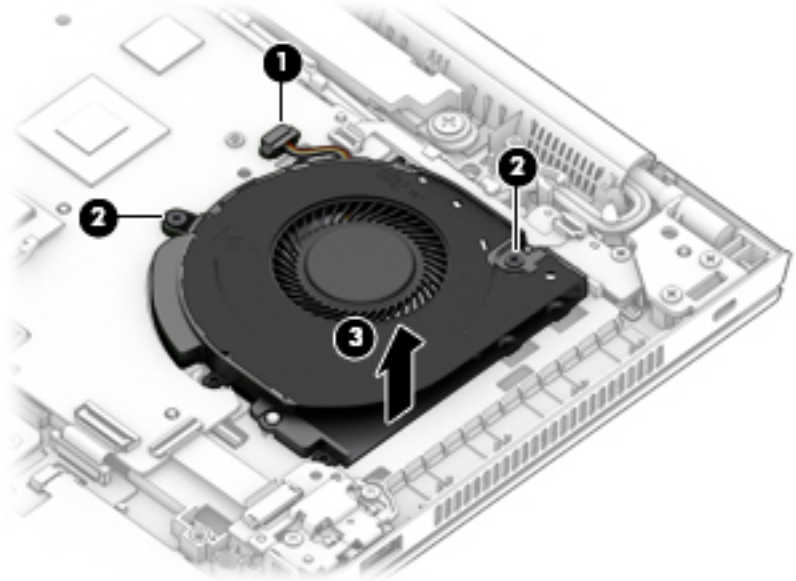
**NOTE:** To remove the fan you must remove screws from both the top (under the keyboard) and bottom of the computer.

1. Position the computer upright and open as far as possible.
2. Remove the five Phillips M2.0×3.0 screws that secure the fan to the computer.



3. Close the computer and position it upside down.
4. Disconnect the fan cable from the system board **(1)**.
5. Loosen the two captive Phillips screws **(2)** that secure the fan to the computer.

6. Remove the fan from the computer **(3)**.




Reverse this procedure to install the fan.

## System board

**NOTE:** All system board spare part kits include replacement thermal material.

All system boards use the following part numbers:

xxxxxx-001: Non-Windows operating systems

xxxxxx-601: Windows operating system

| Description | Spare part number |
|---|---|
| System board with integrated AMD Ryzen 3 PRO 2300U Mobile Processor | L29298-301 |

Before removing the system board, follow these steps:

1. 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.
2. Disconnect all external devices connected to the computer.
3. Disconnect the power from the computer by first unplugging the power cord from the AC outlet, and then unplugging the AC adapter from the computer.
4. Remove the bottom cover (see Bottom cover on page 33).
5. Remove the battery (see Battery on page 46).
6. Remove the keyboard (see Keyboard on page 42).
7. Remove the RJ-45 board and bracket (see RJ-45 board with bracket on page 52).
8. Remove the fan (see Fan on page 61).

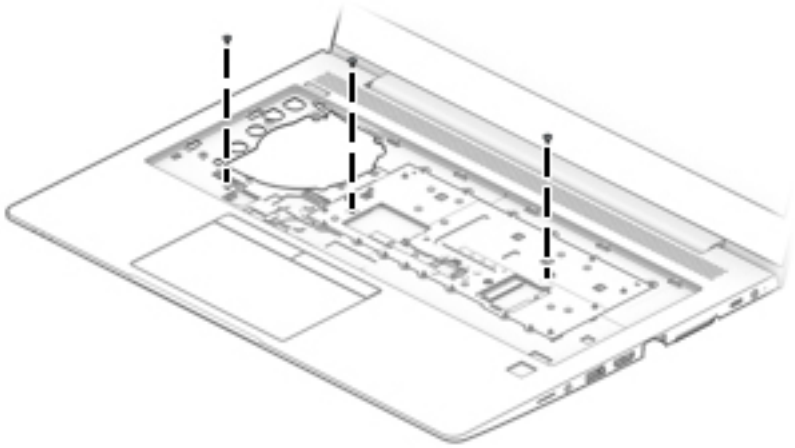
When replacing the system board, be sure to remove the following components (as applicable) from the defective system board and install on the replacement system board:

- Solid-state drive (see Solid-state drive (SSD) on page 35)
- Memory modules (see Memory modules on page 36)
- WLAN/Bluetooth module (see WLAN/Bluetooth combo card on page 38)
- WWAN module (see WWAN module on page 40)
- Heat sink (see Heat sink assembly on page 48)

Remove the system board:

1. Position the computer upright and open as far as possible.

2. Remove the three Phillips M2.5×3.0 screws that secure the system board to the computer.



3. Close the computer and position it upside down.
4. Disconnect the following cables from the system board:

   **(1)** RTC battery cable

   **(2)** Fingerprint reader cable

   **(3)** NFC module cable

   **(4)** Speaker cable

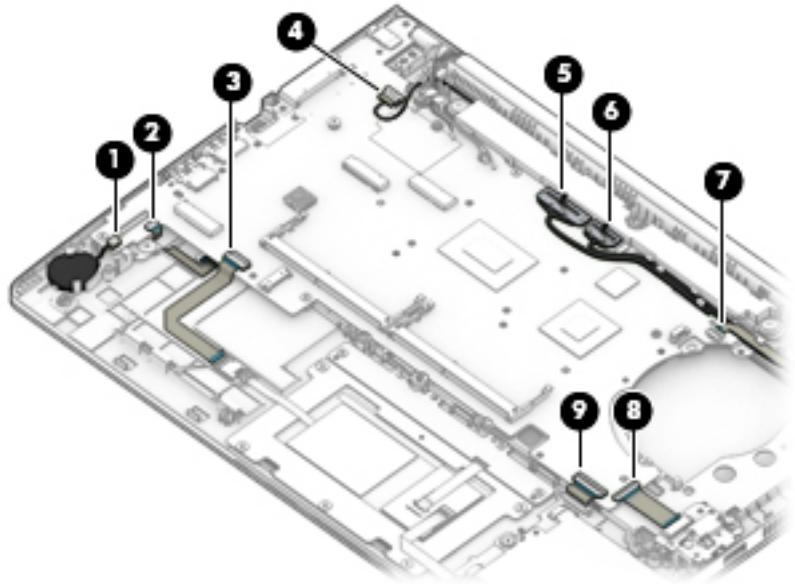
   **(5)** Display cable

   **(6)** Camera cable

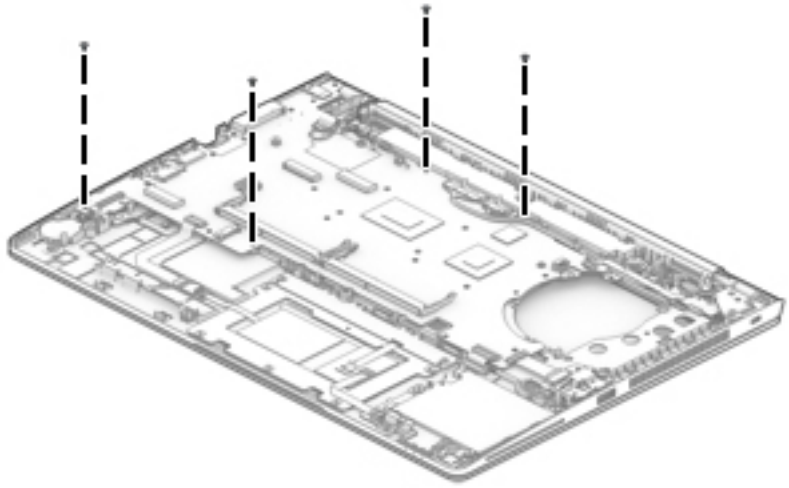
   **(7)** Power button board cable

   **(8)** USB cable

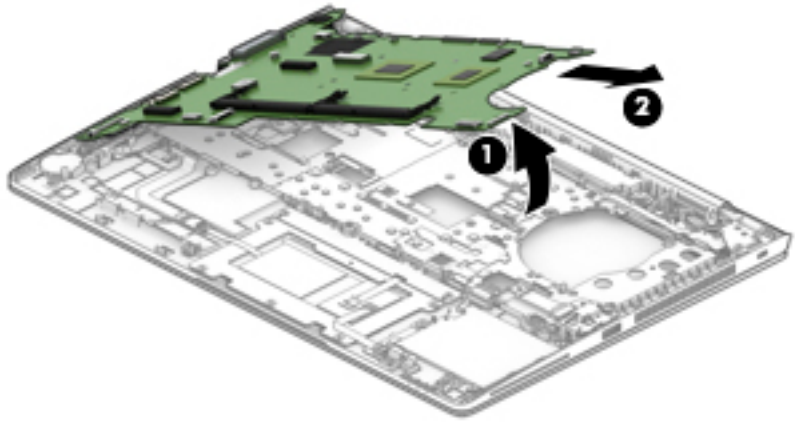
   **(9)** Smart card reader cable



5. Remove the four Phillips M2.5×3.0 screws that secure the system board to the computer.



6. Lift the right side of the system board up at an angle **(1)**.
7. Pull the system board up and toward the right to disengage the connectors from the left side of the computer, and then remove the system board **(2)**.




Reverse this procedure to install the system board.

## Display assembly

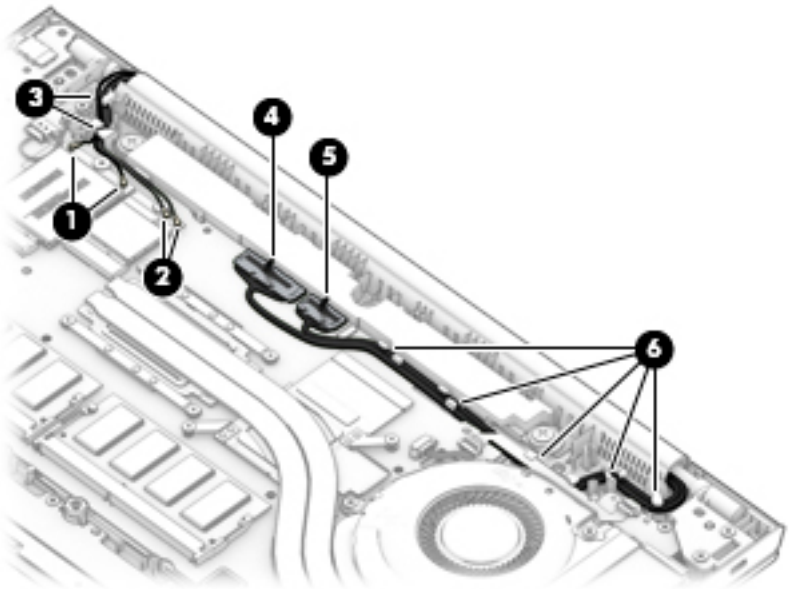
**NOTE:** Display assemblies are spared at the subcomponent level only. Display assembly spare part information is also available at Display assembly subcomponents on page 22.

Before removing the display assembly, follow these steps:

1. 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.
2. Disconnect all external devices connected to the computer.
3. Disconnect the power from the computer by first unplugging the power cord from the AC outlet, and then unplugging the AC adapter from the computer.
4. Remove the bottom cover (see Bottom cover on page 33).
5. Disconnect the battery cable from the system board (see Battery on page 46).

Remove the display assembly:

1. Disconnect the antenna cables from the WWAN module **(1)** and the WLAN module **(2)**.
2. Remove the antenna cables from the clips built into the computer **(3)**.
3. Disconnect the display cable **(4)** and the camera cable **(5)** from the system board.
4. Remove the cables from the clips built into the computer **(6)**.

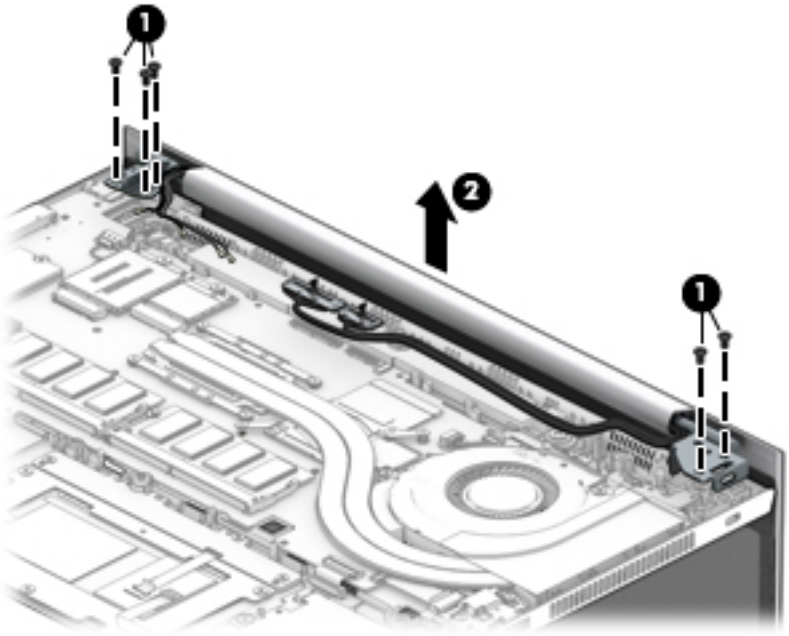



5. With the computer upside down, open the display, and then place the computer on a table with the display positioned off the edge of the table.
6. Remove the five Phillips M2.5×5.0 screws **(1)** from the display hinges.

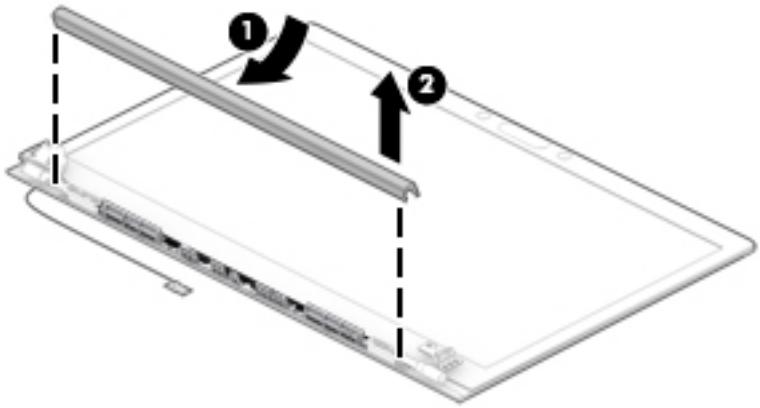
7. Lift the display assembly straight up and remove it **(2)**.

⚠ **CAUTION:** When installing the display assembly, be sure that the wireless antenna cables are routed and arranged properly.

Failure to properly route the antennas can result in degradation of the computer's wireless performance.

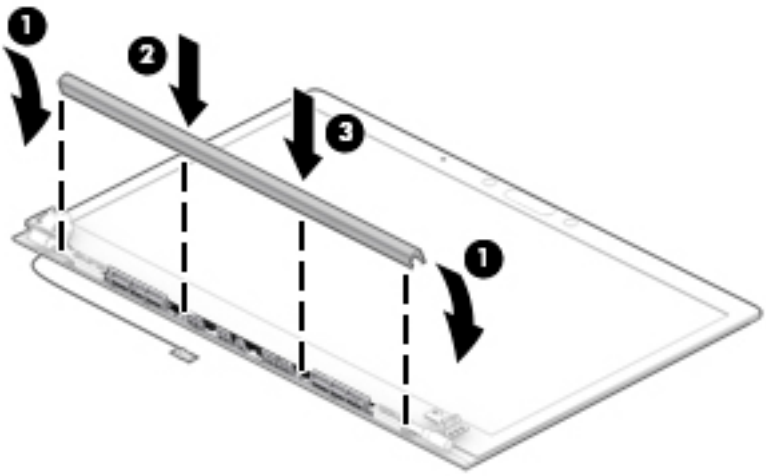


8. To remove the display hinge cover, rotate top of hinge cover away from display enclosure to disengage the tabs **(1)**, and then pull the cover off the enclosure **(2)**.



The display hinge cover (for touch displays) is available using spare part number L14375-001. The display hinge cover (for non-touch displays) is available using spare part number L14376-001.

When installing the hinge cover, make sure all cables are routed correctly under the hinge cover and the hooks on the end of the cover are aligned correctly with the snaps on the bottom of the display **(1)**. Press the left **(2)**, and then right **(3)** middle sections of the hinge cover until it snaps into place.



9. To remove the display bezel, flex the top **(1)** of the bezel, the inside edges of the left and right sides **(2)**, and then the bottom **(3)** of the bezel until it disengages from the display enclosure.

10. Remove the display bezel **(4)**.

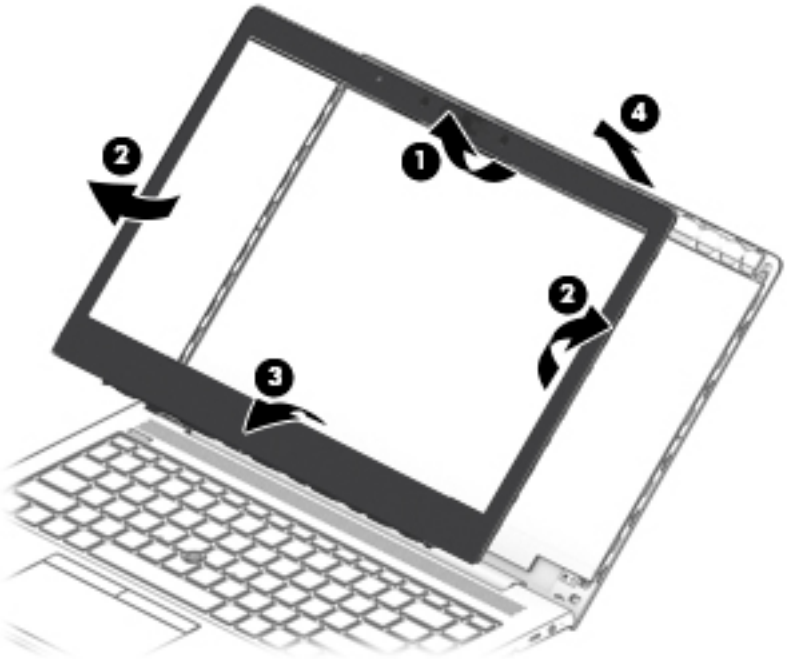
    The display bezel is available using the following spare part numbers:

    Models with a microphone module: L15505-001

    Models with an HD camera: L15506-001

    Models with an IR camera: L15507-001

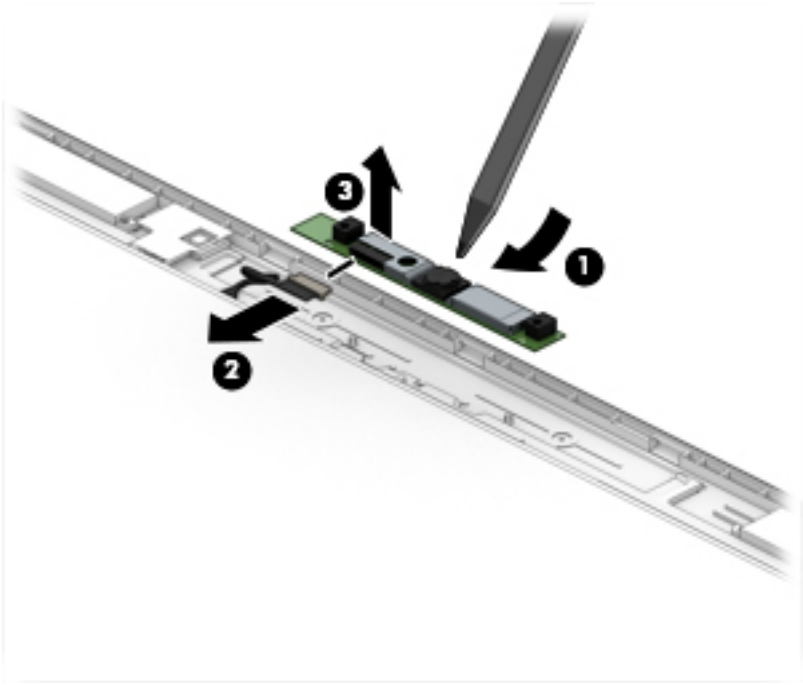
    Camera shutters are available in the Plastics Kit using spare part number L15503-001.




11. Two different camera modules are available. Refer to the following procedure appropriate for your computer if it is necessary to replace the camera module:

    a. **HD camera or microphone module**

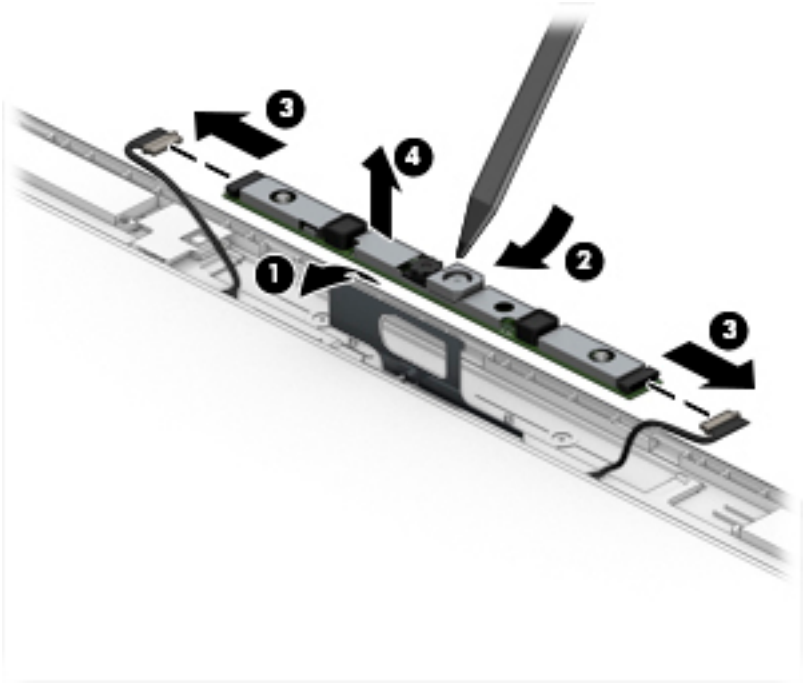
       Lift upward to disengage the module from the adhesive on the display enclosure **(1)**, disconnect the cable from the module **(2)**, and then remove the module from the display **(3)**.



The HD camera module is available using spare part number L28405-001. The microphone module is available using spare part number L15512-001.

**b. IR camera**

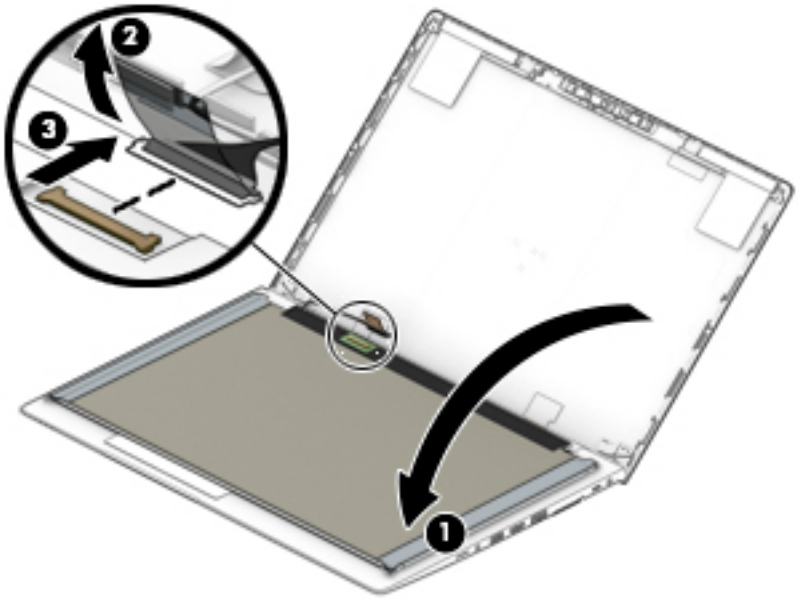
Remove the tape from atop the module **(1)**, lift upward to disengage the module from the adhesive on the display enclosure **(2)**, disconnect the cables from the left and right sides of the module **(3)**, and then remove the camera module from the display **(4)**.



The IR camera module is available using spare part number L28404-001.

12. If it is necessary to remove the display panel from the enclosure, remove the four Phillips M2.0×2.0 screws that secure the panel to the display enclosure.

13. Rotate the display panel over onto the keyboard **(1)**.
14. On the back of the display panel, lift the tape from atop the connector **(2)**, and then disconnect the display cable from the rear of the panel **(3)**.




The raw display panel is available using the following spare part numbers:

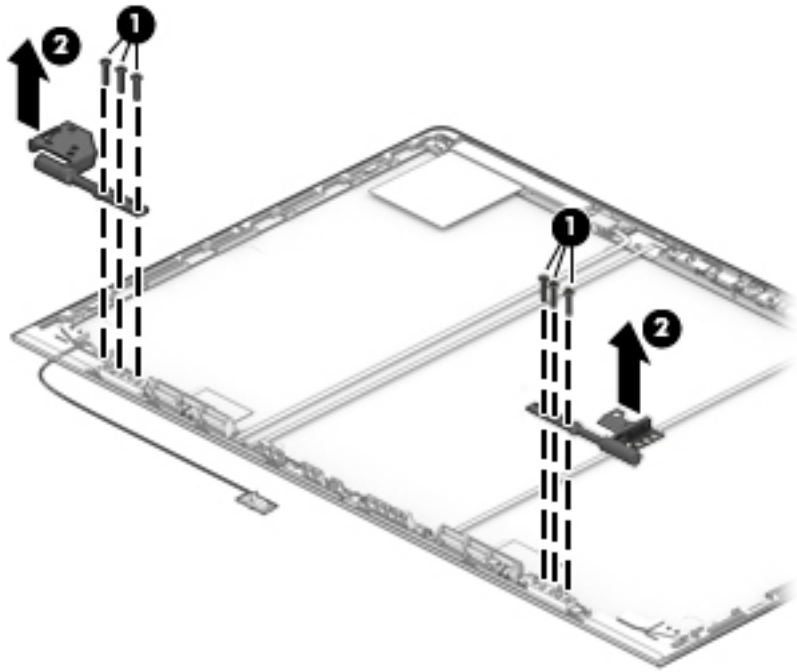
FHD panel, non-touch: L22310-001

FHD panel, non-touch, models with IR and HD cameras and WWAN modules: L22309-001

FHD panel, touch, models with IR and HD cameras and WWAN modules: L22311-001

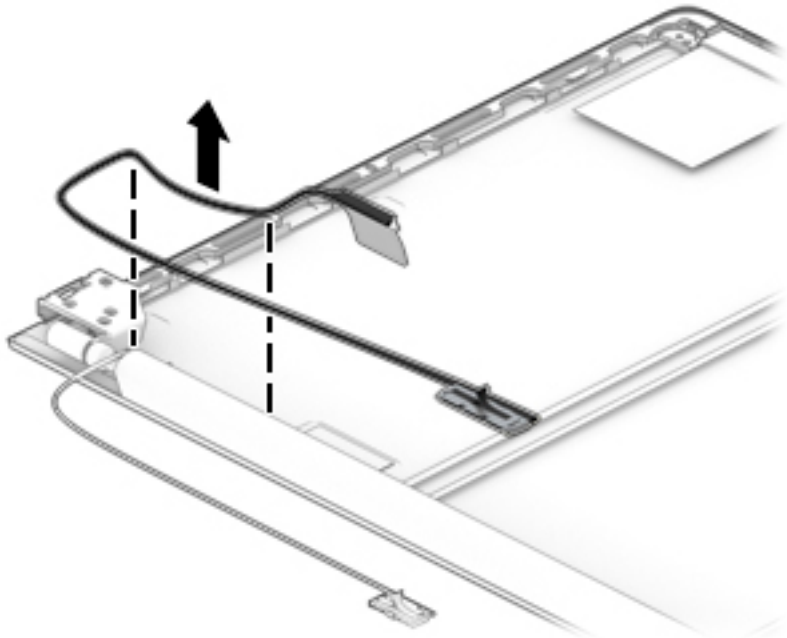
15. If it is necessary to replace the display hinges, remove the three Phillips M2.5x11.0 screws that secure each hinge **(1)**, and then remove the hinges from the display enclosure **(2)**.

    Display hinges (for touch displays) are available in the Hinge Kit using spare part number L14375-001. Display hinges (for non-touch displays) are available using spare part number L14376-001.




16. If it is necessary to replace the display cable, lift the cable from the routing path in the display enclosure.

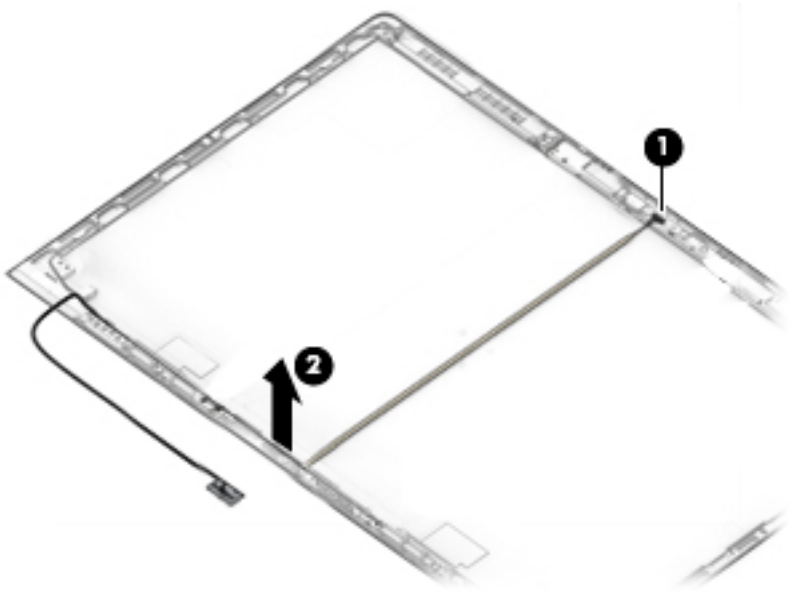
    The display cable is available in the Cable Kit, using spare part number L14370-001.



17. If it is necessary to replace the camera cable:

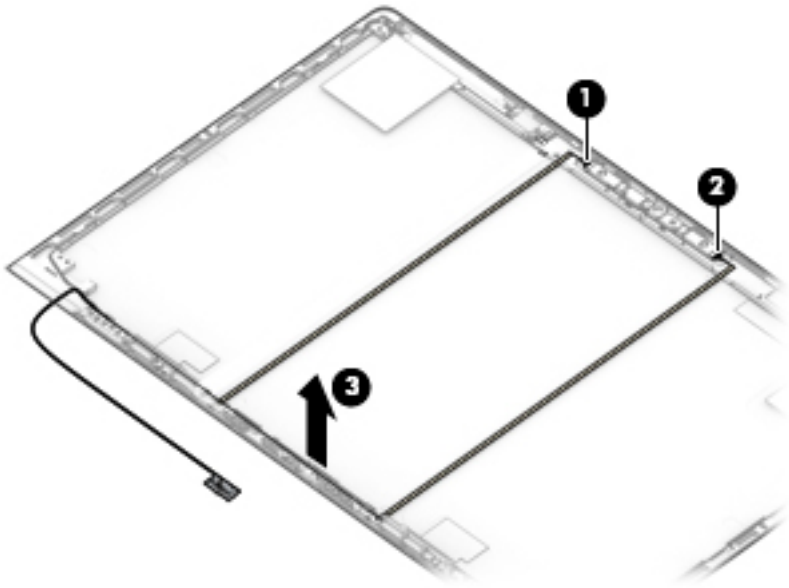
**a. HD camera models**

Disconnect the cable from the HD camera **(1)**, and then remove the cable from the display enclosure **(2)**.




**b. IR camera models**

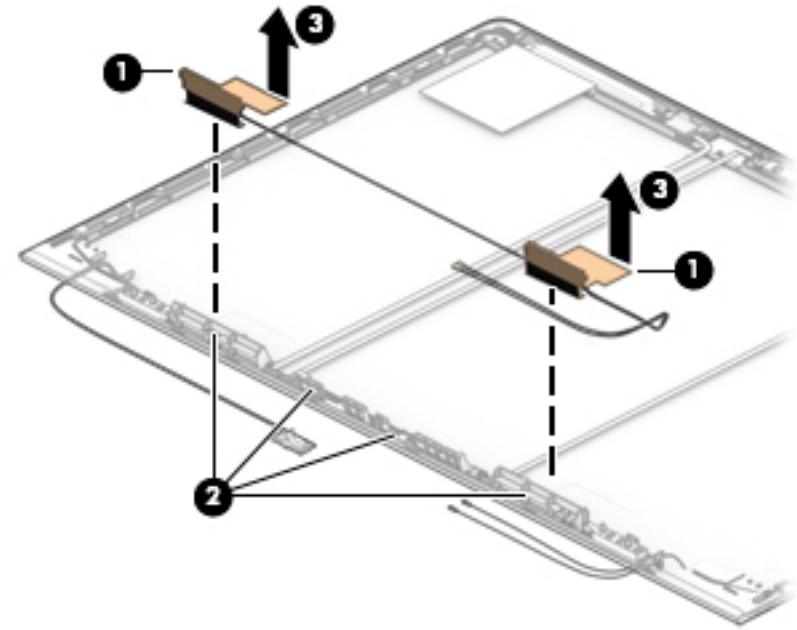
Disconnect the cable from the left **(1)** and right **(2)** sides of the IR camera, and then remove the cable from the display enclosure **(3)**.




The camera cable is available in the Cable Kit using spare part number L14370-001.

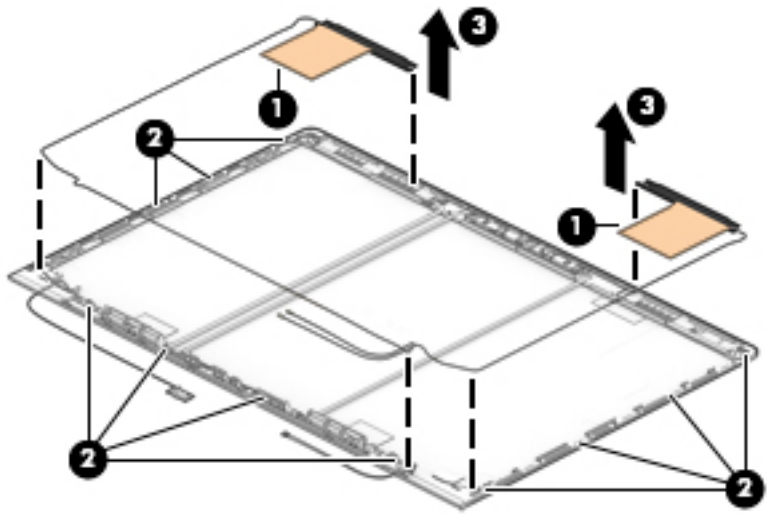
18. If it is necessary to replace the WLAN antenna cables, peel the antennas from the top of the display enclosure **(1)**, remove the antenna cables from the routing path on the bottom of the display enclosure **(2)**, and then remove the antenna cables **(3)**.

**NOTE:** The WLAN antennas are spared with the display enclosure.




19. If it is necessary to replace the WWAN antenna cables, peel the antennas from the top of the display enclosure **(1)**, remove the antenna cables from the bottom and sides of the display enclosure **(2)**, and then remove the antenna cables **(3)**.

**NOTE:** The WWAN antennas are spared with the display enclosure.




The display enclosure is available using spare part number L15501-001 for models without a WWAN module and L15502-001 for models with a WWAN module.

Reverse this procedure to reassemble and install the display assembly.

## Top cover

| Description | Spare part number |
|---|---|
| Top cover | L21975-001 |

The top cover remains after removing all other spared parts from the computer.

# 7 Interpreting system validation diagnostic front panel LEDs and audible codes

During the system validation phase that occurs at system startup, the BIOS validates the functionality of the following subsystems and conditions:

- AC adapter
- System board power
- Processor failure
- BIOS corruption
- Memory failure
- Graphics failure
- System board failure
- BIOS authentication failure

If an error is detected, specific patterns of long and short blinks, accompanied by long and short beeps (where applicable) are used to identify the error. These patterns will make up a two part code:

- Major – the category of the error
- Minor – the specific error within the category

**NOTE:** Single beep/blink codes are not used.

| Number of long beeps/blinks | Error category |
|---|---|
| 1 | Not used |
| 2 | BIOS |
| 3 | Hardware |
| 4 | Thermal |
| 5 | System board |

Patterns of blink/beep codes are determined by using the following parameters:

- 1 second pause occurs after the last major blink.
- 2 second pause occurs after the last minor blink.
- Beep error code sequences occur for the first 5 iterations of the pattern and then stop.
- Blink error code sequences continue until the computer is unplugged or the power button is pressed.

**NOTE:** Not all diagnostic lights and audible codes are available on all models.

The red LED blinks to represent the major error category (long blinks). The white LED blinks to represent the minor error category (short blinks). For example, '3.5' indicates 3 long red blinks and 5 short white blinks to communicate the processor is not detected.

| Component tested | Major/ minor code | Error condition | Notebook Caps Lock/Num Lock LED | Desktop | Action |
|---|---|---|---|---|---|
| BIOS | 2.2 | The main area (DXE) of BIOS has become corrupted and there is no recovery binary image available | CAP/NUM Blink = 2 | 2.2 - Power LED (red.white) | Follow the Crisis Recovery instructions at http://support.hp.com/us-en/document/c02693833/. |
| | 2.3 | The embedded controller policy requires the user to enter a key sequence (SureStart 2.0) | CAP/NUM Blink = 8 | 2.3 - Power LED (red.white) | If analysis of the event that caused Sure Start recovery is desired, replace the board and send the bad board back. Otherwise, press this key combination to restore BIOS and boot: Up Arrow+ Down Arrow+ Esc. |
| | 2.4 | The embedded controller is recovering the boot block or DXE. Since it takes 10 sec. or so to load the DXE image and get video in the DXE case, this blink code is necessary. (SureStart) | Battery LED White and Amber blinking | 2.4 - Power LED (red.white) | Wait for DXE recovery to complete. |
| Hardware | 3.2 | The embedded controller has timed out waiting for BIOS to return from memory initialization | CAP/NUM Blink = 3 | 3.2 - Power LED (red.white) | System board replacement. |
| | 3.3 | The embedded controller has timed out waiting for BIOS to return from graphics initialization ( 4/13- Graphics adaptor not found) | CAP/NUM Blink = 4 | 3.3 - Power LED (red.white) | If the system has an MXM module, try a different MXM module. Otherwise, the board most likely needs to be replaced. |
| | 3.4 | The system board displays a power failure (crowbar) * | CAP/NUM Blink = 5 | 3.4 - Power LED (red.white) | System board replacement. |
| System board | 5.2 | The embedded controller cannot find valid firmware | CAP/NUM Blink = 7 (2 BB failure) Battery LED Blinking = 1 Hz (3 B failure) | 5.2 - Power LED (red.white) | System board replacement. |
| | 5.3 | The embedded controller has timed out waiting for the BIOS | CAP/NUM Blink = 1 | Not implemented | System board replacement. |

# 8 Computer Setup (BIOS), TPM, and HP Sure Start

## Using Computer Setup

Computer Setup, 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). Computer Setup includes settings for the types of devices installed, the startup sequence of the computer, and the amount of system and extended memory.

**NOTE:** Use extreme care when making changes in Computer Setup. Errors can prevent the computer from operating properly.

### Starting Computer Setup

▲ Turn on or restart the computer, and when the HP logo appears, press f10 to enter Computer Setup.

#### Using a USB keyboard or USB mouse to start Computer Setup (BIOS)

You can start Computer Setup by using a keyboard or mouse connected to a USB port, but you must first disable FastBoot.

1. Turn on or restart the computer, and when the HP logo appears, press f9 to enter the Boot Device Options menu.
2. Clear the check box for **Fast Boot**.
3. To save your changes and exit, select the **Save** icon in the lower-right corner of the screen, and then follow the on-screen instructions.

– or –

Select **Main**, select **Save Changes and Exit**, and then press enter.

Your changes go into effect when the computer restarts.

### Navigating and selecting in Computer Setup

- To select a menu or a menu item, use the tab key and the keyboard arrow keys and then press enter, or use a pointing device to select the item.
- To scroll up and down, select the up arrow or the down arrow in the upper-right corner of the screen, or use the up arrow key or the down arrow key on the keyboard.
- To close open dialog boxes and return to the main Computer Setup screen, press esc, and then follow the on-screen instructions.

To exit Computer Setup menus, choose one of the following methods:

- To exit Computer Setup menus without saving your changes:

  Select the **Exit** icon in the lower-right corner of the screen, and then follow the on-screen instructions.

  – or –

  Select **Main**, select **Ignore Changes and Exit**, and then press enter.

- To save your changes and exit Computer Setup menus:

  Select the **Save** icon in the lower-right corner of the screen, and then follow the on-screen instructions.

  – or –

  Select **Main**, select **Save Changes and Exit**, and then press enter.

Your changes go into effect when the computer restarts.

## Restoring factory settings in Computer Setup

**NOTE:** Restoring defaults will not change the hard drive mode.

To return all settings in Computer Setup to the values that were set at the factory, follow these steps:

1. Start Computer Setup. See Starting Computer Setup on page 78.
2. Select **Main**, and then select **Apply Factory Defaults and Exit**.

   **NOTE:** On select products, the selections may display **Restore Defaults** instead of **Apply Factory Defaults and Exit**.

3. Follow the on-screen instructions.
4. To save your changes and exit, select the **Save** icon in the lower-right corner of the screen, and then follow the on-screen instructions.

   – or –

   Select **Main**, select **Save Changes and Exit**, and then press enter.

Your changes go into effect when the computer restarts.

**NOTE:** Your password settings and security settings are not changed when you restore the factory settings.

## Updating the BIOS

Updated versions of the BIOS may 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 Computer Setup (BIOS), first determine the BIOS version on your computer.

BIOS version information (also known as *ROM date* and *System BIOS*) can be accessed by pressing fn+esc (if you are already in Windows) or by using Computer Setup.

1. Start Computer Setup. See Starting Computer Setup on page 78.
2. Select **Main**, and then select **System Information**.
3. To exit Computer Setup without saving your changes, select the **Exit** icon in the lower-right corner of the screen, and then follow the on-screen instructions.

   – or –

   Select **Main**, select **Ignore Changes and Exit**, and then press enter.

To check for later BIOS versions, see Downloading a BIOS update on page 80.

## Downloading a BIOS update

**CAUTION:** 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 on 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.

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. Make a note of the date, name, or other identifier. You may 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.

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

BIOS installation procedures vary. Follow any instructions that are displayed on the screen after the download is complete. If no instructions are displayed, 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.

### Changing the boot order using the f9 prompt

To dynamically choose a boot device for the current startup sequence, follow these steps:

1. Access the Boot Device Options menu:
   - Turn on or restart the computer, and when the HP logo appears, press f9 to enter the Boot Device Options menu.
2. Select a boot device, press enter, and then follow the on-screen instructions.

## TPM BIOS settings (select products only)

**IMPORTANT:** Before enabling Trusted Platform Module (TPM) functionality on this system, you must ensure that your intended use of TPM complies with relevant local laws, regulations and policies, and approvals or licenses must be obtained if applicable. For any compliance issues arising from your operation/usage of TPM which violates the above mentioned requirement, you shall bear all the liabilities wholly and solely. HP will not be responsible for any related liabilities.

TPM provides additional security for your computer. You can modify the TPM settings in Computer Setup (BIOS).

**NOTE:** If you change the TPM setting to Hidden, TPM is not visible in the operating system.

To access TPM settings in Computer Setup:

1. Start Computer Setup. See Starting Computer Setup on page 78.
2. Select **Security**, select **TPM Embedded Security**, and then follow the on-screen instructions.

## Using HP Sure Start (select products only)

Select computer models are configured with HP Sure Start, a technology that monitors the computer's BIOS for attacks or corruption. If the BIOS becomes corrupted or is attacked, HP Sure Start automatically restores the BIOS to its previously safe state, without user intervention.

HP Sure Start is configured and already enabled so that most users can use the HP Sure Start default configuration. The default configuration can be customized by advanced users.

To access the latest documentation on HP Sure Start, go to http://www.hp.com/support. Select **Find your product**, and then follow the on-screen instructions.

# 9 Using HP PC Hardware Diagnostics (UEFI)

HP PC Hardware Diagnostics is a Unified Extensible Firmware Interface (UEFI) that allows you to run diagnostic tests to determine whether the computer hardware is functioning properly. The tool runs outside the operating system so that it can isolate hardware failures from issues that are caused by the operating system or other software components.

When HP PC Hardware Diagnostics (UEFI) detects a failure that requires hardware replacement, a 24-digit Failure ID code is generated. This ID code can then be provided to support to help determine how to correct the problem.

**NOTE:** To start diagnostics on a convertible computer, your computer must be in notebook mode and you must use the keyboard attached.

To start HP PC Hardware Diagnostics (UEFI), follow these steps:

1. Turn on or restart the computer, and quickly press esc.
2. Press f2.

   The BIOS searches three places for the diagnostic tools, in the following order:

   a. Connected USB drive

      **NOTE:** To download the HP PC Hardware Diagnostics (UEFI) tool to a USB drive, see Downloading HP PC Hardware Diagnostics (UEFI) to a USB device on page 82.

   b. Hard drive

   c. BIOS
3. When the diagnostic tool opens, select the type of diagnostic test you want to run, and then follow the on-screen instructions.

**NOTE:** If you need to stop a diagnostic test, press esc.

## Downloading HP PC Hardware Diagnostics (UEFI) to a USB device

**NOTE:** The HP PC Hardware Diagnostics (UEFI) download instructions are provided in English only, and you must use a Windows computer to download and create the HP UEFI support environment because only .exe files are offered.

There are two options to download HP PC Hardware Diagnostics to a USB device.

**Download the latest UEFI version**

1. Go to http://www.hp.com/go/techcenter/pcdiags. The HP PC Diagnostics home page is displayed.
2. In the HP PC Hardware Diagnostics section, select the **Download** link, and then select **Run**.

**Download any version of UEFI for a specific product**

1. Go to http://www.hp.com/support.
2. Select **Get software and drivers**.

3. Enter the product name or number.

   – or –

   Select **Identify now** to let HP automatically detect your product.

4. Select your computer, and then select your operating system.

5. In the **Diagnostic** section, follow the on-screen instructions to select and download the UEFI version you want.

**Additional BIOS crisis recovery tool**

HP provides a BIOS crisis recovery tool through the HP PC Hardware Diagnostics 3-in-1 USB key. This tool can be used by HP authorized service providers to recover systems that have failed due to a corrupted BIOS. For more information about using the 3-in-1 USB key for BIOS crisis recovery, go to http://www.hp.com/go/techcenter/pcdiags. Additional information is included in the web-based training offered by HP University. See the modules that cover HP PC Hardware Diagnostics (UEFI).

# 10 Diagnostics and troubleshooting

## LEDs

**Table 10-1 Power and IDE Flash Activity LEDs**

| LED | Status |
|---|---|
| Power LED Off | When the unit is plugged into the wall socket and the Power LED is off, the unit is powered off. However, the network can trigger a Wake On LAN event in order to perform management functions. |
| Power LED On | Displays during boot sequence and while the unit is on. During boot sequence, hardware initialization is processed and startup tests are performed on the following:<br>• Processor initialization<br>• Memory detection and initialization<br>• Video detection and initialization<br>**NOTE:** If one of the tests fails, the unit will simply stop, but the LED will stay on. If the video test fails, the unit beeps. There are no messages sent to video for any of these failed tests.<br>**NOTE:** After the video subsystem is initialized, anything that fails will have an error message. |
| **NOTE:** RJ-45 LEDs are located inside the RJ-45 connector on the top, rear panel of the thin client. The LEDs are visible when the connector is installed. Blinking green indicates network activity, and amber indicates a 100MB speed connection. | |
| IDE LED is Off | When the unit is powered on and the flash activity light is off, then there is no access to the system flash. |
| IDE LED blinks white | Indicates the system is accessing the internal IDE flash. |

# Wake-on LAN

Wake-on LAN (WOL) allows a computer to be turned on or resumed from sleep state by a network message. You can enable or disable WOL in Computer Setup using the **S5 Maximum Power Savings** setting.

To enable or disable WOL:

1. Turn on or restart the computer.
2. Press either esc or F10 while the “Press the ESC key for Startup Menu” message is displayed at the bottom of the screen.

   **NOTE:** If you do not press esc or F10 at the appropriate time, you must restart the computer and again press esc or F10 when the monitor light turns green to access the utility.

3. If you pressed esc, press F10 to enter Computer Setup.
4. Navigate to **Power > Hardware Power Management**.
5. Set **S5 Maximum Power Savings** as follows:
   - Disable WOL = Enabled
   - Enable WOL = Disabled
6. Press F10 to accept any changes.
7. Select **File** > **Save Changes and Exit**.

# Power-On Sequence

At power-on, the flash boot block code initializes the hardware to a known state, then performs basic power-on diagnostic tests to determine the integrity of the hardware. Initialization performs the following functions:

1. Initializes CPU and memory controller.
2. Initializes and configures all PCI devices.
3. Initializes video software.
4. Initializes the video to a known state.
5. Initializes USB devices to a known state.
6. Performs power-on diagnostics. For more information, see “Power-On Diagnostic Tests”.
7. The unit boots the operating system.

# Resetting the Setup and Power-on passwords

You can reset the Setup and Power-on passwords as follows:

1. Turn off the computer and disconnect the power cord from the power outlet.
2. Remove the side access panel and the metal side cover.
3. Remove the password jumper from the system board header labeled PSWD/E49.
4. Replace the metal side cover and the side access panel.
5. Connect the computer to AC power, and then turn on the computer.
6. Turn off the computer and disconnect the power cord from the power outlet.
7. Remove the side access panel and the metal side cover.
8. Replace the password jumper.
9. Replace the metal side cover and the side access panel.

# Power-on diagnostic tests

The Power-on diagnostics performs basic integrity tests of the hardware to determine its functionality and configuration. If a diagnostic test fails during hardware initialization the unit simply stops. There are no messages sent to video.

**NOTE:** You may try to restart the unit and run through the diagnostic tests a second time to confirm the first shutdown.

The following table lists the tests that are performed on the unit.

**Table 10-2 Power-on diagnostic test**

| Test | Description |
|---|---|
| Boot Block Checksum | Tests boot block code for proper checksum value |
| DRAM | Simple write/read pattern test of the first 640k of memory |
| Serial Port | Tests the serial port using simple port verification test to determine if ports are present |
| Timer | Tests timer interrupt by using polling method |
| RTC CMOS battery | Tests integrity of RTC CMOS battery |
| NAND flash device | Tests for proper NAND flash device ID present |

# Interpreting POST diagnostic front panel LEDs and audible codes

This section covers the front panel LED codes as well as the audible codes that may occur before or during POST that do not necessarily have an error code or text message associated with them.

⚠ **WARNING!** When the computer is plugged into an AC power source, voltage is always applied to the system board. To reduce the risk of personal injury from electrical shock and/or hot surfaces, be sure to disconnect the power cord from the wall outlet and allow the internal system components to cool before touching.

**NOTE:** Recommended actions in the following table are listed in the order in which they should be performed.

Not all diagnostic lights and audible codes are available on all models.

**Table 10-3 Diagnostic front panel LEDs and audible codes**

| Activity | Beeps | Possible Cause | Recommended Action |
|---|---|---|---|
| White Power LED On. | None | Computer on. | None |
| White Power LED flashes every two seconds. | None | Computer in Suspend to RAM mode (some models only) or normal Suspend mode. | No action required. Press any key or move the mouse to wake the computer. |
| Red Power LED flashes two times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is solved. | 2 | Processor thermal protection activated:<br>A fan may be blocked or not turning.<br>OR<br>The heat sink/fan assembly is not properly attached to the processor.<br>OR<br>The unit has vents blocked or is in a location where the ambient temperature is too high. | 1. Ensure that the computer air vents are not blocked and the processor cooling fan is plugged in and running, if equipped.<br>2. Contact an authorized reseller or service provider. |
| Red Power LED flashes four times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is solved. | 4 | Power failure (power supply is overloaded).<br>OR<br>The incorrect external power supply adapter is being used on the unit. | 1. Check if a device is causing the problem by removing ALL attached devices. Power on the system. If the system enters the POST, then power off and replace one device at a time and repeat this procedure until failure occurs. Replace the device that is causing the failure. Continue adding devices one at a time to ensure all devices are functioning properly.<br>2. Replace the power supply.<br>3. Replace the system board. |
| Red Power LED flashes five times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is solved. | 5 | Pre-video memory error. | **CAUTION:** To avoid damage to the memory modules or the system board, you must unplug the computer power cord before attempting to reseat, install, or remove a memory module.<br>1. Reseat memory modules.<br>2. Replace memory modules one at a time to isolate the faulty module. |

**Table 10-3 Diagnostic front panel LEDs and audible codes (continued)**

| Activity | Beeps | Possible Cause | Recommended Action |
|---|---|---|---|
| | | | 3. Replace third-party memory with HP memory.<br>4. Replace the system board. |
| Red Power LED flashes six times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is solved. | 6 | Pre-video graphics error. | For systems with a graphics card:<br>1. Reseat the graphics card.<br>2. Replace the graphics card.<br>3. Replace the system board.<br>For systems with integrated graphics, replace the system board. |
| Red Power LED flashes eight times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is solved. | 8 | Invalid ROM based on bad checksum. | 1. Reflash the system ROM with the latest BIOS image using the BIOS Recovery procedure.<br>2. Replace the system board. |
| System does not power on and LEDs are not flashing. | None | System unable to power on. | Press and hold the power button for less than four seconds. If the solid-state drive LED turns white, the power button is working correctly. Try the following:<br>1. Remove the power cord from the computer.<br>2. Open the computer and press the yellow CMOS button on the system board for four seconds (located near the front USB ports).<br>3. Verify that the AC cord is plugged into the power supply.<br>4. Close the unit and reattach the power cord.<br>5. Try to power on the computer.<br>6. Replace the unit. |

# POST numeric codes and text messages

This section covers those POST errors that have numeric codes associated with them. The section also includes some text messages that may be encountered during POST.

**NOTE:** The computer will beep once after a POST text message is displayed on the screen.

**Table 10-4 Numeric Codes and Text Messages**

| Control panel message | Description | Recommended action |
|---|---|---|
| 103-System Board Failure | DMA or timers. | 1. Clear CMOS.<br>2. Remove expansion boards.<br>3. Replace the system board. |
| 110-Out of Memory Space for Option ROMs | Recently added PCI expansion card contains an option ROM too large to download during POST. | 1. If a PCI expansion card was recently added, remove it to see if the problem remains.<br>2. In Computer Setup, set **Advanced** > **Device Options** > **NIC PXE Option ROM Download** to **DISABLE** to prevent PXE option ROM for the internal NIC from being downloaded during POST to free more memory for an expansion card's option ROM. Internal PXE option ROM is used for booting from the NIC to a PXE server. |
| 161-Real-Time Clock Power Loss | Invalid time or date in configuration memory.<br>RTC (real-time clock) battery may need to be replaced. | Reset the date and time under **Control Panel** (Computer Setup can also be used). If the problem persists, replace the RTC battery. See the Removal and Replacement section for instructions on installing a new battery, or contact an authorized dealer or reseller for RTC battery replacement. |
| 164-MemorySize Error | Memory amount has changed since the last boot (memory added or removed). | Press the F1 key to save the memory changes. |
| 201-Memory Error | RAM failure. | 1. Ensure memory modules are correctly installed.<br>2. Verify proper memory module type.<br>3. Remove and replace the identified faulty memory module(s).<br>4. If the error persists after replacing memory modules, replace the system board. |
| 214-DIMM Configuration Warning | Populated DIMM Configuration is not optimized. | Rearrange the DIMMs so that each channel has the same amount of memory. |
| 301-Keyboard Error | Keyboard failure. | 1. Reconnect keyboard with computer turned off.<br>2. Check connector for bent or missing pins.<br>3. Ensure that none of the keys are depressed.<br>4. Replace keyboard. |
| 510-Flash Screen Image Corrupted | Flash Screen image has errors. | Reflash the system ROM with the latest BIOS image. |

**Table 10-4 Numeric Codes and Text Messages (continued)**

| Control panel message | Description | Recommended action |
|---|---|---|
| 512-Chassis, Rear Chassis, or Front Chassis Fan not Detected | Chassis, rear chassis, or front chassis fan is not connected or may have malfunctioned. | 1. Reseat chassis, rear chassis, or front chassis fan.<br>2. Reseat fan cable.<br>3. Replace chassis, rear chassis, or front chassis fan. |
| 513-Front Chassis fan not detected | Front chassis fan is not connected or may have malfunctioned. | 1. Reseat front chassis fan.<br>2. Reseat fan cable.<br>3. Replace front chassis fan. |
| 912-Computer Cover Has Been Removed Since Last System Startup | Computer cover was removed since last system startup. | No action required. |
| 921-Device in PCI Express slot failed to initialize | There is an incompatibility/problem with this device and the system or PCI Express Link could not be retrained to an x1. | Try rebooting the system. If the error reoccurs, the device may not work with this system |
| 1720-SMART Hard Drive Detects Imminent Failure | Hard drive is about to fail. (Some hard drives have a hard drive firmware patch that will fix an erroneous error message.) | 1. Determine if hard drive is giving correct error message. Run the Drive Protection System test using F2 Diagnostics.<br>2. Apply hard drive firmware patch if applicable. (Available at http://www.hp.com/support.)<br>3. Back up contents and replace hard drive. |
| Invalid Electronic Serial Number | Electronic serial number is missing. | Enter the correct serial number in Computer Setup. |
| Network Server Mode Active and No Keyboard Attached | Keyboard failure while Network Server Mode enabled. | 1. Reconnect keyboard with computer turned off.<br>2. Check connector for bent or missing pins.<br>3. Ensure that none of the keys are depressed.<br>4. Replace keyboard. |
| Parity Check 2 | Parity RAM failure. | Run Computer Setup and Diagnostic utilities. |

# Troubleshooting

## Basic troubleshooting

If the thin client is experiencing operating problems or will not power on, review the following items.

**Table 10-5 Power-on troubleshooting**

| Issue | Procedures |
|---|---|
| The thin client unit is experiencing operating problems. | Ensure that the following connectors are securely plugged into the thin client unit:<br>Power connector, keyboard, mouse, network RJ-45 connector, display |
| The thin client unit does not power on. | 1. Verify that the power supply is good by installing it on a known working unit and testing it. If the power supply does not work on the test unit, replace the power supply.<br>2. If the unit does not work properly with the replaced power supply, have the unit serviced. |
| The thin client unit powers on and displays a splash screen, but does not connect to the server. | 1. Verify that the network is operating and the network cable is working properly.<br>2. Verify that the unit is communicating with the server by having the System Administrator ping the unit from the server:<br>– If the thin client pings back, then the signal was accepted and the unit is working. This indicates a configuration issue.<br>– If the thin client does not ping back and the thin client does not connect to the server, re-image the unit. |
| No link or activity on the network RJ-45 LEDs or the LEDs do not illuminate blinking green after powering on the thin client unit. (The network LEDs are located inside the RJ-45 connector on the top, rear panel of the thin client. Indicator lights are visible when the connector is installed.) | 1. Verify that the network is not down.<br>2. Make sure the RJ-45 cable is good by installing the RJ-45 cable onto a known working device—if a network signal is detected then the cable is good.<br>3. Verify the power supply is good by replacing the power cable to the unit with a known working power supply cable and testing it.<br>4. If network LEDs still do not light and you know the power supply is good, then re-image the unit.<br>5. If network LEDs still do not light, run the IP configuration procedure.<br>6. If network LEDs still do not light, have the unit serviced. |
| A newly connected unknown USB peripheral does not respond or USB peripherals connected prior to the newly connected USB peripheral will not complete their device actions. | An unknown USB peripheral may be connected and disconnected to a running platform as long as you do not reboot the system. If problems occur, disconnect the unknown USB peripheral and reboot the platform. |
| Video does not display. | 1. Verify that the monitor brightness is set to a readable level.<br>2. Verify the monitor is good by connecting it to a known working computer and ensure its front LED turns green (assuming the monitor is Energy Star compliant). If the monitor is defective, replace it with a working monitor and repeat testing.<br>3. Re-image the thin client unit and power on the monitor again.<br>4. Test the thin client unit on a known working monitor. If the monitor does not display video, replace the thin client unit. |

## Diskless (No-Flash) unit troubleshooting

This section is only for those units that do not have ATA Flash capability. Because there is no ATA Flash in this model the boot priority sequence is:

- USB device
- PXE

1. When the unit boots, the monitor should display the following information:

**Table 10-6 Diskless unit troubleshooting**

| Item | Information | Action |
|---|---|---|
| MAC Address | NIC portion of the system board is OK | If no MAC Address, the system board is at fault. Contact the Call Center for service. |
| GUID | General system board information | If no GUID information, the system board is at fault and should be replaced. |
| Client ID | Information from server | If no Client ID information there is no network connection. This may be caused by a bad cable, the server is down, or a bad system board. Contact the Call Center for service for the bad system board. |
| MASK | Information from server | If no MASK information there is no network connection. This may be caused by a bad cable, the server is down, or a bad system board. Contact the Call Center for service for the bad system board. |
| DHCP IP | Information from server | If no DHCP IP information there is no network connection. This may be caused by a bad cable, the server is down, or a bad system board. Contact the Call Center for service for the bad system board. |

If you are running in a Microsoft RIS PXE environment, go to step 2.

If you are running in a Linux environment, go to step 3.

2. If you are running in a Microsoft RIS PXE environment, press the F12 key to activate the network service boot as soon as the DHCP IP information appears on the screen.

   If the unit does not boot to the network, the server is not configured to PXE.

   If you missed the F12 cue, the system will try to boot to the ATA flash that is not present. The message on the screen will read: **ERROR: Non-system disk or disk error. Replace and press any key when ready.**

   Pressing any key will restart the boot cycle.

3. If you are running in a Linux environment, an error message will appear on the screen if there is no Client IP. **ERROR: Non-system disk or disk error. Replace and press any key when ready.**

# Configuring a PXE server

**NOTE:** All PXE software is supported by authorized service providers on a warranty or service contract basis. Customers who call the HP Customer Service Center with PXE issues and questions should be referred to their PXE provider for assistance.

Additionally, refer to the following:

– For Windows Server 2008 R2: http://technet.microsoft.com/en-us/library/7d837d88-6d8e-420c-b68f-a5b4baeb5248.aspx

– For Windows Server 2012: http://technet.microsoft.com/en-us/library/jj648426.aspx

The services listed below must be running, and they may be running on different servers:

1. Domain Name Service (DNS)
2. Remote Installation Services (RIS)

**NOTE:** Active Directory DHCP is not required, but is recommended.

# 11 Using HP ThinUpdate to restore the image

HP ThinUpdate software is installed on Thin Client computers (select products only) to provide backup and recovery. If it is not installed on your computer, you can download it from http://www.hp.com/support (search for the Thin Client model and click on the **Drivers & software** section of the support page for that model. For information on using this software, refer to the Manuals section).

**NOTE:** HP recommends periodically going to the website to check for application updates.

Use HP ThinUpdate software for the following processes:

- Creating recovery media and backups
- Restoring and recovering your system
- Installing and updating software

HP ThinUpdate allows you to download images and add-ons from HP, capture an HP thin client image, and create bootable USB flash drives for image deployment.

- The Image Downloads feature lets you download an image from HP to either local storage or a USB flash drive. The USB flash drive option creates a bootable USB flash drive that can be used to deploy the image to other thin clients.
- The Image Capture feature lets you capture an image from an HP thin client and save it to a USB flash drive, which can be used to deploy the image to other thin clients.
- The Add-on Downloads feature lets you download add-ons from HP to either local storage or a USB flash drive.
- The USB Drive Management feature lets you do the following:
  - Create a bootable USB flash drive from an image file on local storage
  - Copy an .ibr image file from a USB flash drive to local storage
  - Restore a USB flash drive layout

You can use a bootable USB flash drive created with HP ThinUpdate to deploy an HP thin client image to another HP thin client of the same model with the same operating system.

**System requirements**

To create a recovery device for the purpose of reflashing or restoring the software image on the flash, you will need the following:

- One or more HP thin clients.
- USB flash device in the following size or larger:
  - Windows 10 IoT (if using the USB format): 32 GB

**NOTE:** Optionally, you can use the tool on a Windows computer.

**This restore method will not work with all USB flash devices.** USB flash devices that do not show up as removable drive in Windows do not support this restore method. USB flash devices with multiple partitions generally do not support this restore method. The range of USB flash devices available on the market is constantly changing. Not all USB flash devices have been tested with the HP Thin Client Imaging Tool.

# 12 Device management

The thin client includes a license for HP Device Manager and has a Device Manager agent pre-installed. HP Device Manager is a thin client optimized management tool used to manage the full life cycle of HP thin clients to include Discover, Asset Management, Deployment and Configuration. For more information on HP Device Manager, please visit www.hp.com/go/hpdm.

If you wish to manage the thin client with other management tools such as Microsoft SCCM or LANDesk, go to www.hp.com/go/clientmanagement for more information.

# 13 Specifications

## Computer specifications

| | Metric | U.S. |
|---|---|---|
| **Dimensions** | | |
| Length | 234.3 mm | 9.22 in |
| Width | 326.0 mm | 12.84 in |
| Height (non-touch) | 17.9 mm | 0.71 in |
| Height (touch) | 18.05 mm | 0.72 in |
| **Weight** | | |
| WWAN and ALS display, no fingerprint reader, 1 SODIMM, WLAN module, with IR camera, no WWAN module, non-touch panel | 1.53 kg | 3.37 lbs |
| WWAN display, no fingerprint reader, 1 SODIMM, WLAN module, IR camera, no WWAN module, touch panel | 1.61 kg | 3.56 lbs |
| **Input power** | | |
| Operating voltage | 19.0 V dc @ 4.74 A – 90 W or 18.5 V dc @ 3.5 A - 65 W or 45 W | |
| Operating current | 4.74 A or 3.5 A | |
| **Temperature** | | |
| Operating (not writing to optical disc) | 0°C to 35°C | 32°F to 95°F |
| Operating (writing to optical disc) | 5°C to 35°C | 41°F to 95°F |
| Nonoperating | -20°C to 60°C | -4°F to 140°F |
| **Relative humidity** | | |
| Operating | 10% to 90% | |
| Nonoperating | 5% to 95% | |
| **Maximum altitude** (unpressurized) | | |
| Operating (14.7 to 10.1 psia) | -15 m to 3,048 m | 50 ft to 10,000 ft |
| Nonoperating (14.7 to 4.4 psia) | -15 m to 12,192 m | -50 ft to 40,000 ft |

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

# 35.6-cm (14.0-in) display specifications

| | Metric | U.S. |
|---|---|---|
| Active diagonal size | 35.6-cm | 14.0-in |
| Resolution | FHD: 1920×1080 | |
| Surface treatment | Anti-glare (except touch screen) | |
| Brightness | FHD (45% CG): 220 nits | |
| | FHD (72% CG): 400 nits or 700 nits | |
| Viewing angle | UWVA | |
| Backlight | LED | |
| Aspect ratio | 16:9 | |
| Display panel interface | eDP | |

# M.2 PCIe solid-state drive specifications

| | 256-GB* | 512-GB* |
|---|---|---|
| **Dimensions** | | |
| Height | 1 mm | 1 mm |
| Length | 50.8 mm | 50.8 mm |
| Width | 28.9 mm | 28.9 mm |
| Weight | < 10 g | < 10 g |
| **Interface type** | ATA-7 | ATA-7 |
| **Transfer rate** | | |
| Sequential Read | Up to 2150 MB/s | Up to 2150 MB/s |
| Random Read | Up to 300,000 IOPs | Up to 300,000 IOPs |
| Sequential Write | Up to 1260 MB/s | Up to 1550 MB/s |
| Random Write | Up to 100,000 IOPs | Up to 100,000 IOPs |
| **Ready time, Maximum (to not busy)** | 1.0 s | 1.0 s |
| **Access times** | | |
| Logical | 0.1 | 0.1 |
| **Total logical sectors** | 500,118,192 | 1,000,215,216 |
| **Operating temperature** | | |
| Operating | 0° to 70°C (32°F to 158°F) | 0° to 70°C (32°F to 158°F) |
| Non-operating | -40° to 80°C (-40°F to 176°F) | -40° to 85°C (-40°F to 185°F) |

*1 GB = 1 billion bytes when referring to hard drive storage capacity. Actual accessible capacity is less.

**NOTE:** Certain restrictions and exclusions apply. Contact technical support for details.

# M.2 SATA solid-state drive specifications

| | 128-GB* | 256-GB* | 512-GB* |
|---|---|---|---|
| **Height** | 1.35 mm | 1.35 mm | 1.35 mm |
| **Weight** | < 10 g | < 10 g | < 10 g |
| **Form factor** | M.2 2280-D2-B-M | M.2 2280-D2-B-M | M.2 2280-D2-B-M |
| **Transfer rate** | up to 540 MB/sec | up to 540 MB/sec | up to 540 MB/sec |
| **Interface type** | SATA-3 | SATA-3 | SATA-3 |
| 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 |
| **Total logical sectors** | 234,441,648 | 468,883,296 | 937,766,592 |
| **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 technical support for details.

# 14 Power cord set requirements

The wide-range input feature of the computer permits it to operate from any line voltage from 100 to 120 volts AC, or from 220 to 240 volts 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 and regions must meet the requirements of the country or region where the computer is used.

## Requirements for all countries

The following 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 amps and a nominal voltage rating of 125 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

| Country/region | Accredited agency | Applicable note number |
|---|---|---|
| Australia | EANSW | 1 |
| Austria | OVE | 1 |
| Belgium | CEBC | 1 |
| Canada | CSA | 2 |
| Denmark | DEMKO | 1 |
| Finland | FIMKO | 1 |
| France | UTE | 1 |
| Germany | VDE | 1 |
| Italy | IMQ | 1 |
| Japan | METI | 3 |
| The Netherlands | KEMA | 1 |
| Norway | NEMKO | 1 |
| The People's Republic of China | COC | 5 |
| South Korea | EK | 4 |

| Country/region | Accredited agency | Applicable note number |
|---|---|---|
| Sweden | SEMKO | 1 |
| Switzerland | SEV | 1 |
| Taiwan | BSMI | 4 |
| The United Kingdom | BSI | 1 |
| The United States | UL | 2 |

1. The flexible cord must be Type HO5VV-F, 3-conductor, 1.0-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 SPT-3 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) or NEMA 6-15P (15 A, 250 V) configuration.
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 VCT or VCTF, 3-conductor, 1.00-mm² conductor size. The wall plug must be a two-pole grounding type with a Japanese Industrial Standard C8303 (7 A, 125 V) 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 certification mark of the agency responsible for evaluation in the country or region where it will be used.
5. The flexible cord must be Type VCTF, 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.

# 15 Statement of memory volatility

The purpose of this chapter is to provide general information regarding nonvolatile memory in HP Business computers. This chapter also provides general instructions for restoring nonvolatile memory that can contain personal data after the system has been powered off and the hard drive has been removed.

HP Business computer products that use Intel®-based or AMD®-based system boards contain volatile DDR memory. The amount of nonvolatile memory present in the system depends upon the system configuration. Intel-based and AMD-based system boards contain nonvolatile memory subcomponents as originally shipped from HP, assuming that no subsequent modifications have been made to the system and assuming that no applications, features, or functionality have been added to or installed on the system.

Following system shutdown and removal of all power sources from an HP Business computer system, personal data can remain on volatile system memory (DIMMs) for a finite period of time and will also remain in nonvolatile memory. Use the steps below to remove personal data from the computer, including the nonvolatile memory found in Intel-based and AMD-based system boards.

**NOTE:** If your tablet has a keyboard base, connect to the keyboard base before beginning steps in this chapter.

## Current BIOS steps

1. Follow steps (a) through (l) below to restore the nonvolatile memory that can contain personal data. Restoring or reprogramming nonvolatile memory that does not store personal data is neither necessary nor recommended.

   a. Turn on or restart the computer, and then press esc while the “Press the ESC key for Startup Menu” message is displayed at the bottom of the screen.

   **NOTE:** If the system has a BIOS administrator password, enter the password at the prompt.

   b. Select **Main**, select **Apply Factory Defaults and Exit**, and then select **Yes** to load defaults.

   The computer will reboot.

   c. During the reboot, press esc while the “Press the ESC key for Startup Menu” message is displayed at the bottom of the screen.

   **NOTE:** If the system has a BIOS administrator password, enter the password at the prompt.

   d. Select the **Security** menu, select **Restore Security Settings to Factory Defaults**, and then select **Yes** to restore security level defaults.

   The computer will reboot.

   e. During the reboot, press esc while the “Press the ESC key for Startup Menu” message is displayed at the bottom of the screen.

   **NOTE:** If the system has a BIOS administrator password, enter the password at the prompt.

   f. If an asset or ownership tag is set, select the **Security** menu and scroll down to the **Utilities** menu. Select **System IDs**, and then select **Asset Tracking Number**. Clear the tag, and then make the selection to return to the prior menu.

g. If a DriveLock password is set, select the **Security** menu, and scroll down to **Hard Drive Utilities** under the **Utilities** menu. Select **Hard Drive Utilities**, select **DriveLock**, then uncheck the checkbox for **DriveLock password on restart**. Select **OK** to proceed.

h. Select the **Main** menu, and then select **Reset BIOS Security to factory default**. Click **Yes** at the warning message.

   The computer will reboot.

i. During the reboot, press esc while the "Press the ESC key for Startup Menu" message is displayed at the bottom of the screen.

**NOTE:** If the system has a BIOS administrator password, enter the password at the prompt.

j. Select the **Main** menu, select **Apply Factory Defaults and Exit**, select **Yes** to save changes and exit, and then select **Shutdown**.

k. Reboot the system. If the system has a Trusted Platform Module (TPM) and/or fingerprint reader, one or two prompts will appear—one to clear the TPM and the other to Reset Fingerprint Sensor; press or tap F1 to accept or F2 to reject.

l. Remove all power and system batteries for at least 24 hours.

2. Complete one of the following:

   - Remove and retain the storage drive.

   – or –

   - Clear the drive contents by using a third party utility designed to erase data from an SSD.

   – or –

   - Clear the contents of the drive by using the following BIOS Setup Secure Erase command option steps:

**IMPORTANT:** If you clear data using Secure Erase, it cannot be recovered.

a. Turn on or restart the computer, and then press esc while the "Press the ESC key for Startup Menu" message is displayed at the bottom of the screen.

b. Select the **Security** menu and scroll down to the **Utilities** menu.

c. Select **Hard Drive Utilities**.

d. Under **Utilities**, select **Secure Erase**, select the hard drive storing the data you want to clear, and then follow the on-screen instructions to continue.

# Nonvolatile memory usage

| Nonvolatile Memory Type | Amount (Size) | Does this memory store customer data? | Does this memory retain data when power is removed? | What is the purpose of this memory? | How is data input into this memory? | How is this memory write-protected? |
|---|---|---|---|---|---|---|
| HP Sure Start flash (select models only) | 8 MBytes | No | Yes | Provides protected backup of critical System BIOS code, EC firmware, and critical computer configuration data for select platforms that support HP Sure Start.<br><br>For more information, see Using HP Sure Start (select models only) on page 106. | Data cannot be written to this device via the host processor. The content is managed solely by the HP Sure Start Embedded Controller. | This memory is protected by the HP Sure Start Embedded Controller. |
| Real Time Clock (RTC) battery backed-up CMOS configuration memory | 256 Bytes | No | Yes | Stores system date and time and noncritical data. | RTC battery backed-up CMOS is programmed using the Computer Setup (BIOS), or changing the Microsoft Windows date & time. | This memory is not write-protected. |
| Controller (NIC) EEPROM | 64 KBytes (not customer accessible) | No | Yes | Stores NIC configuration and NIC firmware. | NIC EEPROM is programmed using a utility from the NIC vendor that can be run from DOS. | A utility is required to write data to this memory and is available from the NIC vendor. Writing data to this ROM in an inappropriate manner will render the NIC non-functional. |
| DIMM Serial Presence Detect (SPD) configuration data | 256 Bytes per memory module, 128 Bytes programmable (not customer accessible) | No | Yes | Stores memory module information. | DIMM SPD is programmed by the memory vendor. | Data cannot be written to this memory when the module is installed in a computer. The specific write-protection method varies by memory vendor. |
| System BIOS | 9 MBytes | Yes | Yes | Stores system BIOS code and computer configuration data. | System BIOS code is programmed at the factory. Code is updated when the system BIOS is updated. Configuration data and settings are input using the Computer Setup (BIOS) or a custom utility. | **NOTE:** Writing data to this ROM in an inappropriate manner can render the computer non-functional.<br><br>A utility is required for writing data to this memory and is available on the HP website; go to http://www.hp.com/support. Select **Find your** |

| Nonvolatile Memory Type | Amount (Size) | Does this memory store customer data? | Does this memory retain data when power is removed? | What is the purpose of this memory? | How is data input into this memory? | How is this memory write-protected? |
|---|---|---|---|---|---|---|
| | | | | | | **product**, and then follow the on-screen instructions. |
| Intel Management Engine Firmware (present only in select Elite or Z models. For more information, go to http://www.hp.com/support. Select **Find your product**, and then follow the on-screen instructions.) | 1.5 MBytes or 7 MBytes | Yes | Yes | Stores Management Engine Code, Settings, Provisioning Data and iAMT third-party data store. | Management Engine Code is programmed at the factory. Code is updated via Intel secure firmware update utility. Unique Provisioning Data can be entered at the factory or by an administrator using the Management Engine (MEBx) setup utility. The third party data store contents can be populated by a remote management console or local applications that have been registered by an administrator to have access to the space. | The Intel chipset is configured to enforce hardware protection to block all direct read/write access to this area. An Intel utility is required for updating the firmware. Only firmware updates digitally signed by Intel can be applied using this utility. |
| Bluetooth flash (select products only) | 2 Mbit | No | Yes | Stores Bluetooth configuration and firmware. | Bluetooth flash is programmed at the factory. Tools for writing data to this memory are not publicly available but can be obtained from the silicon vendor. | A utility is required for writing data to this memory and is made available through newer versions of the driver whenever the flash requires an upgrade. |
| 802.11 WLAN EEPROM | 4 Kbit to 8 Kbit | No | Yes | Stores configuration and calibration data. | 802.11 WLAN EEPROM is programmed at the factory. Tools for writing data to this memory are not made public. | A utility is required for writing data to this memory and is typically not made available to the public unless a firmware upgrade is necessary to address a unique issue. |
| Webcam (select products only) | 64 Kbit | No | Yes | Stores webcam configuration and firmware. | Webcam memory is programmed using a utility from the device manufacturer that can be run from Windows. | A utility is required for writing data to this memory and is typically not made available to the public unless a firmware upgrade is necessary to address a unique issue. |
| Fingerprint reader (select products only) | 512 KByte flash | Yes | Yes | Stores fingerprint templates. | Fingerprint reader memory is programmed by user enrollment in HP ProtectTools Security Manager. | Only a digitally signed application can make the call to write to the flash. |

# Questions and answers

1. **How can the BIOS settings be restored (returned to factory settings)?**

   **IMPORTANT:** Restore defaults does not securely erase any data on your hard drive. See question and answer 6 for steps to securely erase data.

   Restore defaults does not reset the Custom Secure Boot keys. See question and answer 7 for information about resetting the keys.

   a. Turn on or restart the computer, and then press esc while the "Press the ESC key for Startup Menu" message is displayed at the bottom of the screen.

   b. Select **Main**, and then select **Apply Factory Defaults and Exit**.

   c. Follow the on-screen instructions.

   d. Select **Main**, select **Save Changes and Exit**, and then follow the on-screen instructions.

2. **What is a UEFI BIOS, and how is it different from a legacy BIOS?**

   The Unified Extensible Firmware Interface (UEFI) BIOS is an industry-standard software interface between the platform firmware and an operating system (OS). It is a replacement for the older BIOS architecture, but supports much of the legacy BIOS functionality.

   Like the legacy BIOS, the UEFI BIOS provides an interface to display the system information and configuration settings and to change the configuration of your computer before an OS is loaded. BIOS provides a secure run-time environment that supports a Graphic User Interface (GUI). In this environment, you can use either a pointing device (Touchscreen, TouchPad, pointing stick, or USB mouse) or the keyboard to navigate and make menu and configuration selections. The UEFI BIOS also contains basic system diagnostics.

   The UEFI BIOS provides functionality beyond that of the legacy BIOS. In addition, the UEFI BIOS works to initialize the computer's hardware before loading and executing the OS; the run-time environment allows the loading and execution of software programs from storage devices to provide more functionality, such as advanced hardware diagnostics (with the ability to display more detailed system information) and advanced firmware management and recovery software.

   HP has provided options in Computer Setup (BIOS) to allow you to run in legacy BIOS, if required by the operating system. Examples of this requirement would be if you upgrade or downgrade the OS.

3. **Where does the UEFI BIOS reside?**

   The UEFI BIOS resides on a flash memory chip. A utility is required to write to the chip.

4. **What kind of configuration data is stored on the DIMM Serial Presence Detect (SPD) memory module? How would this data be written?**

   The DIMM SPD memory contains information about the memory module, such as size, serial number, data width, speed/timing, voltage, and thermal information. This information is written by the module manufacturer and stored on an EEPROM. This EEPROM cannot be written to when the memory module is installed in a computer. Third-party tools do exist that can write to the EEPROM when the memory module is not installed in a computer. Various third-party tools are available to read SPD memory.

5. **What is meant by "Restore the nonvolatile memory found in Intel-based system boards"?**

   This message relates to clearing the Real Time Clock (RTC) CMOS memory that contains computer configuration data.

6. **How can the BIOS security be reset to factory defaults and data erased?**

**IMPORTANT:** Resetting will result in the loss of information.

These steps will not reset Custom Secure Boot Keys. See question and answer 7 for information about resetting the keys.

a. Turn on or restart the computer, and then press esc while the “Press the ESC key for Startup Menu” message is displayed at the bottom of the screen.

b. Select **Main**, and then select **Reset Security to Factory Defaults**.

c. Follow the on-screen instructions.

d. Select **Main**, select **Save Changes and Exit**, and then follow the on-screen instructions.

7. **How can the Custom Secure Boot Keys be reset?**

Secure Boot is a feature to ensure that only authenticated code can start on a platform. If you enabled Secure Boot and created Custom Secure Boot Keys, simply disabling Secure Boot will not clear the keys. You must also select to clear the Custom Secure Boot Keys. Use the same Secure Boot access procedure you used to create the Custom Secure Boot Keys, but make the selection to clear or delete all Secure Boot Keys.

a. Turn on or restart the computer, and then press esc while the “Press the ESC key for Startup Menu” message is displayed at the bottom of the screen.

b. Select the **Security** menu, select **Secure Boot Configuration**, and then follow the on-screen instructions.

c. At the **Secure Boot Configuration** window, select **Secure Boot**, select **Clear Secure Boot Keys**, and then follow the on-screen instructions to continue.

# Using HP Sure Start (select models only)

Select computer models are configured with HP Sure Start, a technology that continuously monitors your computer's BIOS for attacks or corruption. If the BIOS becomes corrupted or is attacked, HP Sure Start restores the BIOS to its previously safe state, without user intervention. Those select computer models ship with HP Sure Start configured and enabled. HP Sure Start is configured and already enabled so that most users can use the HP Sure Start default configuration. The default configuration can be customized by advanced users.

To access the latest documentation on HP Sure Start, go to http://www.hp.com/support. Select **Find your product**, and then follow the on-screen instructions.

# 16 Recycling

When a non-rechargeable 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 Web site at http://www.hp.com/recycle.

# Index