



HP mt20 Mobile Thin Client

Maintenance and Service Guide

© Copyright 2017 HP Development Company, L.P.

AMD is a trademark of Advanced Micro Devices, Inc. Bluetooth is a trademark owned by its proprietor and used by HP Inc. under license. Intel is a trademark of Intel Corporation in the U.S. and other countries. Microsoft and Windows are trademarks of the Microsoft group of companies.

The information contained herein is subject to change without notice. The only warranties for HP products and services are set forth in the express warranty statements accompanying such products and services. Nothing herein should be construed as constituting an additional warranty. HP shall not be liable for technical or editorial errors or omissions contained herein.

First Edition: February 2017

Document Part Number: 915603-001

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.

Your product does not support Windows 8 or Windows 7

In accordance with Microsoft's support policy, HP does not support the Windows 8 or Windows 7 operating system on this product or provide any Windows 8 or Windows 7 drivers on <http://support.hp.com>.

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 computer, do not place the computer directly on your lap or obstruct the computer air vents. Use the computer only on a hard, flat surface. Do not allow another hard surface, such as an adjoining optional printer, or a soft surface, such as pillows or rugs or clothing, to block airflow. Also, do not allow the AC adapter to contact the skin or a soft surface, such as pillows or rugs or clothing, during operation. The computer and the AC adapter comply with the user-accessible surface temperature limits defined by the International Standard for Safety of Information Technology Equipment (IEC 60950-1).

Table of contents

1 Product description	1
2 Components	4
Right	4
Left	5
Display	6
Top	7
TouchPad	7
Lights	8
Buttons and speakers	9
Special function keys	10
Using the hot keys	11
Bottom	12
Labels	13
3 Illustrated parts catalog	14
Computer major components	14
Cable Kit	16
Display components	17
Plastics Kit	18
Miscellaneous parts	19
4 Removal and replacement procedures preliminary requirements	21
Tools required	21
Service considerations	21
Plastic parts	21
Cables and connectors	21
Grounding guidelines	22
Electrostatic discharge damage	22
Packaging and transporting guidelines	23
Workstation guidelines	23
Equipment guidelines	24
5 Removal and replacement procedures for Customer Self-Repair parts	25
Component replacement procedures	25
Battery Safe mode	25

Service door	26
Memory modules	27
WLAN/Bluetooth combo card	29
M.2 solid-state drive	31
Keyboard	32
6 Removal and replacement procedures for Authorized Service Provider parts	35
Component replacement procedures	35
Display subcomponents (bezel, webcam, panel)	35
Top cover	39
Power button board	42
Function board	44
Speaker assembly	46
TouchPad assembly	47
USB/audio board	49
Battery	50
Fan	52
System board	54
RTC battery	57
Heat sink assembly	58
Display assembly	60
Power connector and cable	66
7 Computer Setup (BIOS), TPM, and HP Sure Start	67
Using Computer Setup	67
Starting Computer Setup	67
Navigating and selecting in Computer Setup	67
Restoring factory settings in Computer Setup	67
Updating the BIOS	68
Determining the BIOS version and using Setup to update BIOS	68
Downloading a BIOS update	69
Changing the boot order using the f9 prompt	69
TPM BIOS settings (select products only)	70
Using HP Sure Start (select products only)	70
8 Using HP PC Hardware Diagnostics (UEFI) (Windows only)	71
Downloading HP PC Hardware Diagnostics (UEFI) to a USB device	71
9 Diagnostics and troubleshooting	73
LEDs	73

Wake-on LAN	74
Power-On Sequence	74
Power-on diagnostic tests	74
Interpreting POST diagnostic front panel LEDs and audible codes	75
POST numeric codes and text messages	77
Troubleshooting	79
Basic troubleshooting	79
Diskless (No-Flash) unit troubleshooting	80
Configuring a PXE server	81
10 HP ThinUpdate	82
11 Device management	83
12 Specifications	84
Computer specifications	84
35.6-cm (14.0-in) display specifications	85
Solid-state drive specifications	85
13 Statement of memory volatility	86
Nonvolatile memory usage	89
Questions and answers	91
Using HP Sure Start (select models only)	92
14 Power cord set requirements	93
Requirements for all countries and regions	93
Requirements for specific countries and regions	93
15 Recycling	95
Index	96

1 Product description

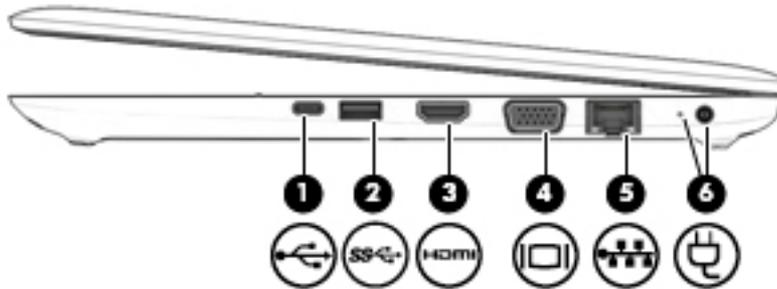
Category	Description
Product Name	HP mt20 Mobile Thin Client
Processors	Intel® Celeron Dual-Core 3865U processor (1.8 GHz, 2-MB L3 cache, 15 W, Intel HD graphics)
Graphics	Integrated UMA graphics Integrated with shared video memory; dynamically allocated
Panels	35.6 cm (14.0-inch), LED backlight, 16:9 aspect ratio, anti-glare, SVA, HD (1366x768), 220 nits; eDP HD slim (3.0 mm), with or without camera
Memory	Two customer-accessible memory module slots supporting up to 8 GB of RAM Supports dual-channel memory PC4-2133, DDR4 SODIMMs Supports the following configurations: <ul style="list-style-type: none">• 8192 MB (4096 × 2; dual channel)• 4096 MB (4096 × 1)
Primary M.2 storage	128 GB, M.2 2280 SSD (NGFF), SATA-3
Audio/Visual	HD audio with DTS Studio Sound Integrated camera (720p HD) Stereo speakers (2) Supports "no camera" option Integrated dual-array microphone (webcam models only) Integrated mono microphone (non-webcam models only) Headphone/microphone combo jack
Ethernet	Realtek RTL8111HSH 10/100/1000 S3/S4/S5 wake on LAN (AC mode and battery mode)
Wireless networking	Wireless Personal Area Network (PAN) Bluetooth Bluetooth 4.2 supported using combo card Wireless Local Area Network (WLAN) Integrated WLAN options by way of wireless module WLAN antennas built into display assembly Supports the following wireless adapter: <ul style="list-style-type: none">• Intel Dual Band Wireless-AC 3168 802.11ac, Dual Band, 1×1 Wi-Fi + Bluetooth 4.0
External media card	Digital Media Reader Slot Supports SD, SDHC, SDXC
Ports	Headphone/microphone combo jack

Category	Description
	<p>RJ-45 (Ethernet, includes link and activity lights)</p> <p>USB 3.0</p> <p>USB 2.0 + powered port</p> <p>USB Type-C basic port</p> <p>VGA (Dsub 15-pin) supporting 2048 × 1536 external resolution at 60-GHz (hot plug/unplug with auto-detect)</p> <p>HDMI 1.4</p> <p>Multi-pin AC port</p>
Keyboard/pointing devices	<p>Keyboard</p> <p>HP Premium Keyboard</p> <p>Full-sized, chiclet, minor spill-resistant keyboard (backlit or not backlit)</p> <p>Touchpad requirements</p> <p>Windows 10 gestures: taps enabled by default: on/off control by driver, 2-finger scrolling and zoom enabled by default, OSD (enable/disable), 3-finger tap; App switch, 4-finger tap - Action Center</p> <p>NOTE: ThinPro/Smart Zero does not support the Windows 10 gestures.</p>
Power requirements	<p>AC adapters</p> <p>65-W Smart AC adapter, 4.5 mm</p> <p>45-W Smart AC adapter, 4.5 mm</p> <p>45-W Smart AC adapter, 2-prong, 4.5 mm</p> <p>Power cords</p> <p>3-wire plug - 1.8 m</p> <p>3-wire plug - 1.0 m</p> <p>2-wire plug - 1.0 m</p> <p>Battery</p> <p>3-cell, 48-Wh, 4.21-Whr Li-ion battery</p>
Security	<p>Security lock</p> <p>TPM 2.0 SLB9670 (Infineon; soldered down)</p>
Operating system	<p>Operating system version</p> <p>Windows 10 IoT Enterprise 2015 LTSB for Retail and Thin Clients</p> <p>HP ThinPro 6</p> <p>HP Smart Zero</p> <p>Preinstalled</p> <p>Windows 10 IoT Enterprise 2015 LTSB for Retail and Thin Clients</p> <p>HP ThinPro 6</p> <p>HP Smart Zero</p>
Serviceability	<p>End-user replaceable parts</p> <p>AC adapter</p>

Category	Description
	M.2 solid-state drive
	Memory module
	WLAN module
	Keyboard

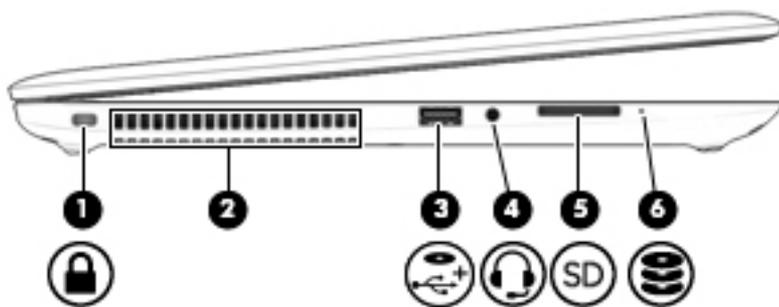
2 Components

Right



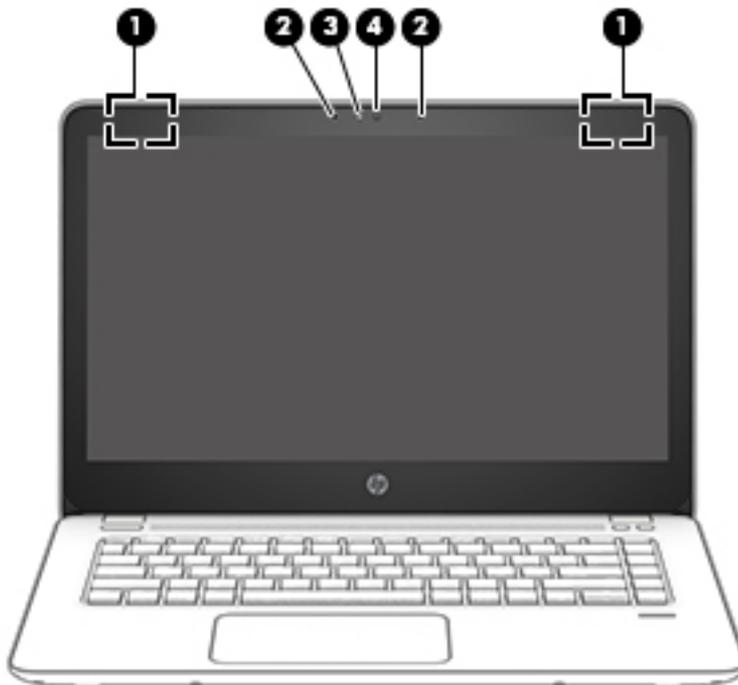
Component	Description
(1)  USB Type-C charging port	Connects any USB device with a Type-C connector and can charge products such as cell phones, laptops, tablets, and MP3 players.
(2)  USB 3.0 port	Connects an optional USB device, such as a keyboard, mouse, external drive, printer, scanner or USB hub.
(3)  HDMI port	Connects an optional video or audio device, such as a high-definition television, any compatible digital or audio component, or a high-speed High Definition Multimedia Interface (HDMI) device.
(4)  External monitor port	Connects an external VGA monitor or projector.
(5)  RJ-45 (network) jack/status lights	Connects a network cable. <ul style="list-style-type: none">• Green (left): The network is connected.• Amber (right): Activity is occurring on the network.
(6)  Power connector	Connects an AC adapter.

Left



Component	Description
(1)  Security cable slot	Attaches an optional security cable to the computer. NOTE: The security cable is designed to act as a deterrent, but it may not prevent the computer from being mishandled or stolen.
(2) Vent	Enables airflow to cool internal components. NOTE: The computer fan starts up automatically to cool internal components and prevent overheating. It is normal for the internal fan to cycle on and off during routine operation.
(3)  USB 2.0 charging port	Connects an optional USB device, such as a keyboard, mouse, external drive, printer, scanner or USB hub and can charge products such as cell phones, laptops, tablets, and MP3 players.
(4)  Audio-out (headphone)/Audio-in (microphone) combo jack	Connects optional powered stereo speakers, headphones, earbuds, a headset, or a television audio cable. Also connects an optional headset microphone. This jack does not support optional standalone microphones. WARNING! To reduce the risk of personal injury, adjust the volume before putting on headphones, earbuds, or a headset. For additional safety information, refer to the <i>Regulatory, Safety, and Environmental Notices</i> . To access this guide in Windows: ▲ Select My PC , select the Specifications tab, and then select User Guides . NOTE: When a device is connected to the jack, the computer speakers are disabled.
(5)  Memory card reader	Reads optional memory cards that store, manage, share, or access information.
(6)  Drive light	<ul style="list-style-type: none"> • Blinking white: The drive is being accessed. • Amber: HP 3D DriveGuard has temporarily parked the drive.

Display



Component	Description
(1) WLAN antennas* (select products only)	Send and receive wireless signals to communicate with wireless local area networks (WLANs).
(2) Internal microphones (1 or 2 depending on model)	Record sound.
(3) Webcam light (select products only)	On: The webcam is in use.
(4) Webcam (select products only)	Records video and captures photographs. Some models allow you to video conference and chat online using streaming video. To use the camera in Windows: <ul style="list-style-type: none">▲ Type <code>camera</code> in the taskbar search box, and then select Camera. In ThinPro/Smart Zero, the webcam can only be used within a session.

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

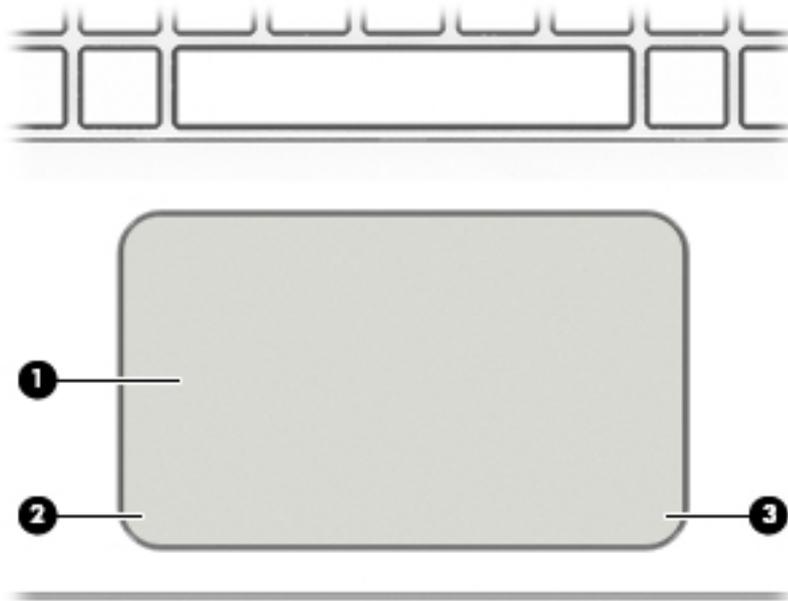
For wireless regulatory notices, see the section of the *Regulatory, Safety, and Environmental Notices* that applies to your country or region.

To access this guide in Windows:

- ▲ Select **My PC**, select the **Specifications** tab, and then select **User Guides**.

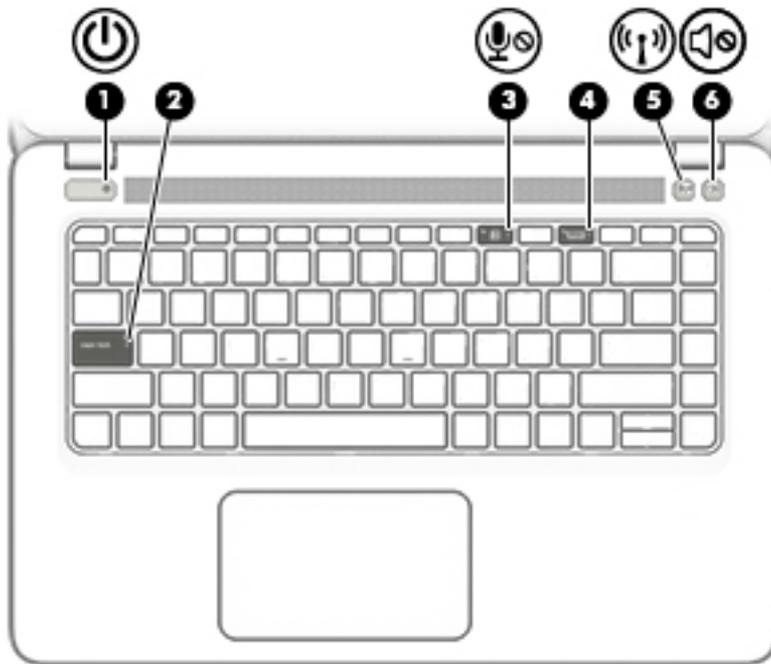
Top

TouchPad



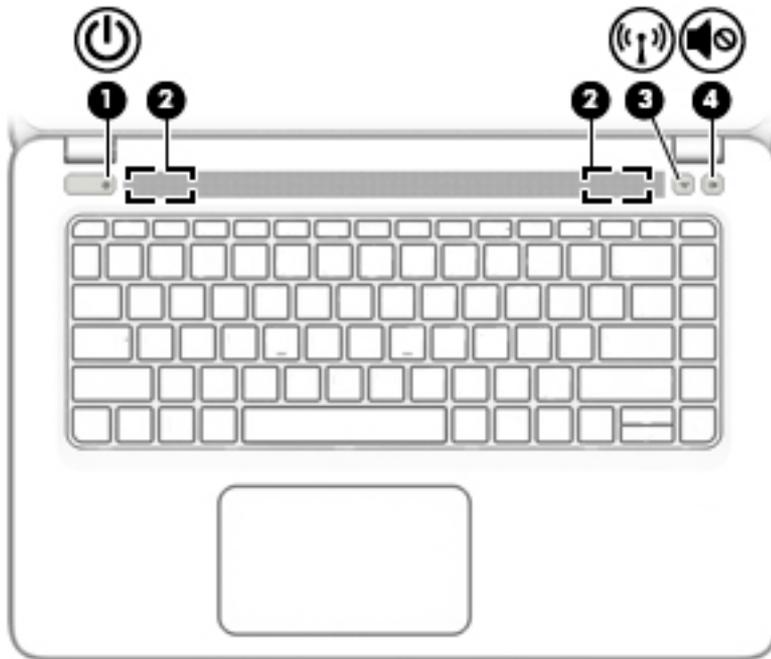
Component	Description
(1)	TouchPad zone Reads your finger gestures to move the pointer or activate items on the screen.
(2)	Left TouchPad button Functions like the left button on an external mouse.
(3)	Right TouchPad button Functions like the right button on an external mouse.

Lights



Component	Description
(1)  Power light	<ul style="list-style-type: none">• On: The computer is on.• Blinking: The computer is in the Sleep state, a power-saving state. The computer shuts off power to the display and other unneeded components.• 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)  Microphone mute light	<ul style="list-style-type: none">• Amber: microphone sound is off.• Off: microphone sound is on.
(4) Num lock light	On: Num lock is on.
(5)  Wireless light	On: An integrated wireless device, such as a wireless local area network (WLAN) device and/or a Bluetooth® device, is on. NOTE: On some models, the wireless light is amber when all wireless devices are off.
(6)  Mute light	<ul style="list-style-type: none">• Amber: Computer sound is off.• White: Computer sound is on.

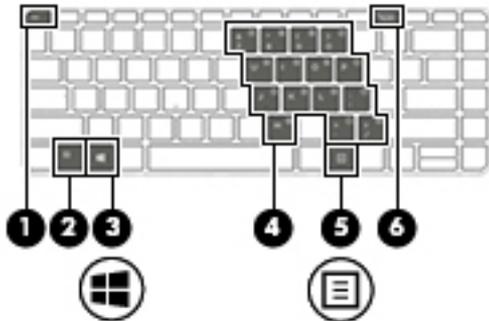
Buttons and speakers



Component	Description
(1)  Power button	<ul style="list-style-type: none"> • When the computer is off, press the button to turn on the computer. • (Windows) When the computer is on, press the button briefly to initiate sleep. • (ThinPro/Smart Zero) When the computer is on, press the button briefly to power off. • (Windows) When the computer is in the Sleep state, press the button briefly to exit Sleep. • When the computer is in Hibernation, press the button briefly to exit Hibernation. <p>CAUTION: Pressing and holding down the power button results in the loss of unsaved information.</p> <p>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.</p> <p>In Windows, to learn more about your power settings, see your power options.</p> <p>▲ Type <code>power</code> in the taskbar search box, and then select Power and sleep settings.</p> <p>– or –</p> <p>Right-click the Start button, and then select Power Options.</p>
(2) Speakers (2)	Produce sound.
(3)  Wireless button	Turns the wireless feature on or off but does not establish a wireless connection.

Component	Description
	A wireless network must be set up before a wireless connection is possible.
(4)  Volume mute button	Mutes and restores speaker sound.

Special function keys



Component	Description
(1) <code>esc</code> key	(ThinPro/Smart Zero) No function. (Windows) Displays system information when pressed in combination with the <code>fn</code> key.
(2) <code>fn</code> key	Executes frequently used system functions when pressed in combination with a function key, the <code>num lock</code> key, or the the <code>esc</code> key. See Using the hot keys on page 11 .
(3)  Windows key	(ThinPro/Smart Zero) No local function. Functions as follows in a remote session to a Windows computer: (Windows) Opens the Start menu. NOTE: Pressing the Windows key again will close the Start menu.
(4) Embedded numeric keypad	A numeric keypad superimposed over the keyboard alphabet keys that enables you to add, subtract, and perform other numeric tasks. When <code>num lock</code> is on, the keypad can be used like an external numeric keypad.
(5)  Windows application key	(ThinPro/Smart Zero) No local function. Displays options for a selected object in a remote session to a Windows computer. (Windows) Displays options for a selected object.
(6) <code>num lock</code> key	Alternates between the navigational and numeric functions on the integrated numeric keypad.

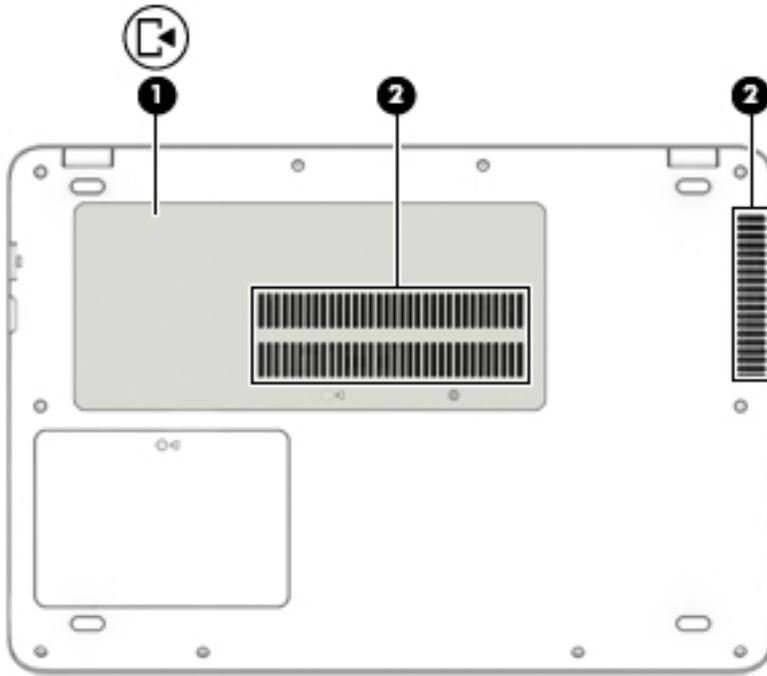
Using the hot keys

To use a hot key:

- ▲ Press the **fn** key, and then press the correct function key represented by the icons below.

Press fn +function key	Description
	<p>Initiates Sleep, which saves your information in system memory. The display and other system components turn off and power is conserved.</p> <p>To exit Sleep, briefly press the power button.</p> <p>CAUTION: To reduce the risk of information loss, save your work before initiating Sleep.</p>
	<p>Turns the keyboard backlight off or on.</p> <p>NOTE: To conserve battery power, turn off this feature.</p>
	<p>Switches the screen image between display devices connected to the system. For example, if a monitor is connected to the computer, repeatedly pressing this key alternates the screen image from the computer display to the monitor display to a simultaneous display on both the computer and the monitor.</p>
	<p>Decreases the screen brightness incrementally as long as you hold down the key.</p>
	<p>Increases the screen brightness incrementally as long as you hold down the key.</p>
	<p>Decreases speaker volume incrementally while you hold down the key.</p>
	<p>Increases speaker volume incrementally while you hold down the key.</p>
	<p>Mutes the microphone.</p>

Bottom



Component		Description
(1) 	Service door	Provides access to the WLAN module slot and the memory module slots. CAUTION: To prevent an unresponsive system, replace the wireless module only with a wireless module authorized for use in the computer by the governmental agency that regulates wireless devices in your country or region. If you replace the module and then receive a warning message, remove the module to restore computer functionality, and then contact support.
(2)	Vents (2)	Enable airflow to cool internal components. NOTE: The computer fan starts up automatically to cool internal components and prevent overheating. It is normal for the internal fan to cycle on and off during routine operation.

Labels

The labels affixed to the computer provide information you may need when you troubleshoot system problems or travel internationally with the computer.

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, or on the back of the display.

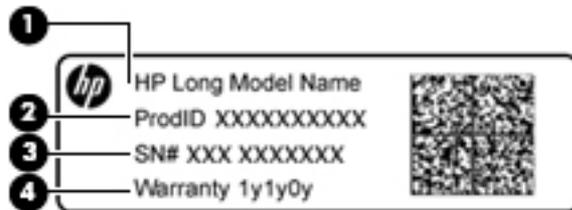
- Service label—Provides important information to identify your computer. When contacting support, you will probably be asked for the serial number, and possibly for the product number or the model number. Locate these numbers before you contact support.

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



Component

- (1) Serial number
- (2) Product number
- (3) Warranty period
- (4) Model number (select products only)



Component

- (1) HP product name
- (2) Product ID number
- (3) Serial number
- (4) Warranty period

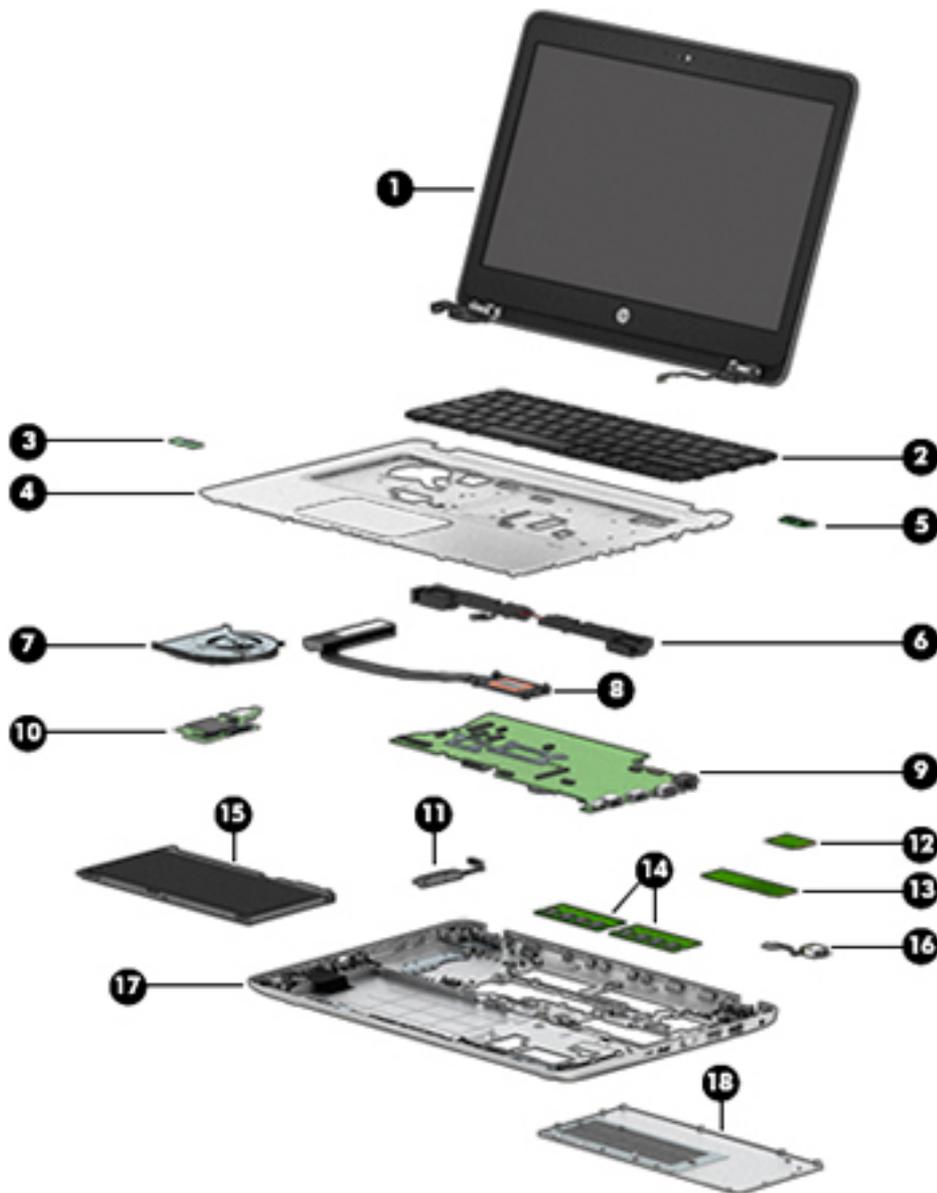
- Regulatory label(s)—Provide(s) regulatory information about the computer.
- Wireless certification label(s)—Provide(s) information about optional wireless devices and the approval markings for the countries or regions in which the devices have been approved for use.

3 Illustrated parts catalog

Computer major components

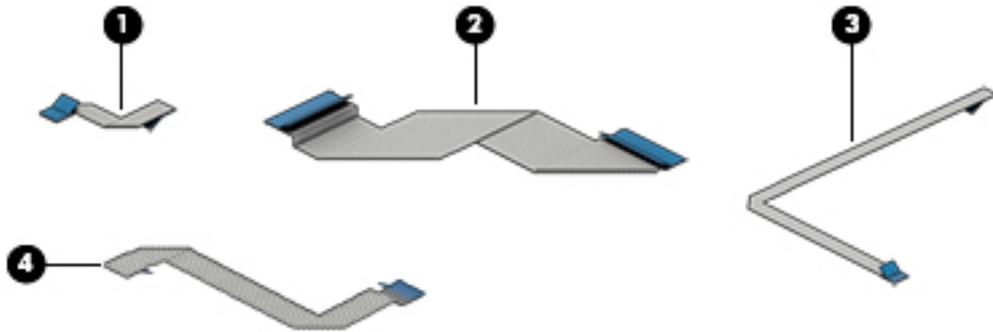
 **NOTE:** HP continually improves and changes product parts. For complete and current information on supported parts for your computer, go to <http://partsurfer.hp.com>, select your country or region, and then follow the on-screen instructions.

 **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 13](#) for details.



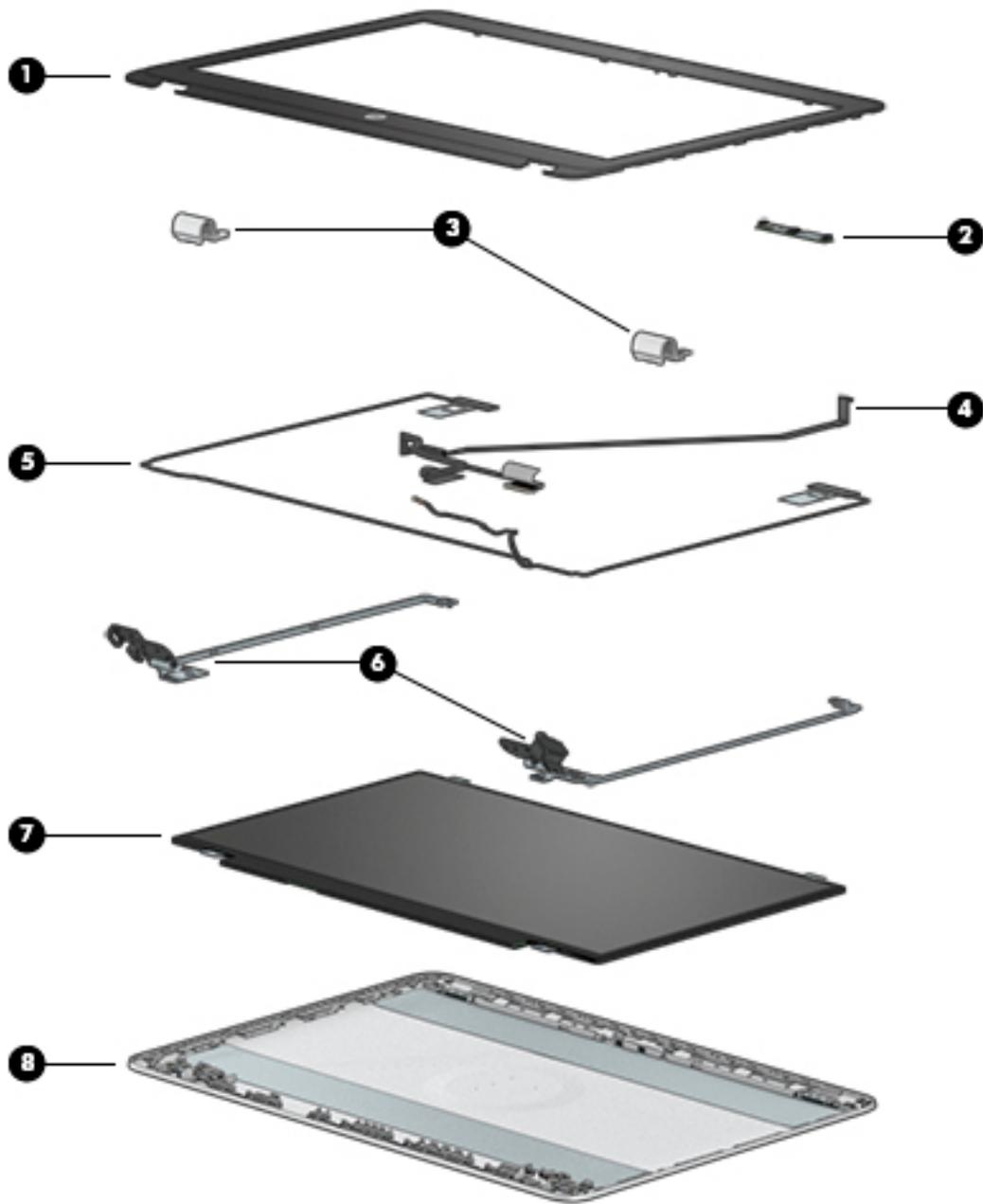
Item	Description	Spare part number
(1)	Display panel assembly , non-touch Non-touch displays are ONLY spared at the subcomponent level. For more information about display components, see Display components on page 17 .	not spared
(2)	Keyboard (includes cable) NOTE: For a detailed list of keyboard country codes, see Keyboard on page 32 .	
	No backlight	906764-xxx
	Backlit	906763-xxx
(3)	Power button board	905712-001
(4)	Top cover (includes touchpad assembly)	905702-001
(5)	Function board	905710-001
(6)	Speaker assembly	905705-001
(7)	Fan	905706-001
(8)	Heat sink assembly (UMA) (includes replacement thermal material)	910980-001
(9)	System board with Intel Celeron 3865U processor (includes replacement thermal material)	921339-301
(10)	USB/audio board	905713-001
(11)	Hard drive cable	not spared
(12)	WLAN module	
	Intel Dual Band Wireless-AC 3168 802.11ac, 1×1 Wi-Fi + Bluetooth 4.2 combination adapter	852511-001
(13)	M.2 solid-state drive, 128 GB	921340-001
(14)	Memory module, 4 GB (PC4-2133)	862397-850
(15)	Battery, Li-ion (4-cell, 48 WHr, 4.21 Ah)	851610-855
(16)	Power connector cable	918201-001
(17)	Base enclosure	905701-001
(18)	Main service door NOTE: The main service door is included in the Plastic Kit.	905703-001

Cable Kit



Item	Description	Spare part number
	Cable Kit	905707-001
(1)	Function board cable	
(2)	USB board cable	
(3)	Power button board cable	
(4)	TouchPad cable	

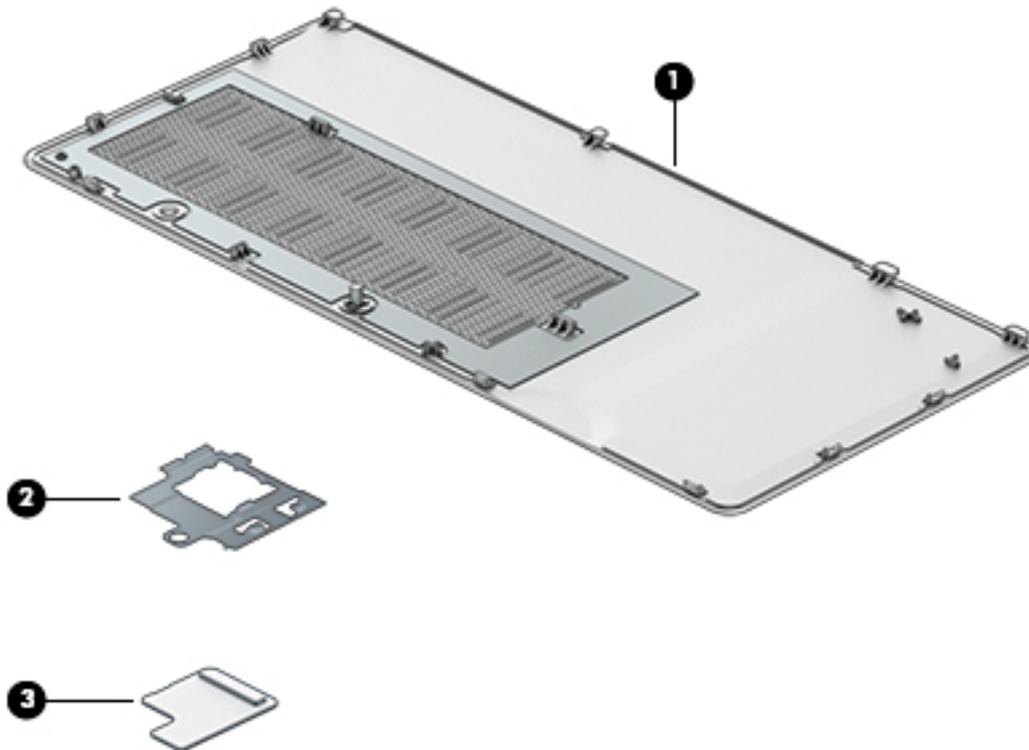
Display components



Item	Description	Spare part number
(1)	Display bezel	
	Models without a webcam	905693-001
	Models with a webcam	905692-001
(2)	Webcam module	826271-002
(3)	Hinge covers (left and right)	905699-001
(4)	Display/webcam cable assembly	905696-001

Item	Description	Spare part number
(5)	WLAN antennas NOTE: Included in display enclosure	not spared
(6)	Display Hinge Kit , includes: Left hinge Right hinge	905698-001
(7)	Display panel (raw) HD	839668-002
(8)	Display rear cover (includes wireless antennas)	905694-001

Plastics Kit



Item	Description	Spare part number
	Plastics Kit	905703-001
(1)	Main service door	
(2)	Fingerprint reader bracket (fingerprint reader not available on this product)	
(3)	Fingerprint reader insert	

Miscellaneous parts

Description	Spare part number
AC adapters	
65-W Smart AC power adapter, 4.5 mm barrel connector (for use in India and the People's Republic of China)	714657-001
45-W Smart AC power adapter, 4.5 mm barrel connector	741727-001
45-W Smart AC power adapter, 4.5 mm barrel connector, 2 prong	742436-001
Power cord (3-pin, C5, black, 1.83-m), for use in:	
Argentina	401300-001
Australia	213356-001
Brazil	438722-001
Denmark	213353-001
Europe (Austria, Belgium, Finland, France, Germany, the Netherlands, Norway and Sweden)	213350-001
India	404827-001
Israel	398063-001
Italy	213352-001
Japan	349756-001
North America	213349-001
People's Republic of China	286497-001
South Africa	361240-001
South Korea	267836-001
Switzerland	213354-001
Taiwan	393313-001
Thailand	285096-001
United Kingdom and Singapore	213351-001
Power cord (3-pin, C5, black, 1.00-m), for use in:	
Argentina	401300-007
Australia	213356-008
Brazil	438722-004
Denmark	213353-008
Europe (Austria, Belgium, Finland, France, Germany, the Netherlands, Norway and Sweden)	213350-009
India	404827-003
Israel	398063-003
Italy	213352-008
Japan	349756-002

Description	Spare part number
North America	213349-009
People's Republic of China	286497-008
South Africa	361240-002
South Korea	267836-008
Switzerland	213354-008
Taiwan	393313-003
Thailand	285096-006
United Kingdom and Singapore	213351-008
Power cord (3-pin, C7, black, 1.00-m), for use in:	
Japan	190548-003
Screw Kit	912377-001
HP keyed cable lock	840158-001
HP Smart AC Adapter dongle, 7.4 mm	734734-001
HP USB-C to USB 3.0 Adapter	814618-001

4 Removal and replacement procedures preliminary requirements

Tools required

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

- Flat-bladed screwdriver
- Phillips P0 and P1 screwdrivers
- Torx T8 screwdriver

Service considerations

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

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

Plastic parts

 **CAUTION:** Using excessive force during disassembly and reassembly can damage plastic parts. Use care when handling the plastic parts. Apply pressure only at the points designated in the maintenance instructions.

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.

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, and 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.

Use nonmagnetic tools.

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			
Event	Relative humidity		
	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 $\pm 10\%$ 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 strips must be worn in contact with the skin.

The following grounding equipment is recommended to prevent electrostatic damage:

- Antistatic tapes
- 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 plastic	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

 **CAUTION:** 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.

 **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.

Component replacement procedures

 **NOTE:** Please read and follow the procedures described here to access and replace Customer Self-Repair parts successfully.

 **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 13](#) for details.

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

There are as many as 14 screws that must be removed, replaced, or loosened when servicing Customer Self-Repair parts. Make special note of each screw size and location during removal and replacement.

Battery Safe mode

Before removing internal components, you must place the computer in “Battery Safe mode.” This mode avoids short-circuits or system malfunction by removing power from internal components.

To place the computer in “Battery Safe mode,” follow these steps:

1. With the computer turned off and AC adapter connected, press the following key and button combination: **Windows key + Backspace key + Power button.**
2. Turn the computer on to initiate “Battery Safe mode.”
3. After the computer powers off, disconnect the AC adapter.

In “Battery Safe mode,” the power button will not turn the computer on if the AC adapter is not connected.

To disengage “Battery Safe mode,” plug in the AC adapter and press the power button.

Service door

Description	Spare part number
Main service door (included in Plastics Kit)	905703-001

The bottom of the computer has two service doors. The smaller service door is not used for this product. The main service door provides access to the memory modules, wireless modules, M.2 solid-state drive, and keyboard screws.

Before removing the service door, follow these steps:

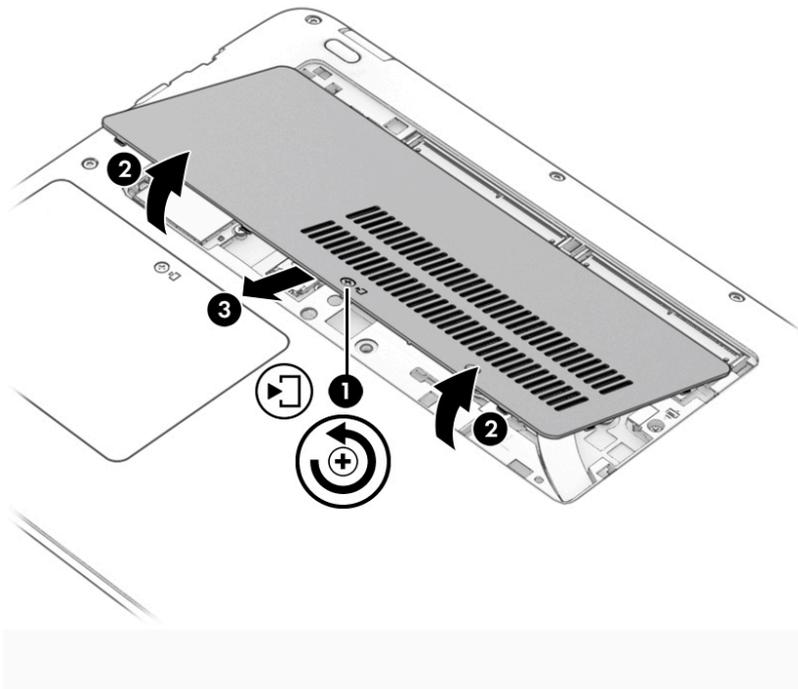
1. Shut down the computer. If you are unsure whether the computer is off or in Hibernation, turn the computer on, and then shut it down through the operating system.
2. Place the computer in “Battery Safe mode” ([Battery Safe mode on page 25](#)).
3. Disconnect all external devices connected to the computer.
4. 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.

Remove the service door:

1. Main service door

Loosen the captive Phillips screw **(1)**.

2. Lift the bottom of the door upward **(2)**, and then remove the door from the computer **(3)**.



Reverse these procedures to install the service door.

Memory modules

Description	Spare part number
4-GB (PC4-2133)	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:

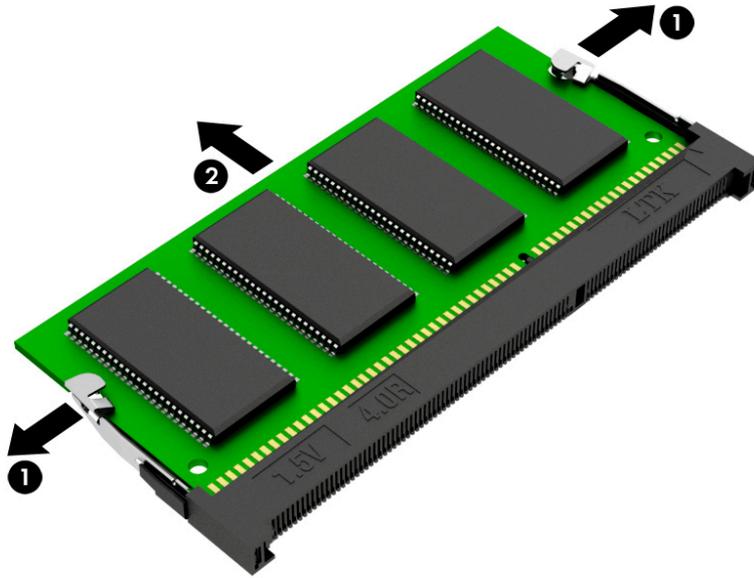
1. Shut down the computer. If you are unsure whether the computer is off or in Hibernation, turn the computer on, and then shut it down through the operating system.
2. Place the computer in "Battery Safe mode" ([Battery Safe mode on page 25](#)).
3. Disconnect all external devices connected to the computer.
4. 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.
5. Remove the main service door (see [Service door on page 26](#)).

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.



Reverse this procedure to install a memory module.

WLAN/Bluetooth combo card

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

Description	Spare part number
Intel Dual Band Wireless-AC 3168 802.11ac, 1×1 Wi-Fi + Bluetooth 4.2 combination adapter	852511-001

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. Place the computer in “Battery Safe mode” ([Battery Safe mode on page 25](#)).
3. Disconnect all external devices connected to the computer.
4. 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.
5. Remove the main service door (see [Service door on page 26](#)).

Remove the WLAN module:

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

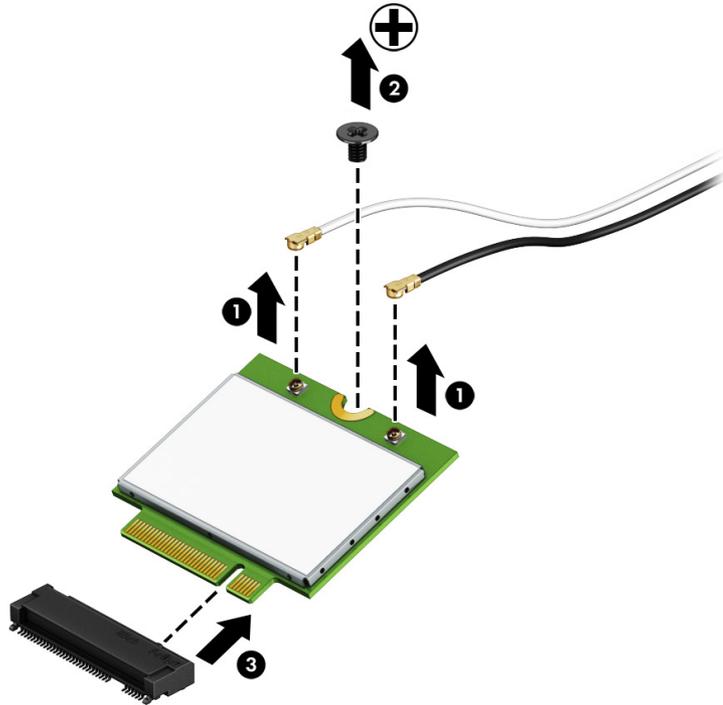


NOTE: The WLAN antenna cable labeled “1” connects to the WLAN module “Main” terminal labeled “1”. The WLAN antenna cable labeled “2” connects to the WLAN module “Aux” terminal labeled “2”. If the computer is equipped with an 802.11a/b/g/n WLAN module, the yellow WLAN antenna cable connects to the middle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

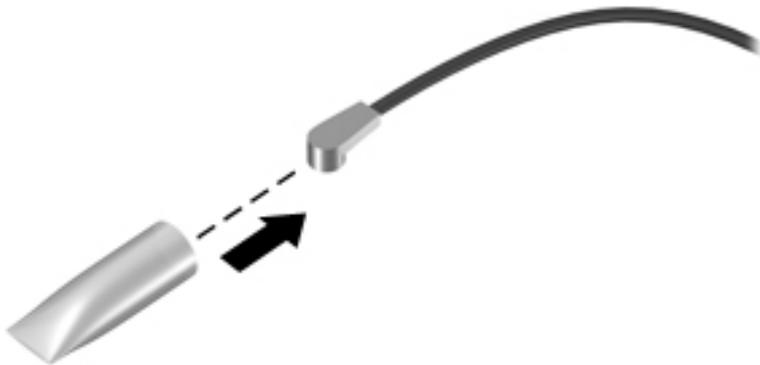
2. Remove the Phillips PM2.0×4.0 screw (**2**) that secures the WLAN module to the computer. (The edge of the module opposite the slot rises away from the computer.)

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

 **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.

M.2 solid-state drive

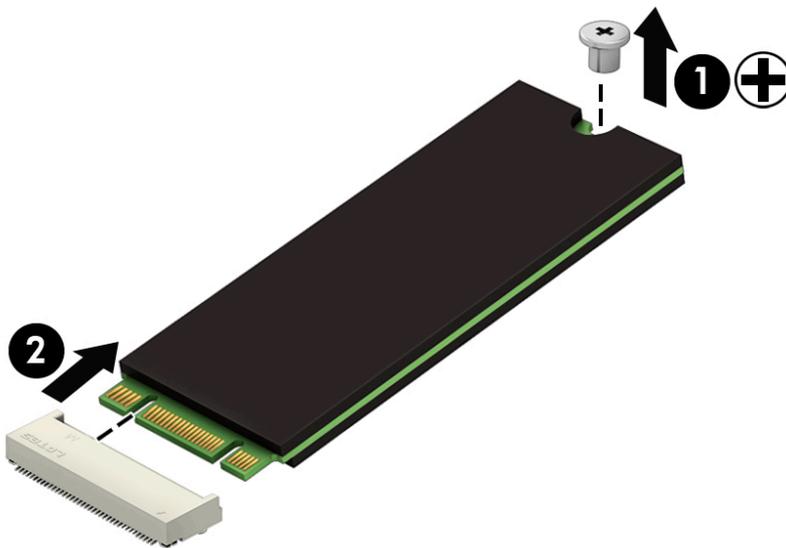
Description	Spare part number
128-GB	921340-001

Before removing the solid-state drive, 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. Place the computer in “Battery Safe mode” ([Battery Safe mode on page 25](#)).
3. Disconnect all external devices connected to the computer.
4. 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.
5. Remove the service door (see [Service door on page 26](#)).

Remove the solid-state drive:

1. Remove the Phillips PM2.0×4.0 screw **(1)** that secures the solid-state drive to the computer. (The edge of the module opposite the slot rises away from the computer.)
2. Remove the solid-state drive **(2)** by pulling the module away from the slot at an angle.



Reverse this procedure to install the solid-state drive.

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	906764-xxx
Keyboard, backlit	906763-xxx

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

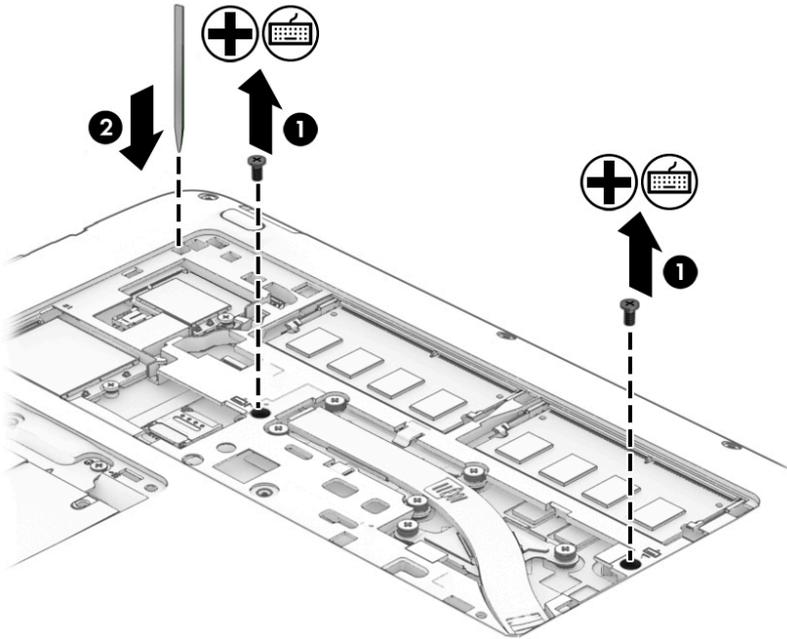
Before removing the keyboard, follow these steps:

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. Place the computer in “Battery Safe mode” ([Battery Safe mode on page 25](#)).
3. Disconnect all external devices connected to the computer.
4. 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.
5. Remove the main service door (see [Service door on page 26](#)).

Remove the keyboard:

1. Remove the 2 Phillips PM2.5×5.0 screws that secure the keyboard to the computer **(1)**.

2. Insert a tool into the access hole in the bottom of the computer and push to disengage the keyboard from the top cover (2).



3. Lift the top of the keyboard upward (1), and then rotate the keyboard until it rests on the palm rest (2).

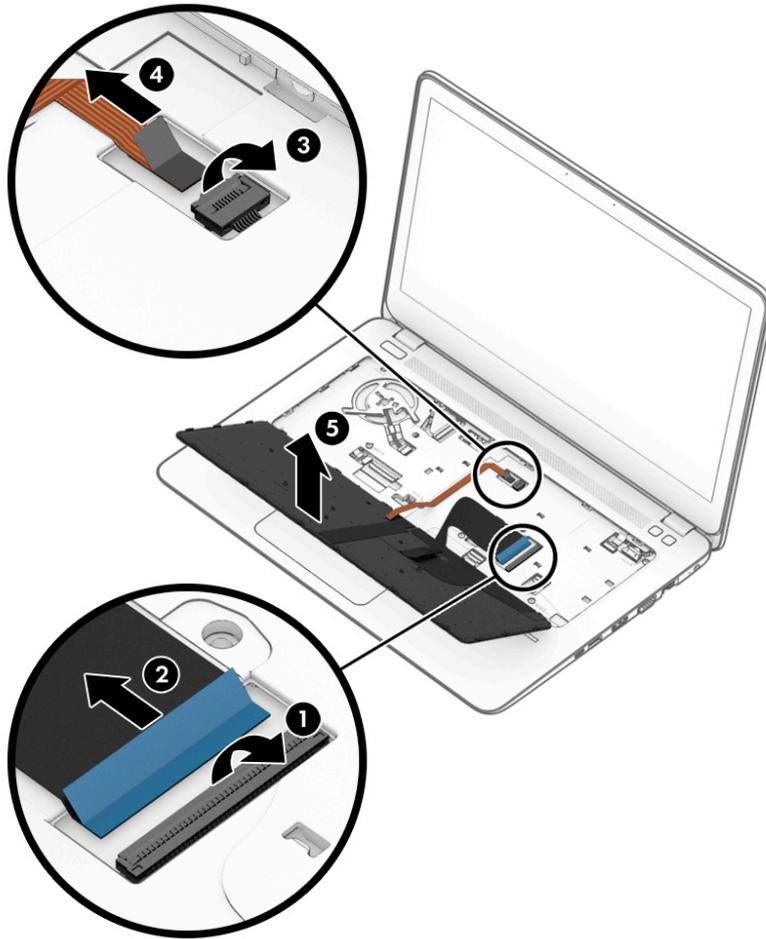


NOTE: A cable (or cables) connect the bottom of the keyboard to the system board. Make sure not to prematurely pull the cables out of the system board connector.



4. Disconnect the keyboard cable by lifting the connector latch (1), and then disconnect the keyboard cable from the system board (2).

5. If applicable, disconnect the backlight cable by lifting the connector latch **(3)**, and then disconnect the cable from the system board **(4)**.
6. Remove the keyboard **(5)**.



Reverse this procedure to install the keyboard.

6 Removal and replacement procedures for Authorized Service Provider 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.

 **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.

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 13](#) for details.

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

There are as many as 57 screws that must be removed, replaced, or loosened when servicing Authorized Service Provider only parts. Make special note of each screw size and location during removal and replacement.

Display subcomponents (bezel, webcam, panel)

This section describes removing display subcomponents that do not require that you remove the entire display assembly from the computer. You can remove the display bezel, webcam/microphone module, and display panel while the display assembly is still attached to the computer.

To remove the remaining display subcomponents, you must remove the entire display assembly from the computer. See [Display assembly on page 60](#) for more information about removing the display assembly in its entirety.

Description	Spare part number
Raw display panel	
HD	839668-002
Display bezel	
Models without a webcam	905693-001
Models with a webcam	905692-001
Webcam/microphone module	
	826271-002

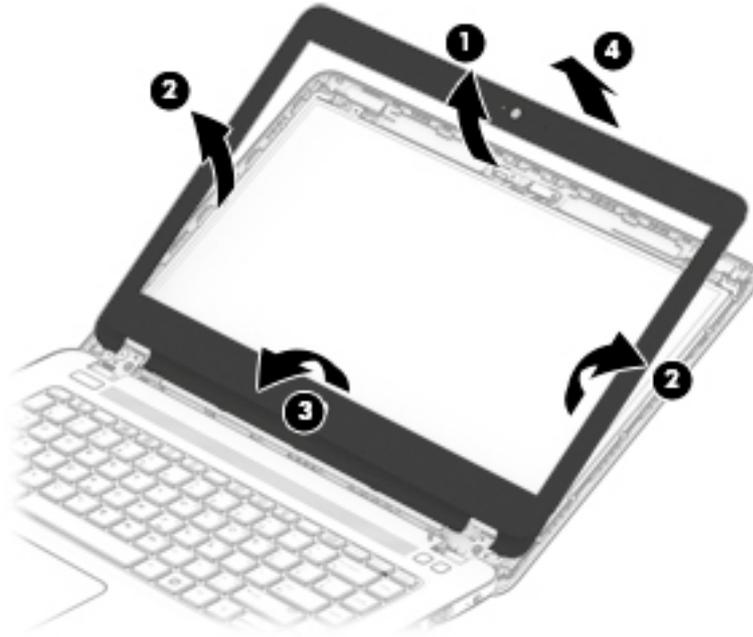
Before removing display subcomponents while the display assembly is still attached to the computer, follow these steps:

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. Place the computer in “Battery Safe mode” ([Battery Safe mode on page 25](#)).

3. Disconnect all external devices connected to the computer.
4. 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.

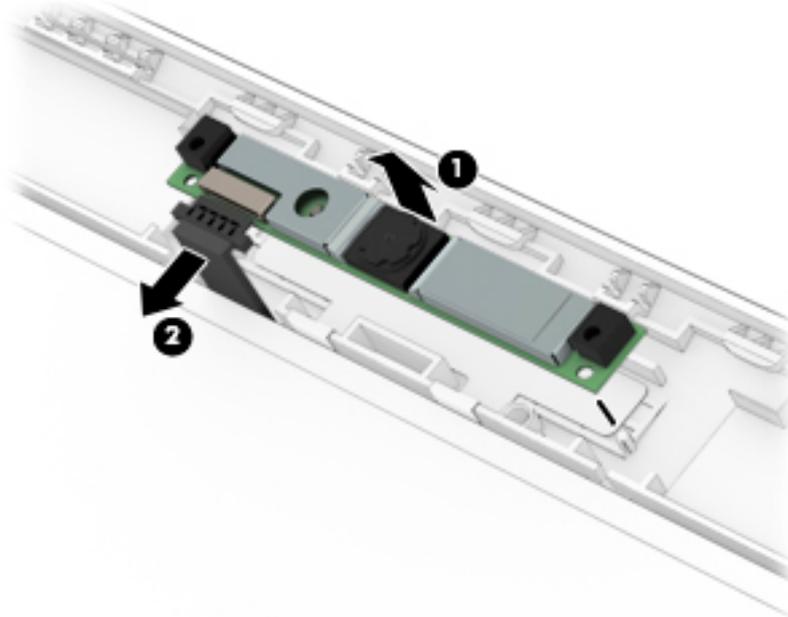
Remove the display bezel, webcam/microphone module, and raw display panel:

1. Position the computer upright with the front toward you, and then open it.
2. Flex the inside of the top edge **(1)**, left and right sides **(2)**, and the inside of the bottom edge **(3)** of the display bezel until the bezel disengages from the display enclosure.
3. Remove the display bezel **(4)**.



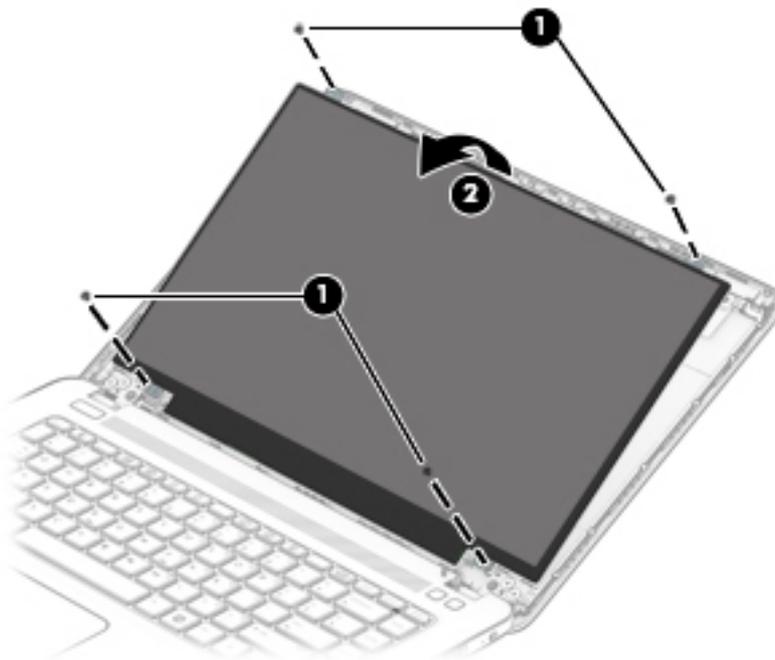
4. To remove the webcam/microphone module:
 - a. Position the display assembly with the top edge toward you.
 - b. Lift to disengage the adhesive that secures the webcam/microphone module to the display **(1)**.

- c. Disconnect the cable **(2)** from the module.



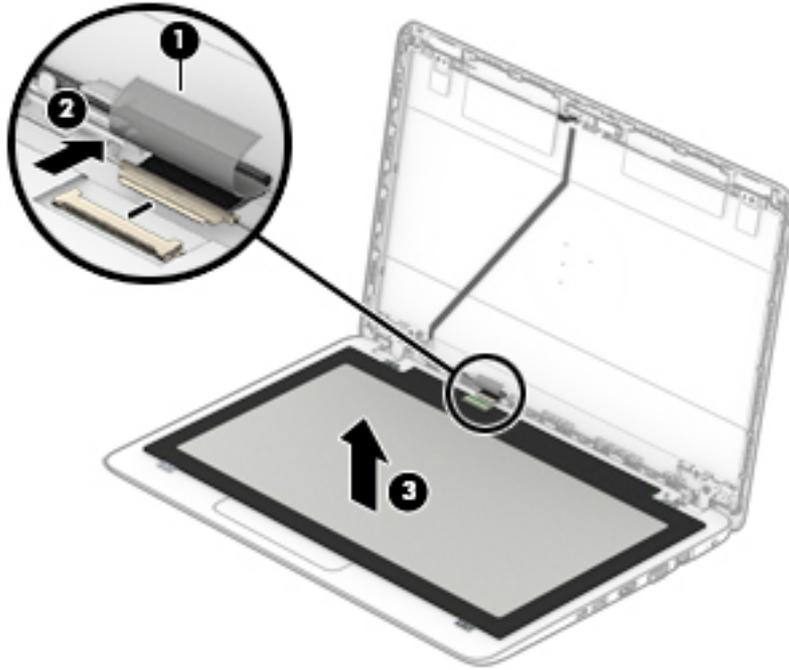
5. To remove the display panel:

- a. Remove the 4 Phillips PM2.0×3.0 screws **(1)** that secure the display panel to the enclosure.
- b. Rotate the display panel onto the keyboard **(2)** to gain access to the display cable connection on the back of the panel.



- c. On the back of the display panel, release the adhesive strip that secures the display panel cable to the display panel **(1)**, and then disconnect the cable **(2)**.

- d. Remove the display panel from the computer **(3)**.



Reverse this procedure to reassemble and install the display bezel, webcam/microphone module, and display panel.

Top cover



NOTE: Top cover spare part kits include the touchpad assembly.

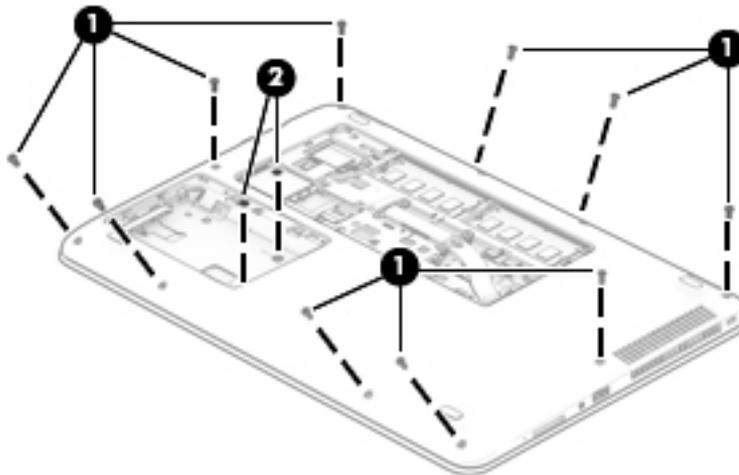
Description	Spare part number
Top cover (includes touchpad)	905702-001

Before removing the top cover, 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. Place the computer in “Battery Safe mode” ([Battery Safe mode on page 25](#)).
3. Disconnect all external devices connected to the computer.
4. 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.
5. Remove the following components:
 - a. Service door (see [Service door on page 26](#)).
 - b. Keyboard (see [Keyboard on page 32](#))

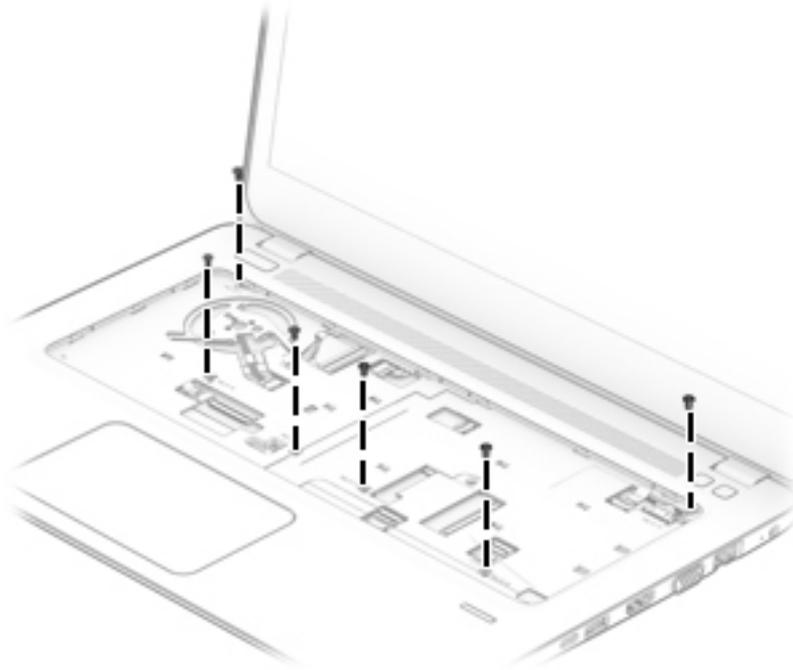
Remove the top cover:

1. Position the computer upside-down with the front toward you.
2. Remove the 10 Torx T8 2.5×7.0 screws **(1)** that secure the top cover to the computer.
3. Remove the 2 Phillips PM2.0×1.5 screws **(2)** that secure the top cover to the computer.



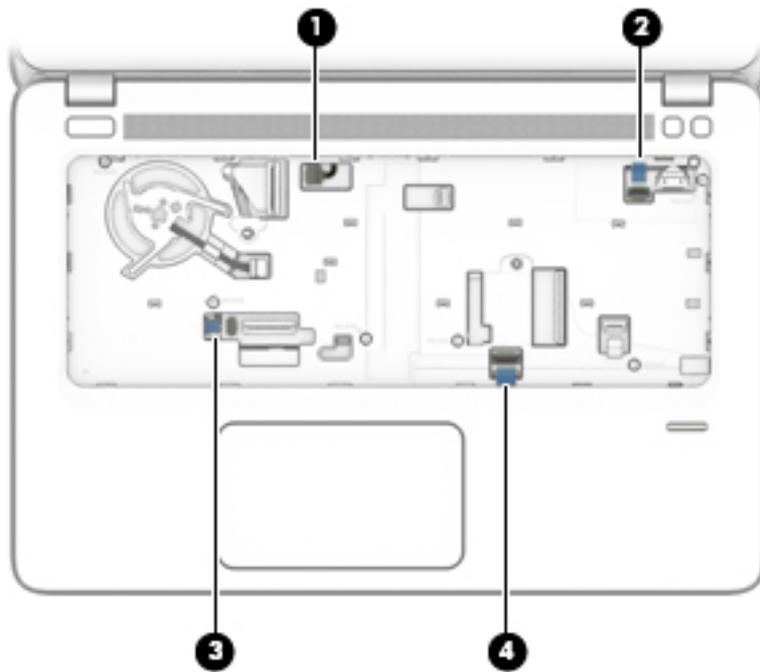
4. Position the computer upright and open it as far as possible.

5. Remove the 6 Torx T8 2.5×5.0 screws that secure the top cover to the computer.

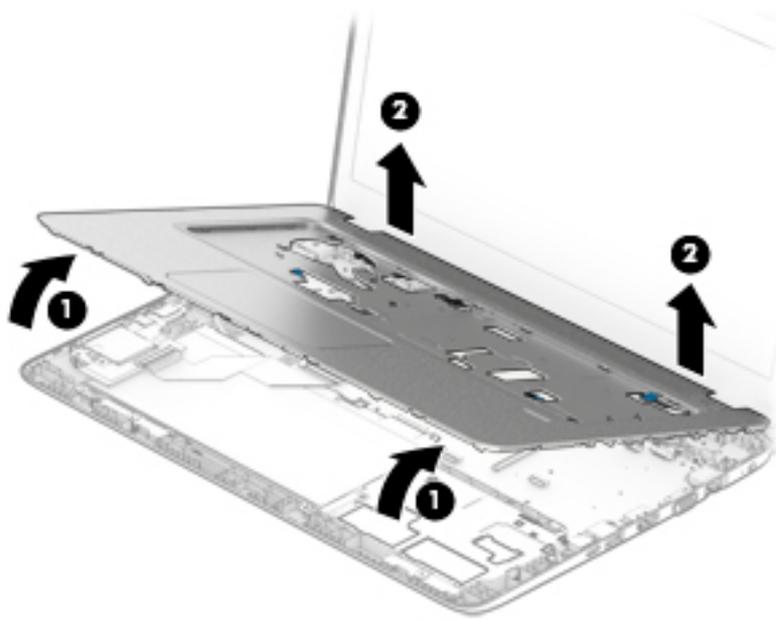


6. Disconnect the following cables from the system board:

- (1) Speaker cable
- (2) Function board cable
- (3) Power button board cable
- (4) Touchpad board cable



7. Rotate the bottom of the top cover upward **(1)**, and then lift the top cover off the computer **(2)**.



Reverse this procedure to install the top cover.

Power button board

Description	Spare part number
Power button board assembly	905712-001
Power button board cable (included in Cable Kit)	905707-001

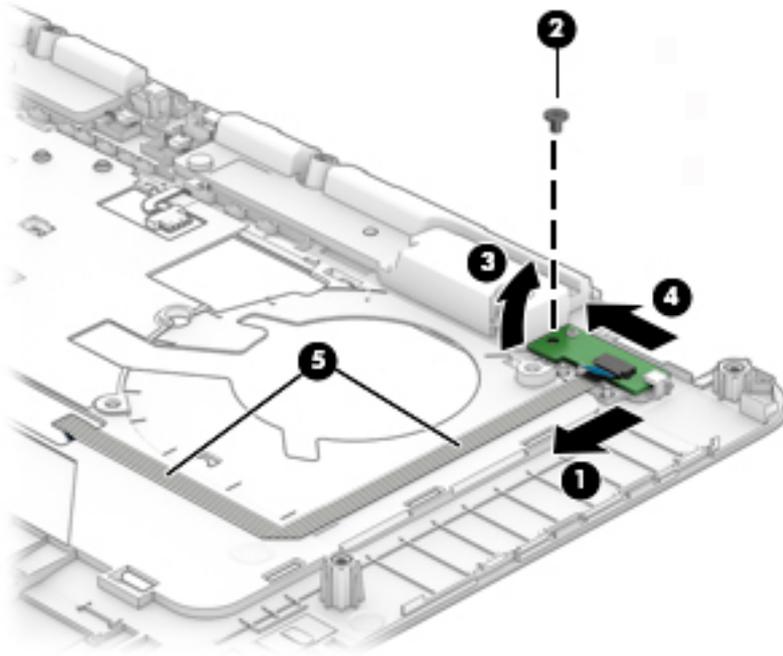
Before removing the power button board, follow these steps:

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. Place the computer in “Battery Safe mode” ([Battery Safe mode on page 25](#)).
3. Disconnect all external devices connected to the computer.
4. 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.
5. Remove the following components:
 - a. Service door (see [Service door on page 26](#))
 - b. Keyboard (see [Keyboard on page 32](#))
 - c. Top cover (see [Top cover on page 39](#))

Remove the power button board:

1. Position the top cover upside-down.
2. Disconnect the cable from the connector on the board **(1)**.
3. Remove the Phillips PM2.0×3.0 screw **(2)** that secures the board to the top cover.
4. Lift the left side of the board **(3)**, and then pull the board out and to the left to remove it from under the tabs **(4)**.

5. If you need to replace the cable, note the cable routing path inside of the top cover (5).



Reverse this procedure to install the power button board.

Function board

Description	Spare part number
Function board	905710-001
Function board cable (included in Cable Kit)	905707-001

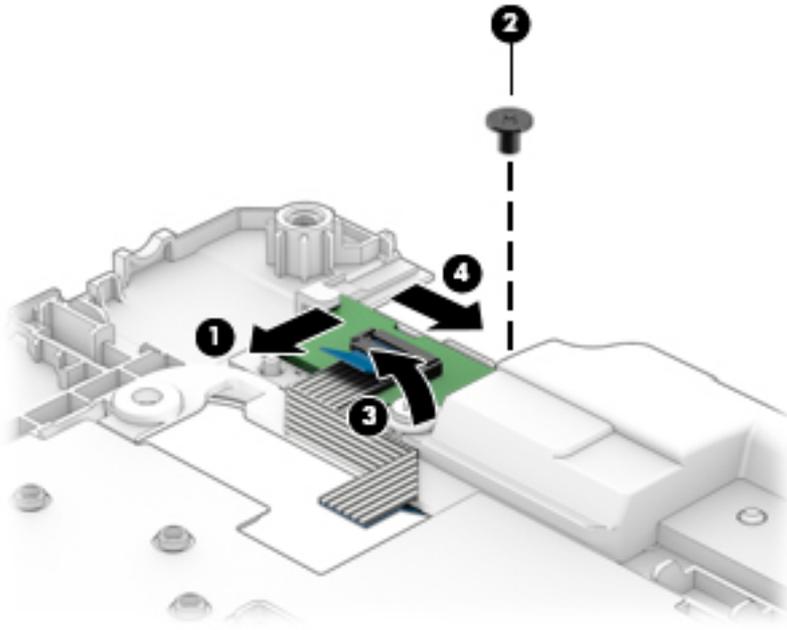
Before removing the function board, follow these steps:

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. Place the computer in “Battery Safe mode” ([Battery Safe mode on page 25](#)).
3. Disconnect all external devices connected to the computer.
4. 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.
5. Remove the following components:
 - a. Service door (see [Service door on page 26](#))
 - b. Keyboard (see [Keyboard on page 32](#))
 - c. Top cover (see [Top cover on page 39](#))

Remove the function board:

1. Position the top cover upside-down.
2. Disconnect the cable from the connector on the function board **(1)**.
3. Remove the Phillips PM2.0×3.0 screw **(2)** that secures the board to the top cover.

4. Lift the right side of the board (3), and then slide the board to the right to remove it from the top cover (4).



Reverse this procedure to install the function board.

Speaker assembly

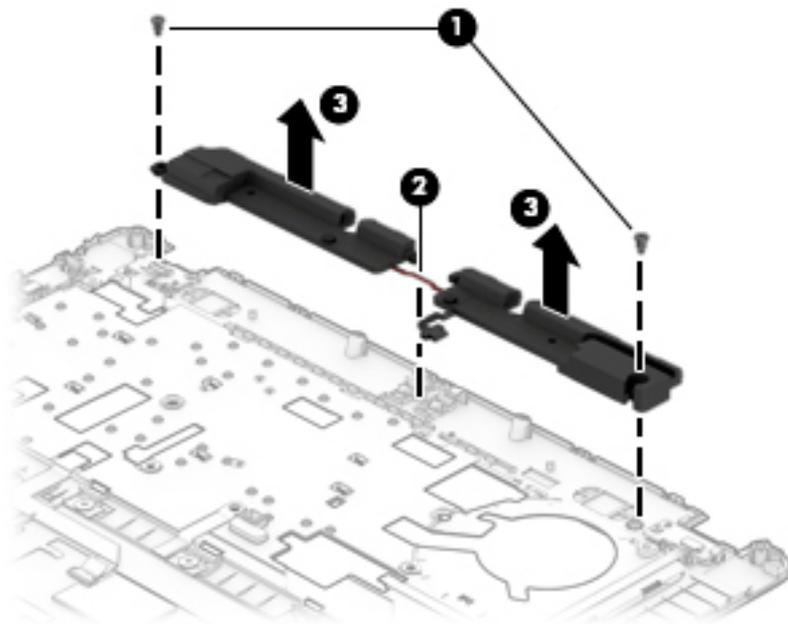
Description	Spare part number
Speaker assembly	905705-001

Before removing the speaker 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. Place the computer in “Battery Safe mode” ([Battery Safe mode on page 25](#)).
3. Disconnect all external devices connected to the computer.
4. 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.
5. Remove the following components:
 - a. Service door (see [Service door on page 26](#)).
 - b. Keyboard (see [Keyboard on page 32](#))
 - c. Top cover (see [Top cover on page 39](#))

Remove the speaker assembly:

1. Position the top cover upside-down.
2. Remove the 2 Phillips PM2.0×3.0 screws (1) that secure the speaker assembly to the top cover.
3. Remove the cable from the clips in the top cover (2).
4. Remove the speakers from the top cover (3).



Reverse this procedure to install the speaker assembly.

TouchPad assembly

Description	Spare part number
TouchPad assembly	not spared
NOTE: The TouchPad is included in the Top Cover spare part kit.	
TouchPad assembly cable (included in Cable Kit)	905707-001

Before removing the TouchPad 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. Place the computer in “Battery Safe mode” ([Battery Safe mode on page 25](#)).
3. Disconnect all external devices connected to the computer.
4. 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.
5. Remove the following components:
 - a. Service door (see [Service door on page 26](#)).
 - b. Keyboard (see [Keyboard on page 32](#))
 - c. Top cover (see [Top cover on page 39](#))

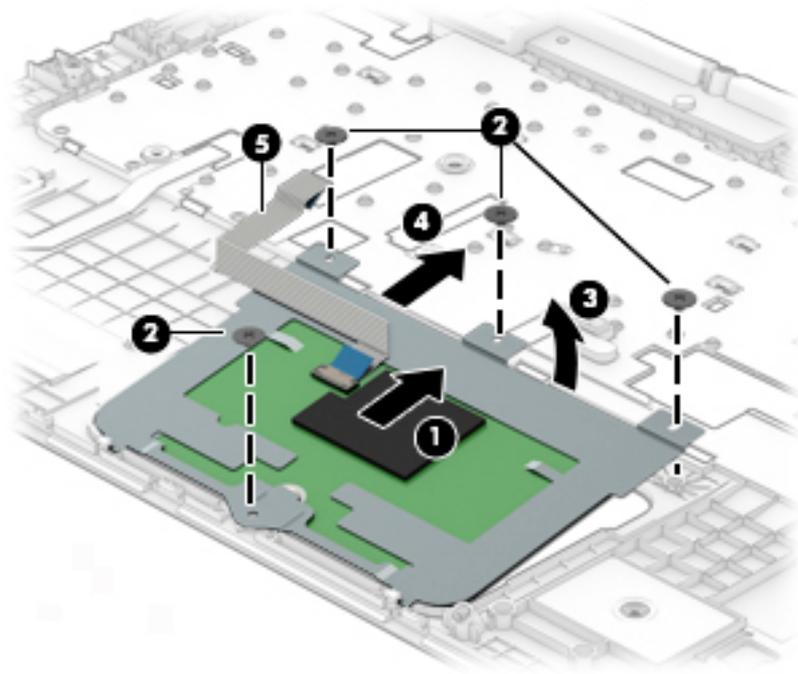
Remove the TouchPad assembly:



NOTE: Before you remove the TouchPad assembly, make sure nothing (memory card or plastic insert) is installed.

1. Position the top cover upside-down.
2. Disconnect the cable from the connector on the TouchPad **(1)**.
3. Remove the 4 Phillips PM2.0×2.0 screws **(2)** that secure the TouchPad to the top cover.
4. Rotate the top of the TouchPad upward **(3)**, and then pull the board toward the top of the top cover to remove it **(4)**.

5. If you need to replace the TouchPad assembly cable, note how it is routed in the top cover (5).



Reverse this procedure to install the TouchPad assembly.

USB/audio board

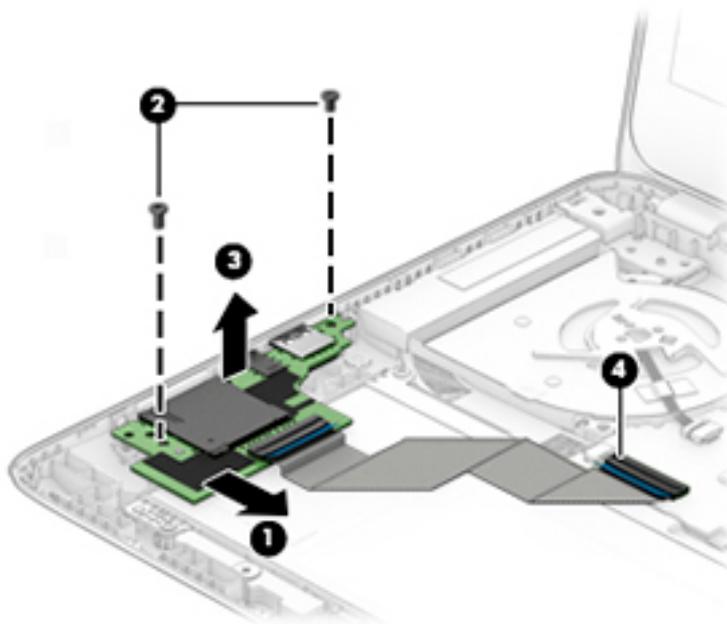
Description	Spare part number
USB/audio board	905713-001
USB/audio board cable (included in Cable Kit)	905707-001

Before removing the USB/audio 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 following components:
 - a. Service door (see [Service door on page 26](#)).
 - b. Keyboard (see [Keyboard on page 32](#))
 - c. Top cover (see [Top cover on page 39](#))

Remove the USB/audio board:

1. Position the computer upright on a flat surface.
2. Disconnect the cable from the board **(1)**.
3. Remove the 2 Phillips PM2.5×5.0 screws **(2)** that secure the board to the computer.
4. Lift the board out of the computer **(3)**.
5. If you need to replace the cable, note its routing path **(4)**.



Reverse this procedure to install the USB/audio board.

Battery

Description	Spare part number
Battery, 4-cell, 48 WHr, 4.21 Ah	851610-855

Before removing the battery, follow these steps:

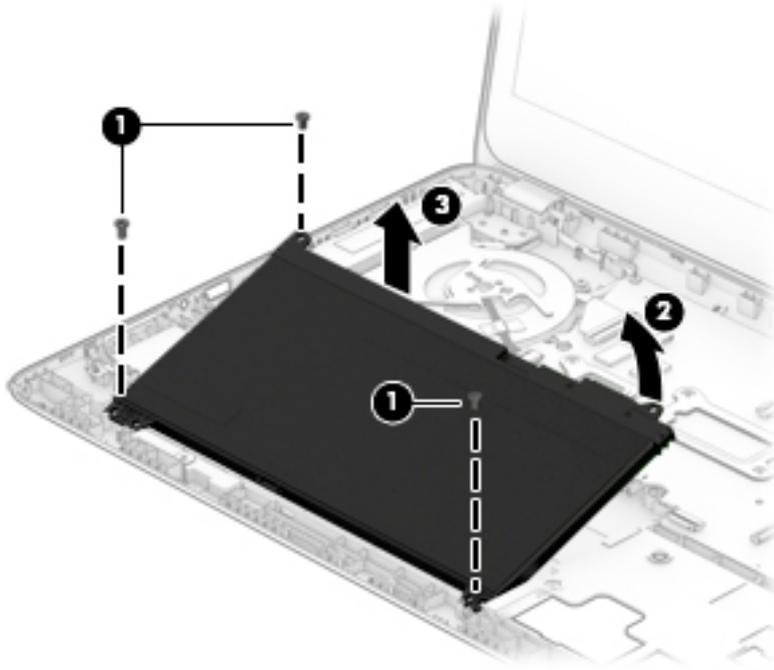
1. Shut down the computer. If you are unsure whether the computer is off or in Hibernation, turn the computer on, and then shut it down through the operating system.
2. Place the computer in “Battery Safe mode” ([Battery Safe mode on page 25](#)).
3. Disconnect all external devices connected to the computer.
4. 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.
5. Remove the following components:
 - a. Service door (see [Service door on page 26](#)).
 - b. Keyboard (see [Keyboard on page 32](#))
 - c. Top cover (see [Top cover on page 39](#))
 - d. USB/audio board (see [USB/audio board on page 49](#))

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 before removing the battery.

1. Position the computer upright on a flat surface.
2. Remove the 3 Torx T8 2.5×5.0 screws **(1)** that secure the battery to the computer.

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



Reverse this procedure to install the battery.

Fan

Description	Spare part number
Fan	905706-001

 **NOTE:** To properly ventilate the computer, allow at least **7.6 cm** (3.0 in) of clearance on the left side of the computer. The computer uses an electric fan for ventilation. The fan is controlled by a temperature sensor and is designed to turn on automatically when high temperature conditions exist. These conditions are affected by high external temperatures, system power consumption, power management/battery conservation configurations, battery fast charging, and software requirements. Exhaust air is displaced through the ventilation grill located on the left side of the computer.

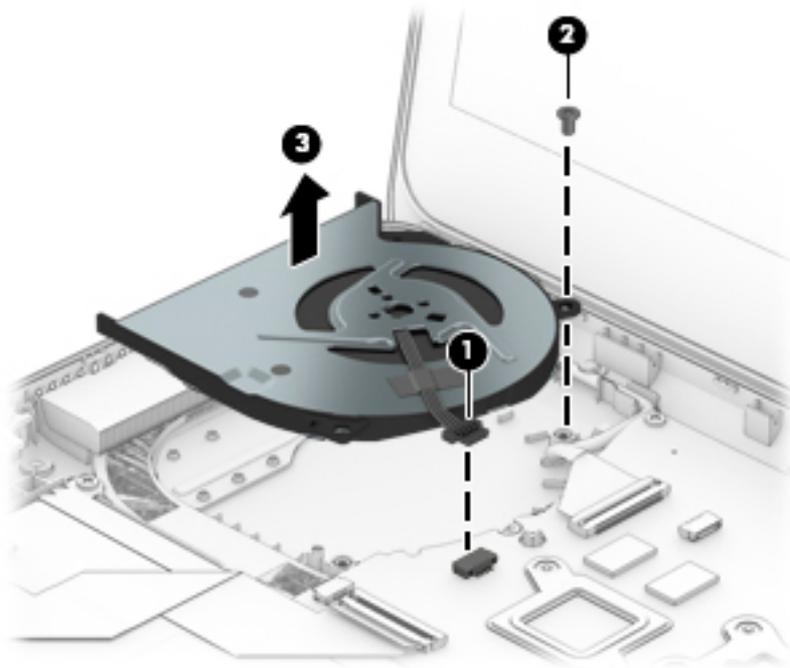
Before removing the fan/heat sink assembly, follow these steps:

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 battery (see [Battery on page 50](#)), and then remove the following components:
 - a. Service door (see [Service door on page 26](#)).
 - b. Keyboard (see [Keyboard on page 32](#))
 - c. Top cover (see [Top cover on page 39](#))
 - d. USB/audio board (see [USB/audio board on page 49](#))
 - e. Battery (see [Battery on page 50](#))

To remove the fan:

1. Position the computer upright on a flat surface.
2. Disconnect the fan cable **(1)** from the system board.
3. Remove the Phillips PM2.5×5.0 screw **(2)** that secures the fan to the computer.

4. Lift 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 10 operating system

Description	Spare part number
System board with Intel Celeron 3865U processor	921339-301

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 following components:
 - a. Service door (see [Service door on page 26](#)).
 - b. Keyboard (see [Keyboard on page 32](#))
 - c. Top cover (see [Top cover on page 39](#))
 - d. USB/audio board (see [USB/audio board on page 49](#))
 - e. Battery (see [Battery on page 50](#))

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:

- Memory modules (see [Memory modules on page 27](#))
- WLAN/Bluetooth module (see [WLAN/Bluetooth combo card on page 29](#))
- M.2 solid-state drive (see [M.2 solid-state drive on page 31](#))
- Heat sink (see [Heat sink assembly on page 58](#))

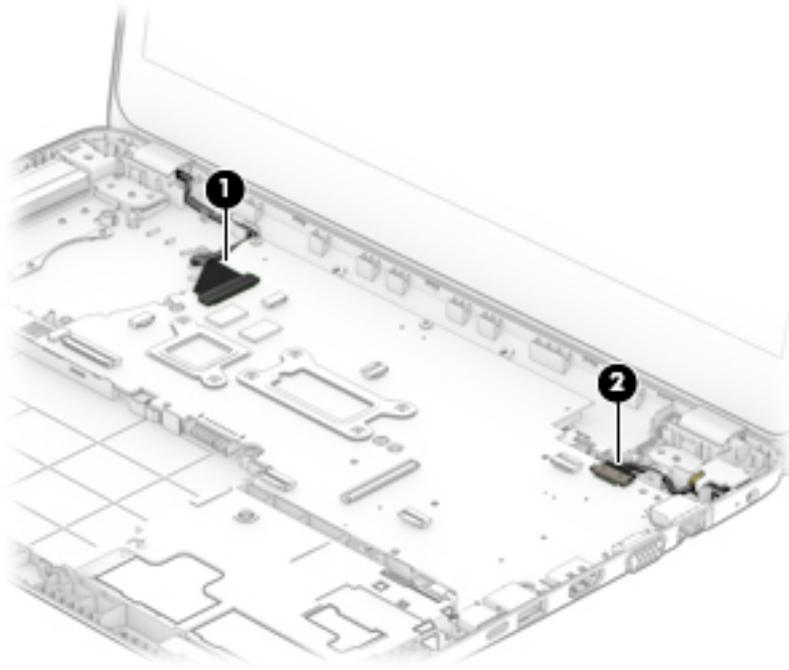
Remove the system board:

1. Position the computer upright on a flat surface.

2. Disconnect the following cables from the system board:

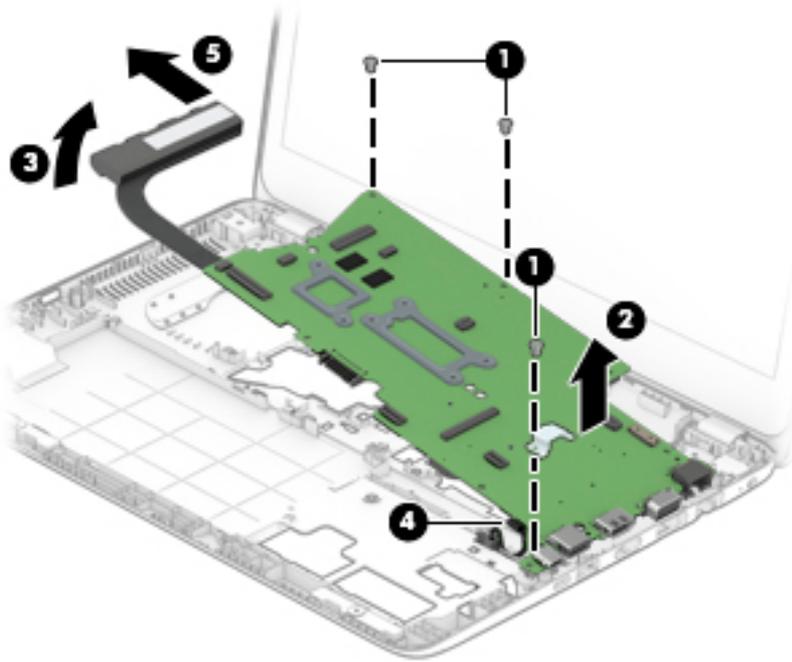
(1) Display cable

(2) Power connector cable



3. Remove the 3 Phillips PM2.5×5.0 screws **(1)** that secure the system board to the computer.
4. Lift the bracket from atop the USB-Type C port **(2)**.
5. Rotate the left side of the system board upward **(3)**.
6. Pull the hard drive cable through the hole in the chassis when removing the system board **(4)**.

7. Pull the system board away from the connectors on the side of the chassis to remove it from the computer (5).



Reverse this procedure to install the system board.

RTC battery

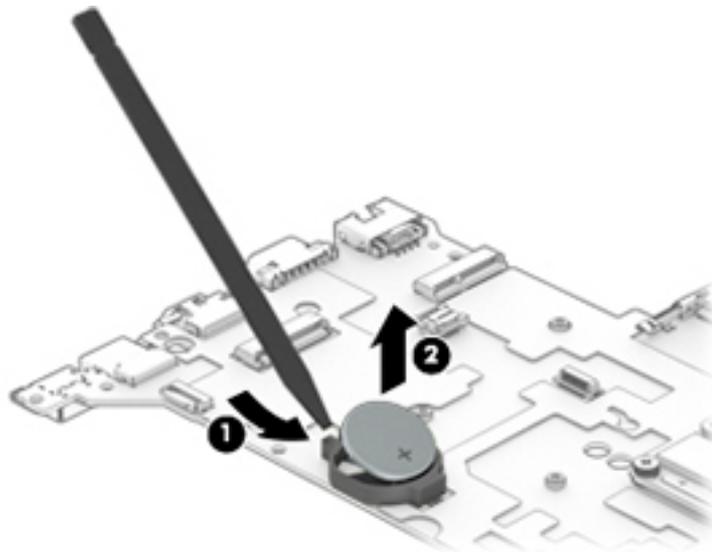
Description	Spare part number
RTC battery	not spared

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 following components:
 - a. Service door (see [Service door on page 26](#)).
 - b. WLAN module (see [WLAN/Bluetooth combo card on page 29](#))
 - c. Keyboard (see [Keyboard on page 32](#))
 - d. Top cover (see [Top cover on page 39](#))
 - e. USB/audio board (see [USB/audio board on page 49](#))
 - f. Battery (see [Battery on page 50](#))
 - g. System board (see [System board on page 54](#))

Remove the RTC battery:

1. Position the system board upside-down.
2. Use a tool to pry the battery out of the socket **(1)**.
3. Remove the battery from the system board **(2)**.



Reverse this procedure to install the RTC battery.

Heat sink assembly

All heat sink assembly spare part kits include replacement thermal material.

Description	Spare part number
Heat sink assembly (UMA)	910980-001

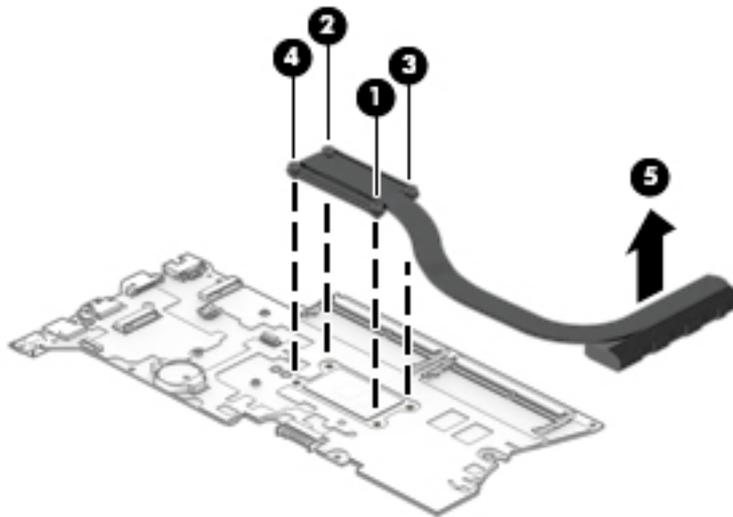
Before removing the heat sink assembly, follow these steps:

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 following components:
 - a. Service door (see [Service door on page 26](#)).
 - b. WLAN module (see [WLAN/Bluetooth combo card on page 29](#))
 - c. Keyboard (see [Keyboard on page 32](#))
 - d. Top cover (see [Top cover on page 39](#))
 - e. USB/audio board (see [USB/audio board on page 49](#))
 - f. Battery (see [Battery on page 50](#))
 - g. Fan (see [Fan on page 52](#))
 - h. System board (see [System board on page 54](#))

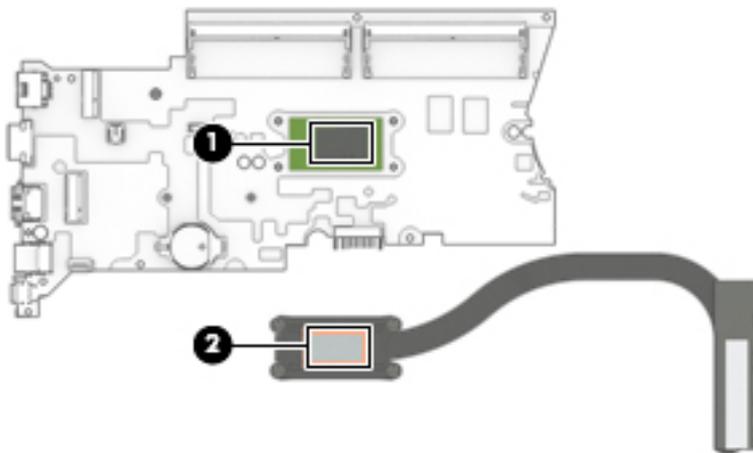
Remove the heat sink assembly:

1. Position the system board upside-down.
2. In the order indicated on the heat sink, loosen the 4 captive Phillips screws **(1)–(4)** that secure the heat sink to the system board.

3. Lift the heat sink from the system board (5).



 **NOTE:** Thoroughly clean thermal material from the surfaces of the system board components (1) and the heat sink (2) each time you remove the heat sink. All heat sink and processor spare part kits include thermal material.



Reverse this procedure to install the heat sink assembly.

Display assembly

Description	Spare part number
Display panel assembly, non-touch Non-touch displays are ONLY spared at the subcomponent level. For more information about display components, see Display components on page 17 .	not spared

This section describes removing components that require you to completely remove the display panel. For more information about removing display components that do not require that you remove the assembly from the computer, see [Display subcomponents \(bezel, webcam, panel\) on page 35](#).

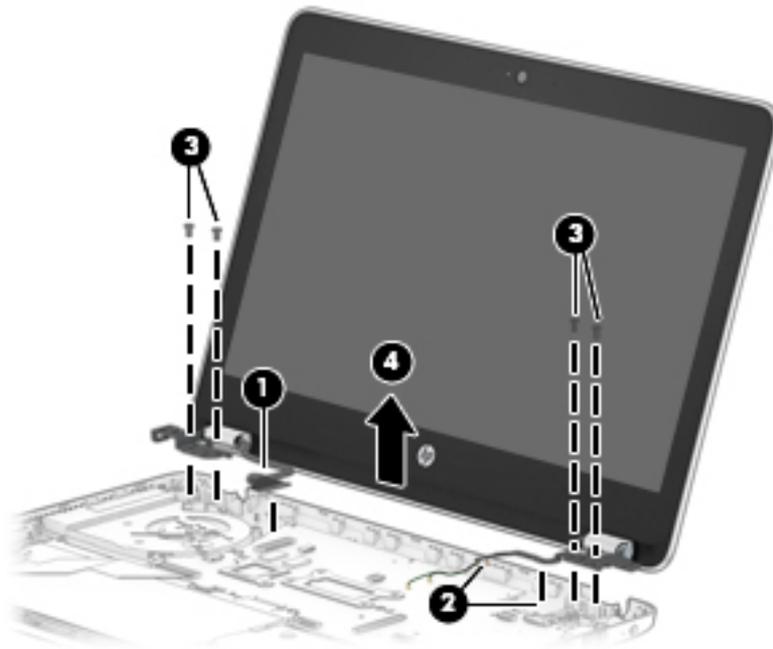
Before removing the display assembly, follow these steps:

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 following components:
 - a. Service door (see [Service door on page 26](#)).
 - b. WLAN module (see [WLAN/Bluetooth combo card on page 29](#))
 - c. Keyboard (see [Keyboard on page 32](#))
 - d. Top cover (see [Top cover on page 39](#))
 - e. USB/audio board (see [USB/audio board on page 49](#))
 - f. Battery (see [Battery on page 50](#))

Remove the display assembly:

1. Position the computer upright on a flat surface.
2. Disconnect the display cable from the system board **(1)**.
3. Pull the wireless antennas through the hole in the computer **(2)**.
4. Remove the 4 Phillips PM2.5×4.0 screws **(3)** from the display hinges.

5. Lift the display assembly straight up and remove it **(4)**.



⚠ 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.

6. 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.

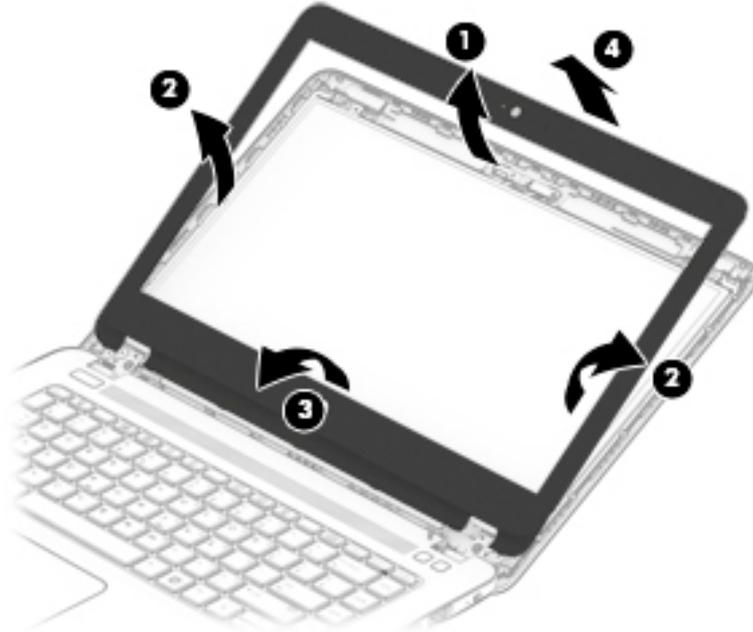
7. Remove the display bezel (4).

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

905693-001: Models with a webcam

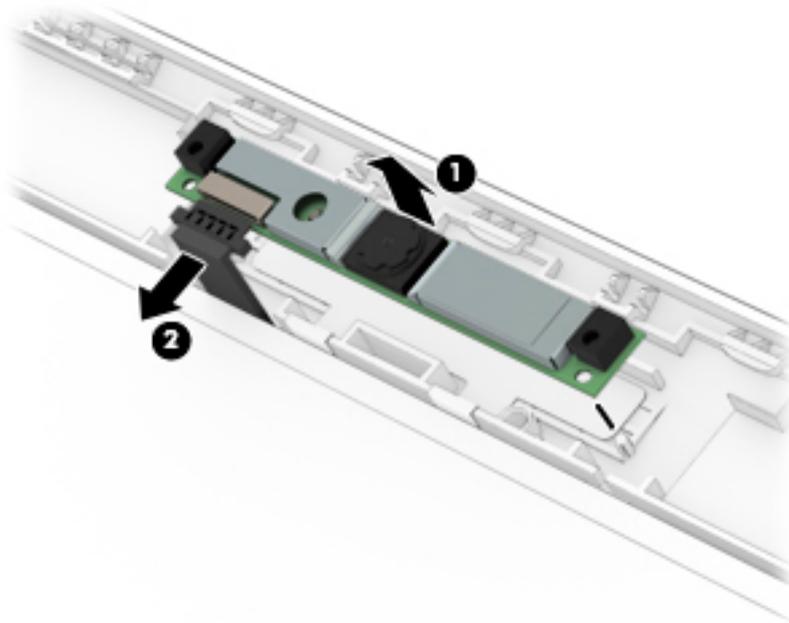
905692-001: Models without a webcam

 **NOTE:** The display will not be connected to the computer as shown in the following image.

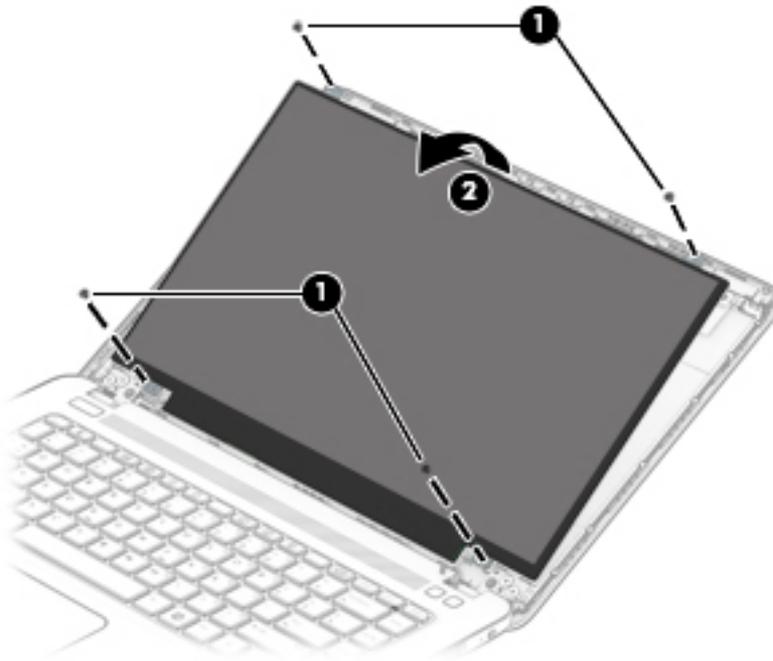


8. If it is necessary to replace the webcam or microphone module, gently pull the module away from the double-sided tape on the display enclosure **(1)**, and then disconnect the cable from the module **(2)**.

The webcam module is available using spare part number 826271-002.

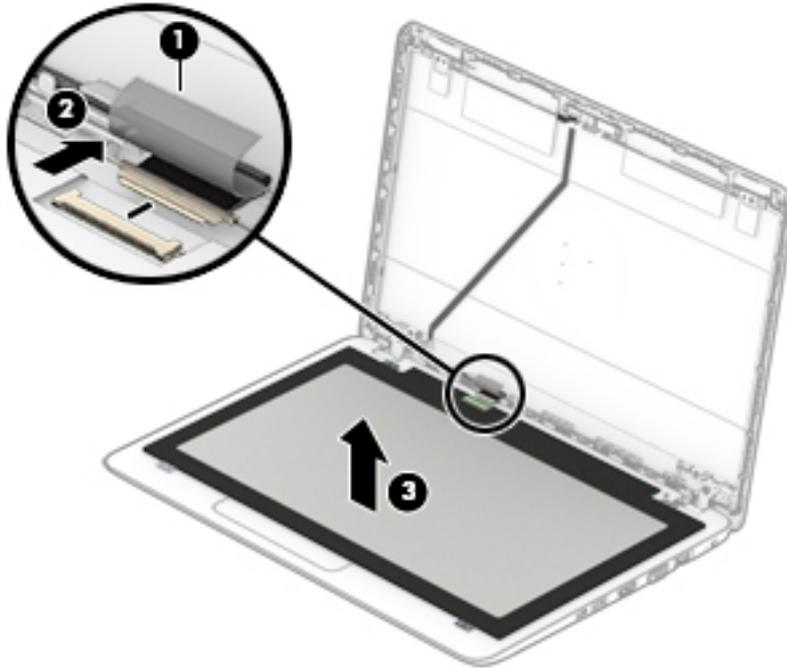


9. If it is necessary to remove or replace the display panel, remove the 4 Phillips PM2.0×3.0 screws **(1)** that secure the display panel to the enclosure.
10. Rotate the display panel onto the keyboard **(2)** to gain access to the display cable connection on the back of the panel.



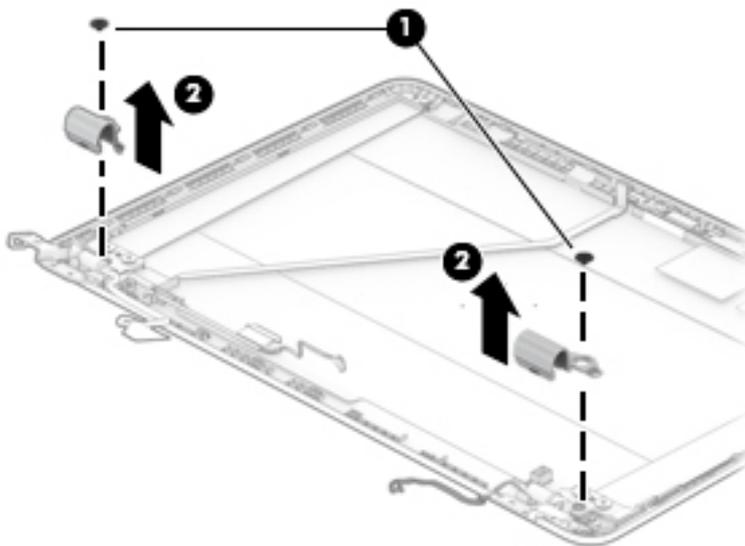
11. On the back of the display panel, release the adhesive strip that secures the display panel cable to the display panel **(1)**, and then disconnect the cable **(2)**.
12. Remove the display panel from the display enclosure **(3)**.

Raw display panels are available using spare part number 839668-002.



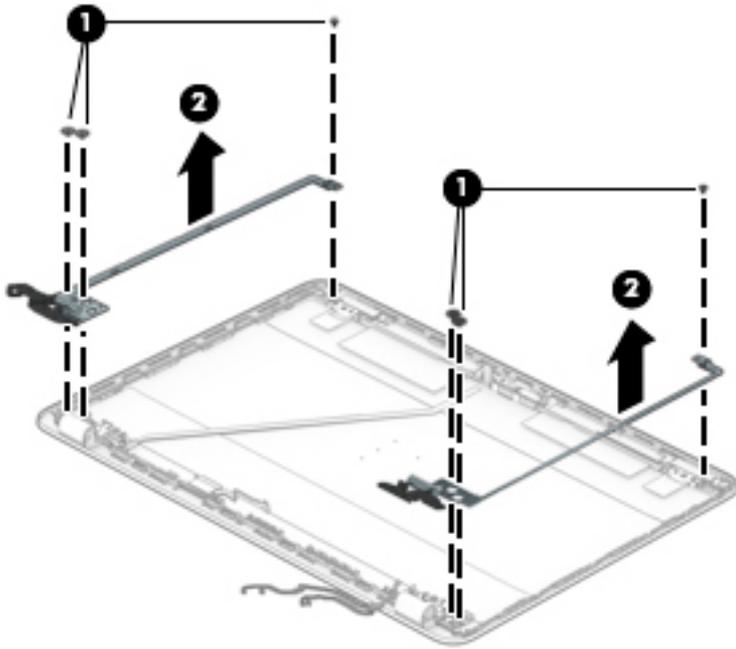
13. If it is necessary to remove or replace the hinge covers, remove the 2 Phillips PM2.5×2.5 screws **(1)** that secure the hinge covers to the display enclosure.
14. Remove the hinge covers from the display hinges **(2)**.

Display hinge covers are available using spare part number 905699-001.



15. If it is necessary to remove or replace the display hinges, remove the 6 Phillips PM2.5×2.5 screws **(1)** that secure both display hinges to the display enclosure.
16. Remove the display hinges from the display enclosure **(2)**.

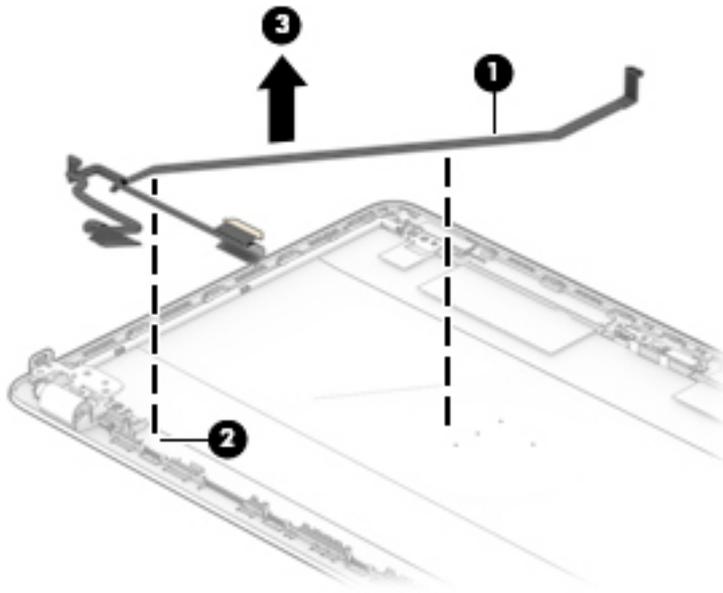
Display hinges are available in the Display Hinge Kit using spare part number 905698-001.



17. If it is necessary to replace the display/webcam cable, remove the webcam cable from the clips in the display enclosure **(1)**, and the clips at the bottom of the display enclosure **(2)**.
18. Remove the cable from the display enclosure **(3)**.

The display/webcam cable is available using spare part number 905696-001.

The display enclosure is available using spare part number 905694-001.



Reverse this procedure to reassemble and install the display assembly.

Power connector and cable

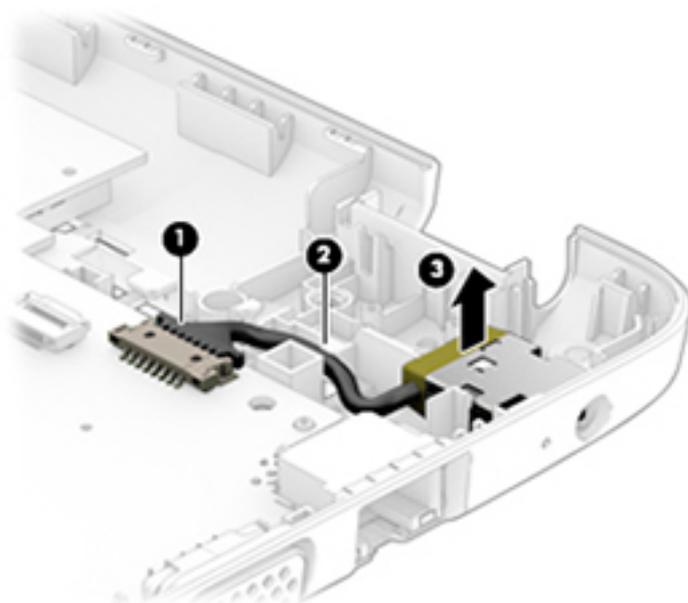
Description	Spare part number
Power connector and cable	918201-001

Before removing the power cable, 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 following components:
 - a. Service door (see [Service door on page 26](#)).
 - b. Keyboard (see [Keyboard on page 32](#))
 - c. Top cover (see [Top cover on page 39](#))
 - d. USB/audio board (see [USB/audio board on page 49](#))
 - e. Battery (see [Battery on page 50](#))
 - f. Display assembly (see [Display assembly on page 60](#))

Remove the power cable:

1. Disconnect the cable from the system board **(1)**.
2. Remove the cable from the clip in the computer **(2)**.
3. Remove the power cable from the computer **(3)**.



Reverse this procedure to install the power cable.

7 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

 **NOTE:** An external keyboard or mouse connected to a USB port can be used with Computer Setup only if USB legacy support is enabled.

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

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 67](#).
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 and using Setup to update BIOS

To decide whether you need to update Computer Setup (BIOS), first determine the BIOS version (also known as *ROM date* and *System BIOS*) on your computer.

ThinPro or Smart Zero

On the **General** tab on the System Information application by pressing the **I** icon on the taskbar.

To use Computer Setup to update BIOS:

1. Download the BIOS from www.hp.com (see [Downloading a BIOS update on page 69](#)).
2. On the ThinPro computer, switch to administrator mode, bring up an xterm, and then run “`hptc-bios-flash <path to BIOS file>`”. This command copies the BIOS file to a directory accessible to the BIOS.
3. Reboot the computer.
4. Enter Computer Setup, select **Update System BIOS**, and then select **Update BIOS using local media**.

Windows

Press **fn+esc** (if you are already in Windows) or use Computer Setup as follows:

1. Start Computer Setup. See [Starting Computer Setup on page 67](#).
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**.

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. To access HP Support, go to <http://www.hp.com/support>, and select your country. Select **Drivers & Downloads**, and then follow the on-screen instructions to access BIOS downloads.
2. At the BIOS 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 revealed on the screen after the download is complete. If no instructions are revealed, follow these steps (in Windows):

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, then press **enter**.

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 67](#).
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.

8 Using HP PC Hardware Diagnostics (UEFI) (Windows only)

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 71](#).

- b. Solid-state 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.

9 Diagnostics and troubleshooting

LEDs

Table 9-1 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	<p>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:</p> <ul style="list-style-type: none">• Processor initialization• Memory detection and initialization• Video detection and initialization <p>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.</p> <p>NOTE: After the video subsystem is initialized, anything that fails will have an error message.</p>
<p>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.</p>	
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 or hibernation 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.

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 9-2 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 9-3 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: A fan may be blocked or not turning. OR The heat sink/fan assembly is not properly attached to the processor. OR The unit has vents blocked or is in a location where the ambient temperature is too high.	<ol style="list-style-type: none"> 1. Ensure that the computer air vents are not blocked and the processor cooling fan is plugged in and running, if equipped. 2. Contact an authorized reseller or service provider.
Red Power LED flashes four times, once every second, followed by a two second pause.	4	Power failure (power supply is overloaded). OR	<ol style="list-style-type: none"> 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

Table 9-3 Diagnostic front panel LEDs and audible codes (continued)

Activity	Beeps	Possible Cause	Recommended Action
Beeps stop after fifth iteration but LEDs continue until problem is solved.		The incorrect external power supply adapter is being used on the unit.	<p>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.</p> <ol style="list-style-type: none"> 2. Replace the power supply. 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.	<p>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.</p> <ol style="list-style-type: none"> 1. Reseat memory modules. 2. Replace memory modules one at a time to isolate the faulty module. 3. Replace third-party memory with HP memory. 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.	<p>For systems with a graphics card:</p> <ol style="list-style-type: none"> 1. Reseat the graphics card. 2. Replace the graphics card. 3. Replace the system board. <p>For systems with integrated graphics, replace the system board.</p>
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.	<ol style="list-style-type: none"> 1. Reflash the system ROM with the latest BIOS image using the BIOS Recovery procedure. 2. Replace the system board.
System does not power on and LEDs are not flashing.	None	System unable to power on.	<p>Press and hold the power button for less than four seconds. If the hard drive LED turns white, the power button is working correctly. Try the following:</p> <ol style="list-style-type: none"> 1. Remove the power cord from the computer. 2. Open the computer and press the yellow CMOS button on the system board for four seconds (located near the front USB ports). 3. Verify that the AC cord is plugged into the power supply. 4. Close the unit and reattach the power cord. 5. Try to power on the computer. 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 9-4 Numeric Codes and Text Messages

Control panel message	Description	Recommended action
103-System Board Failure	DMA or timers.	<ol style="list-style-type: none">1. Clear CMOS.2. Remove expansion boards.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.	<ol style="list-style-type: none">1. If a PCI expansion card was recently added, remove it to see if the problem remains.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. 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.	<ol style="list-style-type: none">1. Ensure memory modules are correctly installed.2. Verify proper memory module type.3. Remove and replace the identified faulty memory module(s).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.	<ol style="list-style-type: none">1. Reconnect keyboard with computer turned off.2. Check connector for bent or missing pins.3. Ensure that none of the keys are depressed.4. Replace keyboard.
510-Flash Screen Image Corrupted	Flash Screen image has errors.	Reflash the system ROM with the latest BIOS image.

Table 9-4 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.	<ol style="list-style-type: none">1. Reseat chassis, rear chassis, or front chassis fan.2. Reseat fan cable.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.	<ol style="list-style-type: none">1. Reseat front chassis fan.2. Reseat fan cable.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.)	<ol style="list-style-type: none">1. Determine if hard drive is giving correct error message. Run the Drive Protection System test using F2 Diagnostics.2. Apply hard drive firmware patch if applicable. (Available at http://www.hp.com/support.)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.	<ol style="list-style-type: none">1. Reconnect keyboard with computer turned off.2. Check connector for bent or missing pins.3. Ensure that none of the keys are depressed.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 9-5 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: Power connector, keyboard, mouse, network RJ-45 connector, display
The thin client unit does not power on.	<ol style="list-style-type: none">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.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.	<ol style="list-style-type: none">1. Verify that the network is operating and the network cable is working properly.2. Verify that the unit is communicating with the server by having the System Administrator ping the unit from the server:<ul style="list-style-type: none">– If the thin client pings back, then the signal was accepted and the unit is working. This indicates a configuration issue.– 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.)	<ol style="list-style-type: none">1. Verify that the network is not down.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.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.4. If network LEDs still do not light and you know the power supply is good, then re-image the unit.5. If network LEDs still do not light, run the IP configuration procedure.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.	<ol style="list-style-type: none">1. Verify that the monitor brightness is set to a readable level.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.3. Re-image the thin client unit and power on the monitor again.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 9-6 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.

10 HP ThinUpdate

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. 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.

- 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 a Windows operating system image (.ibr 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:
 - ThinPro: 8 GB
 - 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.

11 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.

12 Specifications

Computer specifications

	Metric	U.S.
Dimensions		
Depth	239.0 mm	9.41 in
Width	343.2 mm	13.51 in
Height	20.3 mm	0.80 in
Weight		
Includes 1 DIMM	1.64 kg	3.61 lbs
Input power		
Operating voltage	19.0 V dc @ 4.74 A – 90 W or 18.5 V dc @ 3.5 A - 65 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
Shock		
Operating	40 g, 2 ms, half-sine	
Nonoperating	200 g, 2 ms, half-sine	
Random vibration		
Operating	0.75 g zero-to-peak, 10 Hz to 500 Hz, 0.25 oct/min sweep rate	
Nonoperating	1.50 g zero-to-peak, 10 Hz to 500 Hz, 0.5 oct/min sweep rate	
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	HD: 1366x768	
Surface treatment	Anti-glare	
Panel Width	3.0 mm	
Brightness	220 nits	
Viewing angle	SVA	
Backlight	LED	
Aspect ratio	16:9	

Solid-state drive specifications

	128-GB*
Height	1.35 mm
Weight	< 10 g
Form factor	M.2 2280-D2-B-M
Transfer rate	up to 540 MB/sec
Interface type	SATA-3
Ready time, maximum (to not busy)	1.0 ms
Access times, logical	0.1 ms
Total logical sectors	234,441,648
Operating temperature	0°C to 70°C (32°F to 158°F)

*1 GB = 1 billion bytes when referring to 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.

13 Statement of memory volatility

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

HP Business PC 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 PC 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 PC, 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.

 **IMPORTANT:** If the **Main** menu displays **Restore Defaults** instead of **Apply Factory Defaults and Exit**, go to [Legacy BIOS Steps on page 87](#).

 **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.

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

- a. Select **Main**, select **Restore Defaults**, and then select **Yes** to load defaults.
 - b. Select the **Security** menu, select **Restore Security Level Defaults**, and then select **Yes** to restore security level defaults.
 - c. 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.
 - d. If a DriveLock password is set, select the **Security** menu, and scroll down to **Hard Drive Tools** under the **Utilities** menu. Select **Hard Drive Tools**, select **DriveLock**, then uncheck the checkbox for **DriveLock password on restart**. Select **OK** to proceed.
 - e. If an Automatic DriveLock password is set, select the **Security** menu, scroll down to **Hard Drive Tools** under the **Utilities** menu. Select **Hard Drive Tools**, scroll down to **Automatic DriveLock**, then select the desired hard drive and disable protection. At the automatic drive lock warning screen, select **Yes** to continue. Repeat this procedure if more than one hard drive has an Automatic DriveLock password.
 - f. Select the **Main** menu, and then select **Reset BIOS Security to factory default**. Click **Yes** at the warning message.
 - g. Select the **Main** menu, select **Save Changes and Exit**, select **Yes** to save changes and exit, and then select **Shutdown**.
 - h. 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.
 - i. 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 Tools**.
 - 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.
- or –
- Clear the contents of the drive by using the following Disk Sanitizer command steps:

 **IMPORTANT:** If you clear data using Disk Sanitizer, it cannot be recovered.

 **NOTE:** The amount of time it takes for Disk Sanitizer to run can take several hours. Plug the computer into an AC outlet before starting.

- 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 Tools**.
- d. Under **Utilities**, select **Disk Sanitizer**, 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)	2 MBytes	No	Yes	Provides protected backup of critical System BIOS code, EC firmware, and critical PC configuration data for select platforms that support HP Sure Start. For more information, see Using HP Sure Start (select models only) on page 92 .	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	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 PC. The specific write-protection method varies by memory vendor.

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?
	(not customer accessible)					
System BIOS	4 MBytes to 5 MBytes	Yes	Yes	Stores system BIOS code and PC 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 PC non-functional. 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 product , and then follow the on-screen instructions.
Intel Management Engine Firmware (present in only specific ZBook and EliteBook 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 5 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	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.
Web camera	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

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?
Fingerprint reader	512 KByte flash	Yes	Yes	Stores fingerprint templates.	Fingerprint reader memory is programmed by user enrollment in HP ProtectTools Security Manager.	upgrade is necessary to address a unique issue. 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.

- 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.
- Select **Main**, and then select **Restore defaults**.
- Follow the on-screen instructions.
- 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 PC. Third-party tools do exist that can write to the EEPROM when the memory module is not installed in a PC. 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 PC 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 BIOS Security to Factory Default**.
- 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.

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 and regions

The following requirements are applicable to all countries and regions:

- The length of the power cord set must be at least **1.5 m** (5.0 ft) and no more than **2.0 m** (6.5 ft).
- All power cord sets must be approved by an acceptable accredited agency responsible for evaluation in the country or region where the power cord set will be used.
- The power cord sets must have a minimum current capacity of 10 A and a nominal voltage rating of 125 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
Argentina	IRAM	1
Australia	SAA	1
Austria	OVE	1
Belgium	CEBEC	1
Brazil	ABNT	1
Canada	CSA	2
Chile	IMQ	1
Denmark	DEMKO	1
Finland	FIMKO	1
France	UTE	1
Germany	VDE	1
India	ISI	1
Israel	SII	1
Italy	IMQ	1

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

1. The flexible cord must be Type H05VV-F, 3-conductor, 0.75mm² conductor size. Power cord set fittings (appliance coupler and wall plug) must bear the certification mark of the agency responsible for evaluation in the country or region where it will be used.
2. The flexible cord must be Type SVT/SJT or equivalent, No. 18 AWG, 3-conductor. The wall plug must be a two-pole grounding type with a NEMA 5-15P (15 A, 125 V ac) or NEMA 6-15P (15 A, 250 V ac) configuration. CSA or C-UL mark. UL file number must be on each element.
3. The appliance coupler, flexible cord, and wall plug must bear a "T" mark and registration number in accordance with the Japanese Dentori Law. The flexible cord must be Type VCTF, 3-conductor, 0.75mm² or 1.25mm² conductor size. The wall plug must be a two-pole grounding type with a Japanese Industrial Standard C8303 (7 A, 125 V ac) configuration.
4. The flexible cord must be Type RVV, 3-conductor, 0.75mm² conductor size. Power cord set fittings (appliance coupler and wall plug) must bear the CCC certification mark.
5. The flexible cord must be Type H05VV-F 3X0.75mm² conductor size. KTL logo and individual approval number must be on each element. Corset approval number and logo must be printed on a flag label.
6. The flexible cord must be Type HVCTF 3X1.25mm² conductor size. Power cord set fittings (appliance coupler, cable, and wall plug) must bear the BSMI certification mark.
7. For 127 V ac, the flexible cord must be Type SVT or SJT 3 x 18 AWG, with plug NEMA 5-15P (15 A, 125 V ac), with UL and CSA or C-UL marks. For 240 V ac, the flexible cord must be Type H05VV-F 3X0.75/1.00mm² conductor size, with plug BS 1363/A with BSI or ASTA marks.

15 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

- A**
 - AC adapter, spare part numbers 19
 - antennas
 - disconnecting 29
 - audible codes 75
 - audio, product description 1
 - audio-out (headphone)/audio-in (microphone) combo jack, identifying 5
- B**
 - base enclosure, spare part number 15
 - basic troubleshooting 79
 - battery
 - removing 50
 - spare part number 15, 50
 - beep codes 75
 - BIOS
 - determining version 68
 - downloading an update 69
 - updating 68
 - Bluetooth card
 - spare part number 29
 - Bluetooth label 13
 - bottom 13
 - buttons
 - left TouchPad 7
 - power 9
 - right TouchPad 7
- C**
 - Cable Kit
 - contents 16
 - spare part number 16
 - cables, service considerations 21
 - caps lock light, identifying 8
 - components
 - bottom 12
 - display 6
 - left side 5
 - right side 4
 - top 7
- Computer Setup**
 - navigating and selecting 67
 - restoring factory settings 67
- computer specifications 84
- connector, power 4
- connectors, service considerations 21
- D**
 - diagnostics and troubleshooting 73
 - disabling/enabling Wake-on LAN (WOL) 74
 - diskless troubleshooting 80
 - display assembly
 - removal 35, 60
 - spare part numbers 17, 60
 - display bezel
 - removing 36
 - spare part numbers 17
 - Display Hinge Kit
 - spare part numbers 18
 - display panel
 - product description 1
 - removing 37
 - display rear cover
 - spare part number 18
 - display specifications 85
 - drive light, identifying 5
- E**
 - electrostatic discharge 22
 - error
 - codes 75
 - messages 77
 - esc key, identifying 10
 - Ethernet, product description 1
 - external media cards, product description 1
 - external monitor port 4
- F**
 - fan
 - removing 52
 - spare part number 15
 - flashing LEDs 75
 - fn key, identifying 10
 - function board
 - removal 44
 - spare part number 15, 44
- G**
 - graphics, product description 1
 - grounding equipment and methods 24
- H**
 - HDMI port, identifying 4
 - heat sink
 - removal 58
 - spare part number 15, 58
 - hinge cover
 - spare part number 17
 - hinges
 - removing 37
 - hot keys
 - microphone mute 11
 - using 11
 - HP PC Hardware Diagnostics (UEFI) using 71
 - HP Sure Start 92
- I**
 - integrated webcam light, identifying 6
 - internal microphones, identifying 6
- J**
 - jacks
 - audio-out (headphone)/audio-in (microphone) combo 5
 - network 4
 - RJ-45 (network) 4
- K**
 - keyboard
 - product description 2
 - removal 32
 - spare part numbers 15, 32
 - keypad
 - Windows application key 10

- keys
 - esc 10
 - fn 10
 - Windows key 10
- L**
- labels
 - Bluetooth 13
 - regulatory 13
 - serial number 13
 - service 13
 - wireless certification 13
 - WLAN 13
- LEDs 73
 - blinking power 75
- legacy support, USB 67
- lights 5
 - caps lock 8
 - microphone mute 8
 - num lock 8
 - power 8
 - RJ-45 (network) 4
 - webcam 6
 - wireless 8
- M**
- memory
 - nonvolatile 86
 - volatile 86
- memory card reader, identifying 5
- memory module
 - identifying 12
 - product description 1
 - removal 27
 - spare part numbers 15, 27
- microphone (audio-in) jack
 - product description 1
- microphone mute key, identifying 11
- microphone mute light, identifying 8
- mini card
 - product description 1
- model name 1
- N**
- network jack, identifying 4
- nonvolatile memory 86
- num lock light 8
- numeric error codes 77
- O**
- operating system, product
 - description 2
- P**
- packing guidelines 23
- plastic parts 21
- Plastics Kit
 - contents 18
 - spare part number 18
- pointing device, product
 - description 2
- ports
 - external monitor 4
 - HDMI 4
 - product description 1
 - USB Type-C charging 4
- power and IDE flash activity LEDs 73
- power button board
 - removal 42
 - spare part number 15, 42
- power button, identifying 9
- power cable
 - removal 66
 - spare part number 15, 66
- power connector, identifying 4
- power cord
 - set requirements 93
 - spare part numbers 19, 20
- power lights 8
- power requirements, product
 - description 2
- power-on diagnostic tests 74
- power-on sequence 74
- processor
 - product description 1
- product description
 - audio 1
 - display panel 1
 - Ethernet 1
 - external media cards 1
 - graphics 1
 - keyboard 2
 - memory module 1
 - microphone 1
 - mini card 1
 - operating system 2
 - pointing devices 2
 - ports 1
 - power requirements 2
 - processors 1
 - product name 1
 - security 2
 - serviceability 2
 - webcam 1
 - wireless 1
- product name 1
- product name and number,
 - computer 13
- R**
- regulatory information
 - regulatory label 13
 - wireless certification labels 13
- removal/replacement
 - preliminaries 21
 - procedures, Authorized Service Provider 35
 - procedures, Customer Self-Repair 25
- removing personal data from volatile
 - system memory 86
- RJ-45 (network) jack, identifying 4
- RJ-45 (network) lights, identifying 4
- RTC battery
 - removal 57
 - spare part number 57
- S**
- Screw Kit, spare part number 20
- security cable slot, identifying 5
- security, product description 2
- serial number 13
- service considerations 21
- service door
 - removing 26
 - spare part number 26
- service labels, locating 13
- serviceability, product description 2
- setup utility
 - navigating and selecting 67
 - restoring factory settings 67
- slots
 - security cable 5
- solid-state drive
 - removal 31
 - spare part numbers 15, 31
 - specifications 85

- speaker assembly
 - removal 46
 - spare part number 15, 46
- speakers, identifying 9
- specifications
 - computer 84
 - display 85
 - solid-state drive 85
- static-shielding materials 24
- Sure Start
 - using 70
- system board
 - removal 54
 - spare part numbers 15, 54
- system memory, removing personal data from volatile 86

T

- thermal material, replacement 59
- tools required 21
- top cover
 - removal 39
 - spare part number 15, 39
- TouchPad
 - buttons 7
- TouchPad assembly
 - removal 47
 - spare part number 47
- TouchPad zone
 - identifying 7
- TPM settings 70
- transporting guidelines 23
- traveling with the computer 13
- troubleshooting 79

U

- USB 3.0 port 4
- USB legacy support 67
- USB ports, identifying 4
- USB Type-C charging port, identifying 4
- USB/audio board
 - removal 49
 - spare part number 15, 49

V

- vents, identifying 5, 12

W

- Wake-on LAN (WOL) 74

- webcam 6
 - product description 1
- webcam light, identifying 6
- webcam module
 - removal 63
 - spare part number 17
- webcam, identifying 6
- webcam/microphone cable
 - removing 37
- webcam/microphone module
 - removing 36
- Windows application key, identifying 10
- Windows key, identifying 10
- wireless antennas
 - disconnecting 29
- wireless certification label 13
- wireless light 8
- wireless, product description 1
- WLAN antennas, identifying 6
- WLAN device 13
- WLAN label 13
- WLAN/Bluetooth combo card
 - removal 29
 - spare part number 15, 29
- workstation guidelines 23