



Maintenance and Service Guide

HP mt22 Mobile Thin Client

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First Edition: February 2020

Document Part Number: L94535-001

Product notice

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

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

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

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 applicable safety standards.

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1 Product description

Table 1-1 Product components and their descriptions

Category	Description
Product Name	HP mt22 Mobile Thin Client
Processors	10th generation, Intel® processor (15 W) Celeron® 5205U, 1.9 GHz, dual core turbo, 2 MB L3 cache; Intel UHD Graphics
Graphics	Integrated Intel UMA Graphics Intel UHD Graphics Supports 3 independent displays when on the HP USB-C Dock G4; Max resolution = 4K @ 30 Hz (DisplayPort 1) or 4K @ 30 Hz (DisplayPort 2) Supports 3 independent displays when on the HP Thunderbolt™ Dock 120 W (using USB-C); Max resolution = 4K @ 30 Hz (DisplayPort 1) or 4K @ 30 Hz (DisplayPort 2)
Panel	35.6 cm (14.0 in), LED backlight, antiglare, nontouch High definition (HD) (1366 × 768), SVA, 45% CG, eDP, slim, 220 nits HD, SVA, 45% CG, eDP, slim, 220 nits, with HD camera Full high definition (FHD) (1920 × 1080), UWVA, 72% CG, eDP + PSR, flat, 1000 nits, privacy 35.6 cm (14.0 in), LED backlight, antiglare, touch screen FHD, UWVA, 45% CG, eDP, slim, 250 nits, with HD camera, Touch-on Panel (TOP)
Memory	Two customer-accessible memory module slots supporting up to 8 GB of RAM Supports dual-channel memory PC4-2400, DDR4 SODIMMs Supports the following configurations: <ul style="list-style-type: none">• 8192 MB (4096 × 2)• 4096 MB (4096 × 1)
Primary M.2 storage	Supports the following M.2 2280 solid-state drive: <ul style="list-style-type: none">• 128 GB, SATA, TLC
Audio/Visual	Audio controls Integrated dual-array microphone Integrated mono microphone Integrated camera (720p HD) Camera privacy cover Supports WDR (Wide Dynamic Range) Audio-out (headphone)/audio-in (microphone) combo jack

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

Category	Description
RJ-45 (network)	<p>Realtek RTL8111HSH-CG (non-DASH)</p> <p>S3/S5 wake on LAN with embedded NIC</p> <p>The following support S3/S5 wake on LAN (via out of band): HP USB-C Universal Dock, HP USB-C Dock G4, HP Thunderbolt Dock 120 W G2, HP USB-C Mini Dock, HP USB-C/A Universal Dock G2, and HP USB-C Dock G5.</p> <p>The following support S0/S3/S5 MAPT (via out of band): HP USB-C Universal Dock, HP USB-C Dock G4, HP Thunderbolt Dock 120 W G2, HP USB-C Mini Dock, HP USB-C/A Universal Dock G2, and HP USB-C Dock G5.</p>
Wireless	<p>Wireless Personal Area Network (PAN) Bluetooth</p> <p>Bluetooth® 5.0 supported using combo card</p> <p>Wireless Local Area Network (WLAN) (select products only)</p> <p>Integrated WLAN options with dual antennas M.2 2230 socket (MIPI/BRI):</p> <ul style="list-style-type: none"> Intel dual-band wireless-AC 9560 802.11ac 2 × 2 Wi-Fi + Bluetooth 5.0 combo adapter (non-vPro) <p>WLAN antennas configured at top of panel</p> <p>Supports HP LAN-Wireless Protection (WLAN/LAN switching)</p> <p>Compatible with Wi-Fi CERTIFIED Miracast™ devices</p> <p>Supports WoWLAN S3 AC Mode</p> <p>Supports Turbo Lite Wi-Fi</p> <p>Bluetooth S3 Wake-up</p>
Ports (Input/output)	<p>Hot plug/unplug and autodetect</p> <p>HDMI 1.4</p> <p>One USB 2.0 + powered port (left)</p> <p>Two USB 3.0 ports (right)</p> <p>One USB 3.1 Gen 1 Type-C port (PD + DP) (right)</p> <p>Audio-out (headphone)/Audio-in (microphone) combo jack</p> <p>RJ-45 (network)</p> <p>Multi-pin AC port</p>
Sensors	<p>Accelerometer</p> <p>Hall sensor</p>
Docking	<p>HP Thunderbolt Dock 120 W G2</p> <p>HP USB-C Dock G4</p> <p>HP USB-C Universal Dock</p> <p>HP USB-C Mini Dock</p> <p>HP TB Dock G2 Audio Module</p> <p>HP USB-C/A Universal Dock G2</p> <p>HP USB-C Dock G5</p>

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

Category	Description	
Keyboard/pointing devices	Keyboard	
	Backlit and nonbacklit, spill-resistant	
	Touchpad requirements	
	Precision Touchpad Default Gestures support	
	FW PTP No Hybrid Mode Support	
Power requirements	Battery	
	3 cell, 45 Whr, lithium polymer, soft pack, HP Long Life HP Fast Charge Technology	
	AC adapters	
	45 W, straight, USB Type-C AC adapter, nPFC, 1.8 m (5.9 ft)	
	45 W, right angle, 4.5 mm	
	45 W, right angle, 4.5 mm, for use in Argentina	
	45 W, right angle, 4.5 mm, 2 prong, for use in Japan	
	65 W straight USB Type-C AC adapter	
	65 W, right angle, 4.5 mm	
	65 W, right angle, 4.5 mm, for use in Argentina	
	65 W Smart AC adapter, right angle, 4.5 mm - EM	
	Power cords	
	3-wire plug (C5), 1.8 m (5.9 ft), conventional	
	3-wire plug (C5), 1.0 m (3.3 ft), conventional	
	2-wire plug (C7), 1.0 m (3.3 ft), conventional,	
	Duckhead power cord (C5NS), 1.8 m (5.9 ft)	
	Duckhead power cord (C5NS), 1.0 m (3.3 ft)	
	Duckhead (C5NS)	
	Security	Security lock
		Integrated fingerprint sensor (select models only)
TPM 2.0 (Nuvoton; soldered down)		
Hardware enforced firmware protection: HP SureStart 2019		
Preboot authentication (password)		
Operating system	Operating system version	
	HP ThinPro	
	HP Smart Zero Core	

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

Category	Description
	Windows® 10 Internet of Things (IoT) 64 Enterprise 2019 LTSC Entry for Thin Clients
Serviceability	User replaceable parts
	AC adapter

2 Components

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

Right

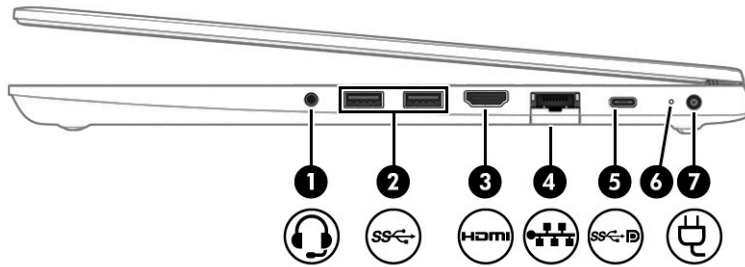


Table 2-1 Right-side components and their descriptions







Component	Description
(1) 	<p>Audio-out (headphone)/Audio-in (microphone) combo jack</p> <p>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 standalone microphones.</p> <p>WARNING! To reduce the risk of personal injury, adjust the volume before putting on headphones, earbuds, or a headset. For additional safety information, see the <i>Regulatory, Safety, and Environmental Notices</i>.</p> <p>To access this guide:</p> <ul style="list-style-type: none"> ▲ Type HP Documentation in the taskbar search box, and then select HP Documentation. <p>NOTE: When a device is connected to the jack, the computer speakers are disabled.</p>
(2) 	<p>USB SuperSpeed port (1 or 2, depending on model)</p> <p>Connects a USB device, such as a cell phone, camera, activity tracker, or smartwatch, and provides high-speed data transfer.</p>
(3) 	<p>HDMI port</p> <p>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.</p>
(4) 	<p>RJ-45 (network) jack/status lights</p> <p>Connects a network cable.</p> <ul style="list-style-type: none"> • Green (left): The network is connected. • Amber (right): Activity is occurring on the network.
(5) 	<p>USB Type-C power connector port, SuperSpeed port, and DisplayPort™ connector</p> <p>Connects an AC adapter that has a USB Type-C connector, supplying power to the computer and, if needed, charging the computer battery.</p> <p>– and –</p>

Table 2-1 Right-side components and their descriptions (continued)

Component	Description
	<p>Connects a USB device that has a Type-C connector, such as a cell phone, camera, activity tracker, or smartwatch, and provides high-speed data transfer.</p> <p>– and –</p> <p>Connects a display device that has a USB Type-C connector, providing DisplayPort output.</p> <p>NOTE: Cables, adapters, or both (purchased separately) might be required.</p>
<p>(6) Battery light</p>	<p>When AC power is connected:</p> <ul style="list-style-type: none">• White: The battery charge is greater than 90%.• Amber: The battery charge is from 0 to 90%.• Off: The battery is not charging. <p>When AC power is disconnected (battery not charging):</p> <ul style="list-style-type: none">• Blinking amber: The battery has reached a low battery level. When the battery has reached a critical battery level, the battery light begins blinking rapidly.• Off: The battery is not charging.
<p>(7)  Power connector</p>	<p>Connects an AC adapter.</p>

Left

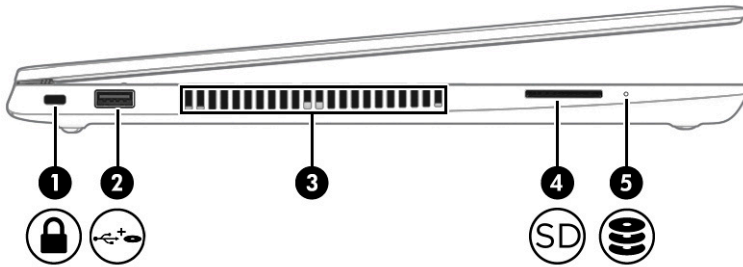






Table 2-2 Left-side components and their descriptions

Component	Description
(1)  Security cable slot	Attaches an optional security cable to the computer. NOTE: The security cable is designed to act as a deterrent, but it may not prevent the computer from being mishandled or stolen.
(2)  USB powered port	Connects and supplies power to a USB device, such as a cell phone, camera, activity tracker, optical drive, or smartwatch, and provides data transfer.
(3) 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.
(4)  Memory card reader	Reads optional memory cards that store, manage, share, or access information. To insert a card: <ol style="list-style-type: none"> 1. Hold the card label-side up, with the connectors facing the computer. 2. Insert the card into the memory card reader, and then press in on the card until it is firmly seated. To remove a card: <ul style="list-style-type: none"> ▲ Press in on the card, and then remove it from the memory card reader.
(5)  Drive light	<ul style="list-style-type: none"> ● Blinking white: The hard drive is being accessed.

Display

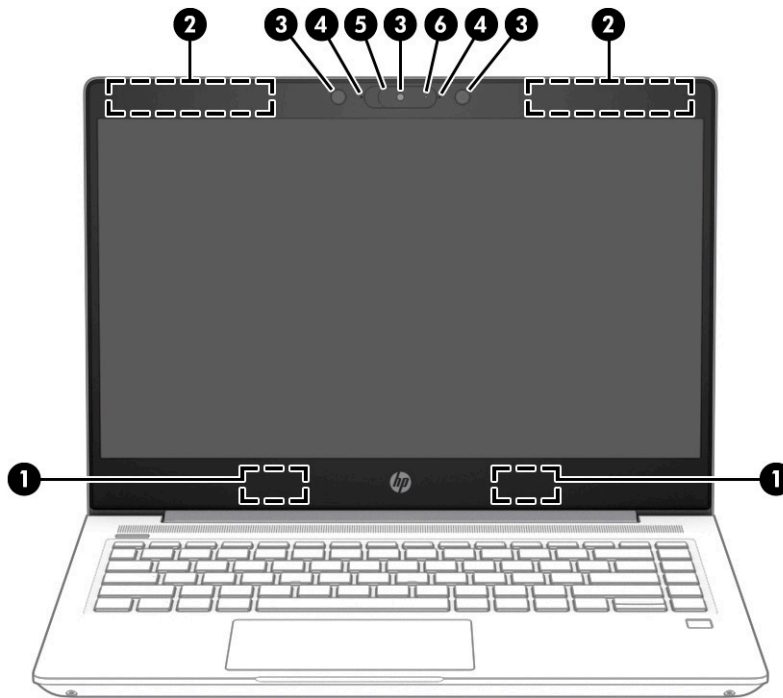


Table 2-3 Display components and their descriptions

Component	Description
(1) WLAN antennas* (select products only)	Send and receive wireless signals to communicate with wireless local area networks (WLANs).
(2) WWAN antennas* (select products only)	Send and receive wireless signals to communicate with wireless wide area networks (WWANs).
(3) Internal microphone(s) (1 or 2, depending on model)	Record(s) sound.
(4) Camera(s) (select products only)	Allow(s) you to video chat, record video, and record still images. Some cameras also allow a facial recognition logon to Windows, instead of a password logon. NOTE: Camera functions vary depending on the camera hardware and software installed on your product.
(5) Camera privacy cover (select products only)	By default, the camera lens is uncovered, but you can slide the camera privacy cover to block the camera's view. To use the camera, slide the camera privacy cover in the opposite direction to reveal the lens. NOTE: If you have both front-facing and rear-facing cameras, when one camera lens is revealed and ready to use, the other is concealed.
(6) Camera light (select products only)	On: The camera is in use.

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

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

To access this guide, type `HP Documentation` in the taskbar search box, and then select **HP Documentation**.

Keyboard area

Touchpad

Touchpad settings

To adjust touchpad settings and gestures, or to turn off the touchpad:

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

To turn on the touchpad:

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

– or –

- ▲ Press the `Tab` key repeatedly until the pointer rests on the **Touchpad** button. Then press the `spacebar` to select the button.

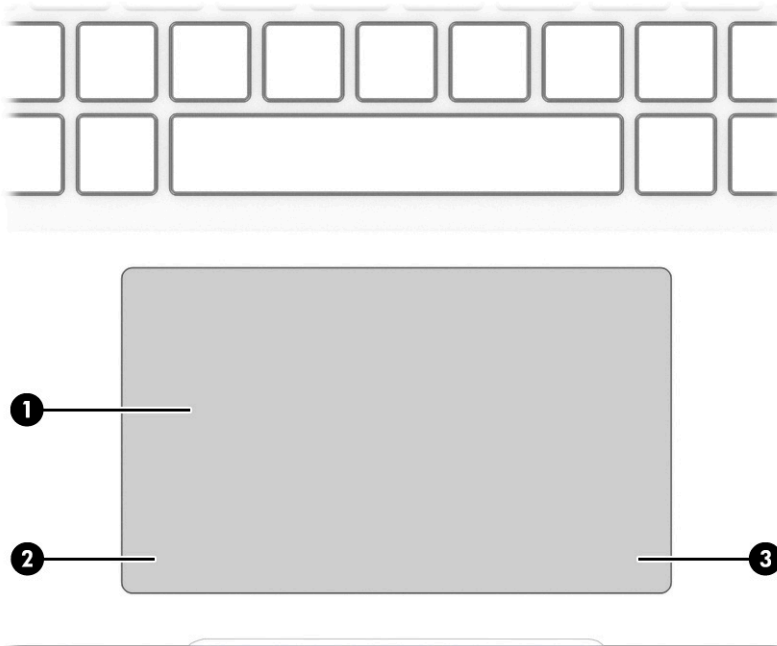


Table 2-4 Touchpad components and their descriptions

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

Lights

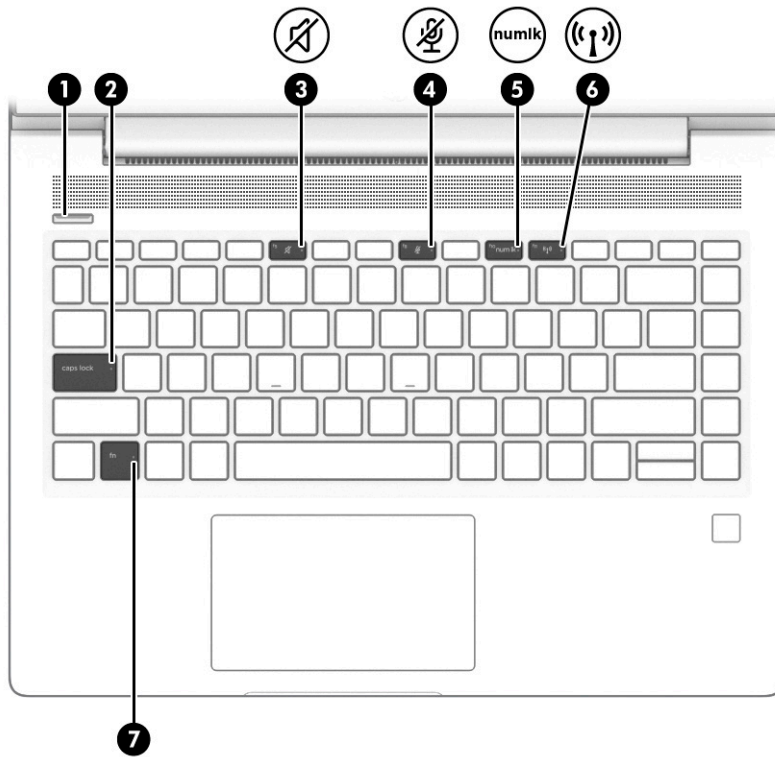





Table 2-5 Lights and their descriptions

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.
(2) Caps lock light	On: Caps lock is on, which switches the key input to all capital letters.
(3)  Mute light	<ul style="list-style-type: none"> On: Computer sound is off. Off: Computer sound is on.
(4)  Microphone mute light	<ul style="list-style-type: none"> On: Microphone is off. Off: Microphone is on.
(5) numlk Num lk light	On: Num lock is on.
(6)  Wireless light	<p>On: An integrated wireless device, such as a wireless local area network (WLAN) device and/or a Bluetooth® device, is on.</p> <p>NOTE: On some models, the wireless light is amber when all wireless devices are off.</p>
(7) Fn lock light	On: The fn key is locked. For more information, see Special keys on page 13 (select products only).

Button, vent, speakers, and fingerprint reader

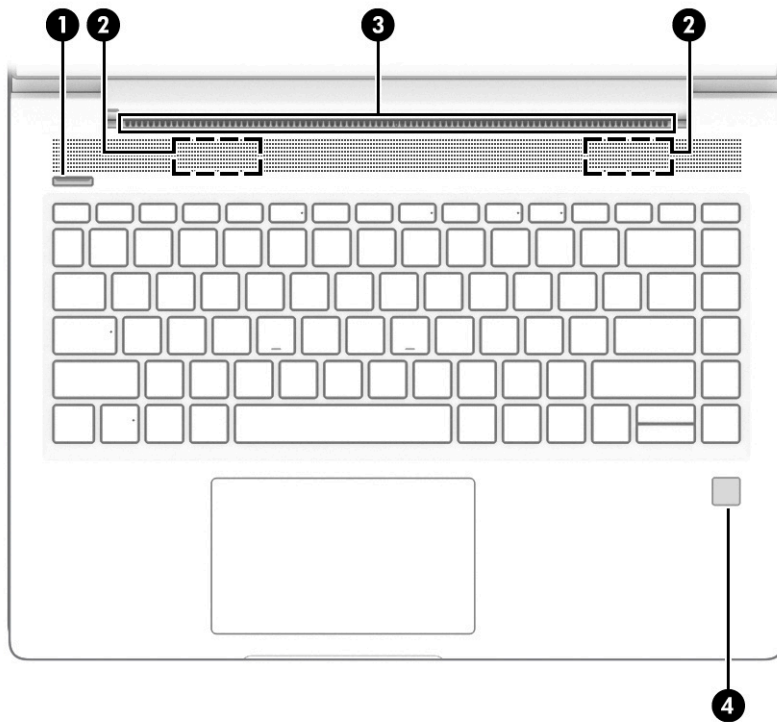


Table 2-6 Button, vent, speakers, fingerprint reader and their descriptions


Component	Description
(1) Power button	<ul style="list-style-type: none"> • When the computer is off, press the button to turn on the computer. • When the computer is on, press the button briefly to initiate Sleep. • When the computer is in the Sleep state, press the button briefly to exit Sleep (select products only). <p>IMPORTANT: 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 10 seconds to turn off the computer.</p> <p>To learn more about your power settings, see your power options.</p> <p>▲ Right-click the Power meter icon  and then select Power Options.</p>
(2) Speakers (2)	Produce sound.
(3) Vent	Enables airflow to cool internal components.

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

Component	Description
(4) Fingerprint reader (select products only)	<p>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.</p> <p>Allows a fingerprint logon to Windows, instead of a password logon.</p> <ul style="list-style-type: none">▲ Touch your finger to the fingerprint reader. <p>IMPORTANT: To prevent fingerprint logon issues, be sure that when you register your fingerprint, that all sides of your finger are registered by the fingerprint reader.</p> <p>IMPORTANT: To verify that your computer has a fingerprint reader, type <i>Sign-in options</i> in the task bar search box and follow the on-screen instructions. If Fingerprint Reader is listed as an option, then your computer includes a fingerprint reader.</p>

Special keys

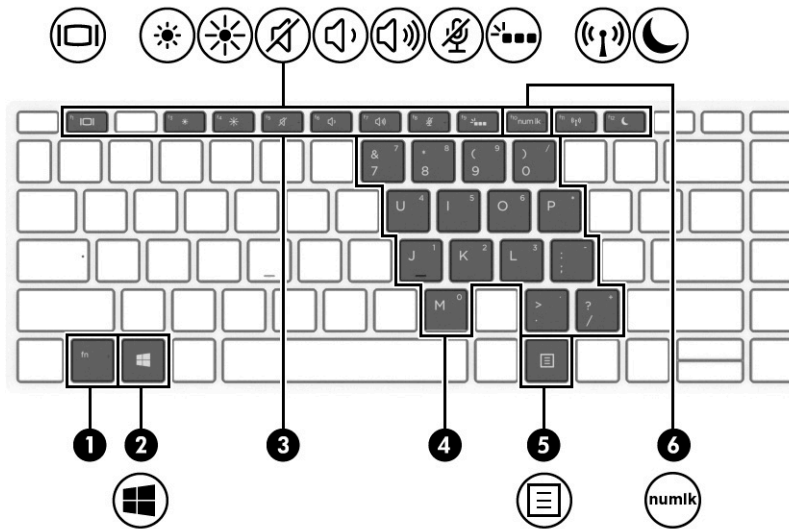




Table 2-7 Special keys and their descriptions

Component	Description
(1) fn key	Executes frequently used system functions when pressed in combination with another key. Such key combinations are called <i>hot keys</i> . See Hot keys (select products only) on page 14 .
(2)  Windows key	Opens the Start menu. NOTE: The Windows key is not functional on HP ThinPro or HP Smart Zero operating systems.
(3) Action keys	Execute frequently used system functions.
(4) Embedded numeric keypad	A numeric keypad superimposed over the keyboard alphabet keys. When num lk is pressed, the keypad can be used like an external numeric keypad. Each key on the keypad performs the function indicated by the icon in the upper-right corner of the key. NOTE: If the keypad function is active when the computer is turned off, that function is reinstated when the computer is turned back on.
(5)  Windows application key	Displays options for a selected object. NOTE: The Windows application key is not functional on HP ThinPro or HP Smart Zero operating systems.
(6) num lk key	Turns the embedded numeric keypad on and off.

Hot keys (select products only)

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

To use a hot key:

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

Table 2-8 Hot keys and their descriptions

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

Bottom

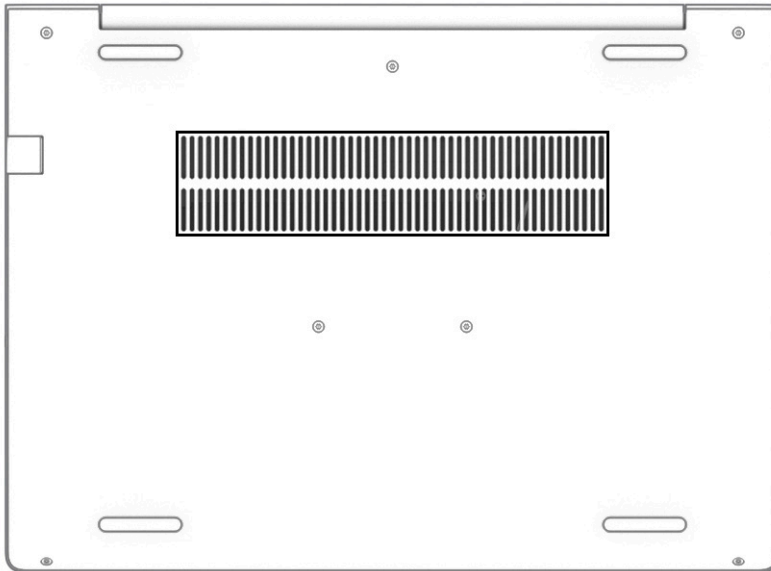


Table 2-9 Bottom component and its description

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

Labels

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

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

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

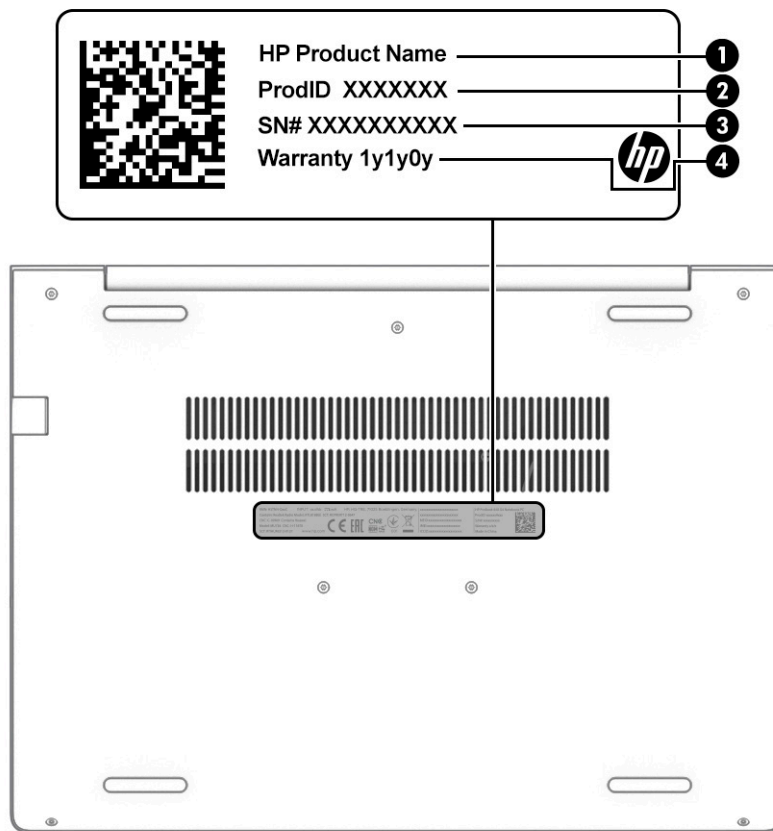


Table 2-10 Service label components


Component
(1) HP product name
(2) Product ID
(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 about supported parts for your computer, go to <http://partsurfer.hp.com>, select your country or region, and then follow the on-screen instructions.

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

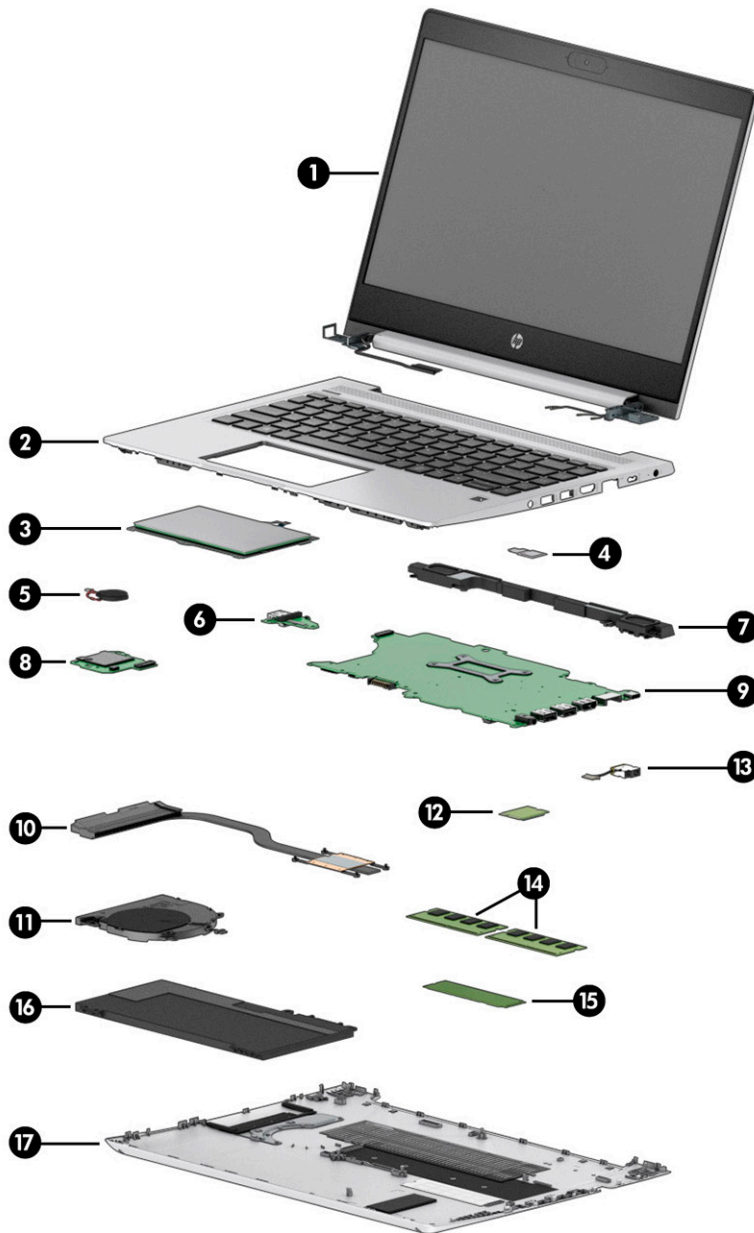


Table 3-1 Computer major components and their descriptions

Item	Description	Spare part number
(1)	Display panel assembly NOTE: Display panels are only available as spare parts at a subcomponent level.	not available as a spare part
(2)	Top cover/keyboard (includes cable) NOTE: For a detailed list of keyboard country codes, see Keyboard/top cover on page 59 .	
	With backlight	L65224-001
	No backlight	L65225-001
(3)	Touchpad (includes cable)	L77252-001
(4)	Fingerprint sensor assembly NOTE: The fingerprint sensor cable is available in the Cable Kit as spare part number L77263-001.	L77229-001
(5)	Real-time clock (RTC) battery	L02772-001
(6)	USB board (includes cable) NOTE: The USB board cable is available in the Cable Kit as spare part number L77263-001.	L44578-001
(7)	Speaker assembly	L44554-001
(8)	Card reader board (includes cable) NOTE: The card reader board cable is also available in the Cable Kit as spare part number L77263-001.	L44579-001
(9)	System board (includes integrated Intel Celeron 5205U processor and replacement thermal material)	
	Non-Windows operating system	L96032-001
	Windows 10 IoT operating system	L96032-301
(10)	Heat sink (includes replacement thermal material)	L44552-001
(11)	Fan	L44556-001
(12)	WLAN module	
	Intel Dual Band Wireless-AC 9560 802.11ac 2 × 2 Wi-Fi + Bluetooth 5.0 Combo Adaptor (non-vPro)	L22634-001
(13)	Power connector cable	L01048-001
(14)	Memory module (DDR4-2400)	
	4 GB	L10598-852
(15)	M.2 solid-state drive	
	128 GB, SATA-3, TLC	L85346-002
(16)	Battery (3 cell, 45 Whr)	L32656-005
(17)	Bottom cover	L44558-001

Display components

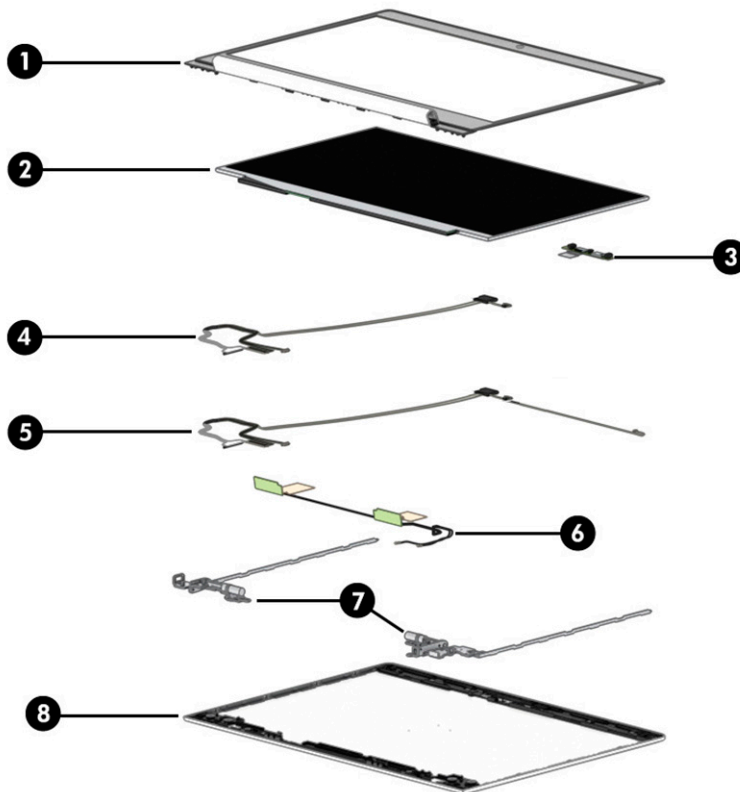


Table 3-2 Display components and their descriptions

Item	Description	Spare part number
(1)	Display bezel	
	For use in models without a camera	L78090-001
	For use in models with an HD camera	L78091-001
(2)	Display panel (raw) (includes bezel adhesive and display enclosure adhesive)	
	HD panel	L97217-001
	FHD panel, touch-on panel (TOP)	L97216-001
	Display/camera cable assembly (includes bezel adhesive and display enclosure adhesive)	
(3)	Camera module, HD (includes bezel adhesive and display enclosure adhesive)	L81889-001
	Microphone board (not illustrated)	L44541-001
(4)	Nontouch models	L78088-001
(5)	Touch models	L78089-001
(6)	WLAN antennas (includes bezel adhesive and display enclosure adhesive)	L78070-001
(7)	Hinge Kit (left and right hinges; includes bezel adhesive and display enclosure adhesive)	L78093-001
(8)	Display rear cover (includes wireless antennas and bezel adhesive)	L78072-001
	Camera privacy cover (not illustrated)	L77237-001

Cable Kit

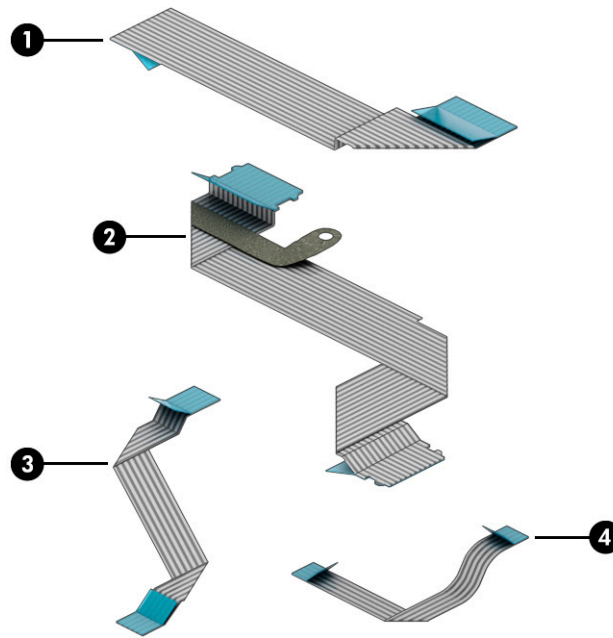


Table 3-3 Cable Kit components and their descriptions

Item	Description	Spare part number
	Cable Kit , includes the following parts:	L77263-001
(1)	USB board cable	
(2)	Card reader board cable	
(3)	Touchpad cable	
(4)	Fingerprint sensor cable	

Bracket Kit

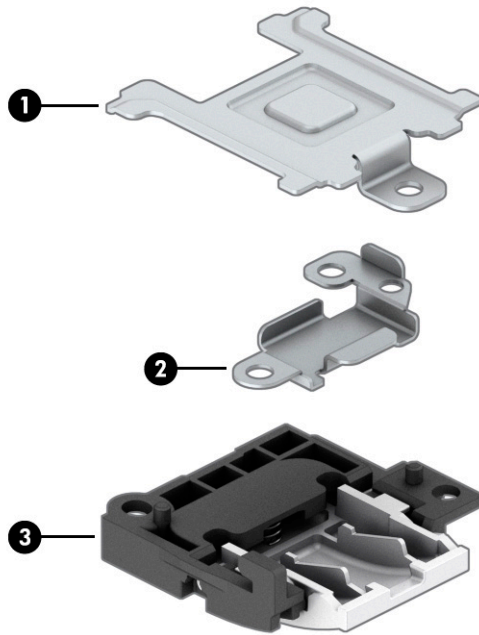


Table 3-4 Bracket Kit components and their descriptions

Item	Description	Spare part number
	Bracket Kit , includes the following parts:	L77264-001
(1)	Fingerprint sensor bracket	
(2)	USB Type-C port bracket	
(3)	RJ-45 (network) jack bracket	
	Fingerprint sensor insert (for use in models without a fingerprint sensor; not illustrated)	

Miscellaneous parts

Table 3-5 Miscellaneous parts and their descriptions

Description	Spare part number
AC adapters	
65 W Smart AC power adapter, 4.5 mm barrel connector, S-3P, EM	913691-850
65 W Smart AC power adapter, 4.5 mm barrel connector, S-3P, nPFC	710412-001
65 W, USB Type-C, wall mount, nPFC, 1.8 m (5.9 ft)	L32392-001
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, 1.8 m (5.9 ft) (RC)	742436-001
45 W, USB Type-C, wall mount, nPFC, 3 pin, 1.8 m (5.9 ft)	L43407-001
Power adapter (C5), for use in Japan	226768-001
Plastics Kit (includes fingerprint sensor insert, fingerprint sensor conductive tape, top conductive tape, touchpad left conductive tape, and touchpad protective tape)	L77265-001
Screw Kit	L78094-001
Power cord (3 pin, C5, black, conventional, 1.0 m [3.3 ft]), for use in:	
Argentina	L19357-001
Australia	L19358-001
Brazil	L19359-001
Denmark	L19360-001
Europe (Austria, Belgium, Finland, France, Germany, the Netherlands, Norway, and Sweden)	L19361-001
India	L19363-001
Israel	L19362-001
Italy	L19364-001
Japan	L19365-001
North America	L19367-001
People's Republic of China	L19368-001
South Africa	L19369-001
South Korea	L19366-001
Switzerland	L19370-001
Taiwan	L19372-001
Thailand	L19371-001
United Kingdom and Singapore	L19373-001
Power cord (3 pin, C5, black, conventional, 1.8 m [5.9 ft]), for use in:	
Argentina	L19357-002
Australia	L19358-002

Table 3-5 Miscellaneous parts and their descriptions (continued)

Description	Spare part number
Brazil	L19359-002
Denmark	L19360-002
Europe (Austria, Belgium, Finland, France, Germany, the Netherlands, Norway, and Sweden)	L19361-002
India	L19363-002
Israel	L19362-002
Italy	L19364-002
Japan	L19365-002
North America	L19367-002
The People's Republic of China	L19368-002
South Africa	L19369-002
South Korea	L19366-002
Switzerland	L19370-002
Taiwan	L19372-002
Thailand	L19371-002
United Kingdom and Singapore	L19373-002
Power cord (C7, black, 1.0 m [3.3 ft]), for use in:	
Japan	L19375-001
Power cord (3 pin, C5NS, black, duckhead, 1.0 m [3.3 ft]), for use in:	
Argentina	L36815-001
Australia	L36816-001
Denmark	L36817-001
Europe (Austria, Belgium, Finland, France, Germany, the Netherlands, Norway, and Sweden)	L36818-001
India	L36820-001
Israel	L36819-001
Japan	L36821-001
North America	L36822-001
The People's Republic of China	L36823-001
South Africa	L36824-001
Switzerland	L36825-001
Thailand	L36826-001
Taiwan	L36827-001
United Kingdom	L36828-001
Italy	L44788-001

Table 3-5 Miscellaneous parts and their descriptions (continued)

Description	Spare part number
Brazil	L44789-001
Power cord (3 pin, C5NS, black, duckhead, 1.8 m [5.9 ft]), for use in:	
Australia	L45264-001
Europe (Austria, Belgium, Finland, France, Germany, the Netherlands, Norway, and Sweden)	L45265-001
Israel	L45266-001
Italy	L45267-001
Japan	L45268-001
North America	L45269-001
The People's Republic of China	L45270-001
South Africa	L45271-001
Switzerland	L45272-001
Thailand	L45273-001
Taiwan	L45274-001
United Kingdom	L45275-001
Power cord (3 pin, C5NS, black, duckhead, 1.8 m [5.9 ft]), for use in:	
Brazil	L48055-001
Denmark	L50729-001
Duckhead connector only (C5NS)	
Argentina	L50823-001
Australia	L50818-004
India	L50824-001
North America	L50818-002
The People's Republic of China	L50818-005
South Korea	L50818-001
The United Kingdom and Singapore	L50818-003

4 Removal and replacement procedures preliminary requirements


Tools required

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

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

Service considerations


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

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

Plastic parts

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

Cables and connectors

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

Cables must be handled with extreme care to avoid damage. Apply only the tension required to unseat or seat the cables during removal and insertion. Handle cables by the connector whenever possible. In all cases, avoid bending, twisting, or tearing cables. Be sure that cables are routed in such a way that they cannot be caught or snagged by parts being removed or replaced. Handle flex cables with extreme care; these cables tear easily.

Drive handling



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

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

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

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

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

Avoid dropping drives from any height onto any surface.

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

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

Avoid exposing a drive to temperature extremes or liquids.

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

Workstation guidelines

Follow these grounding workstation guidelines:

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

Electrostatic discharge information

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

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



IMPORTANT: To prevent damage to the device when you are removing or installing internal components, observe these precautions:

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

Before touching an electronic component, discharge static electricity by using the guidelines described in this section.

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

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

Generating static electricity

Note the following:

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

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

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

Multiple electric components can be packaged together in plastic tubes, trays, or polystyrene foam.



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

Preventing electrostatic damage to equipment

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

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

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

Personal grounding methods and equipment

Use the following equipment to prevent static electricity damage to electronic components:

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

Table 4-2 Static shielding protection levels

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

Grounding the work area

To prevent static damage at the work area, use the following precautions:

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

Recommended materials and equipment

HP recommends the following materials and equipment to prevent static electricity:

- Antistatic tape
- Antistatic smocks, aprons, or sleeve protectors
- Conductive bins and other assembly or soldering aids
- Conductive foam
- Conductive tabletop workstations with ground cord of $1\text{ M}\Omega \pm 10\%$ resistance


- Static-dissipative table or floor mats with hard tie to ground
- Field service kits
- Static awareness labels
- Wrist straps and footwear straps providing $1\text{ M}\Omega \pm 10\%$ resistance
- Material handling packages
- Conductive plastic bags
- Conductive plastic tubes
- Conductive tote boxes
- Opaque shielding bags
- Transparent metallized shielding bags
- Transparent shielding tubes

Packaging and transporting guidelines

Follow these grounding guidelines when packaging and transporting equipment:


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

5 Removal and replacement procedures for authorized service provider parts

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

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

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 15](#) for details.

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.

Preparation for disassembly

See [Removal and replacement procedures preliminary requirements on page 24](#) for initial safety procedures.

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

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:

- ▲ With the computer turned off and AC adapter connected, press the following key and button combination: **Windows key + Backspace key + Power button**.

After the computer powers off, disconnect the AC adapter.

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

Bottom cover

Table 5-1 Bottom cover description and part number


Description	Spare part number
Bottom cover	L44558-001

Before removing the bottom cover, follow these steps:

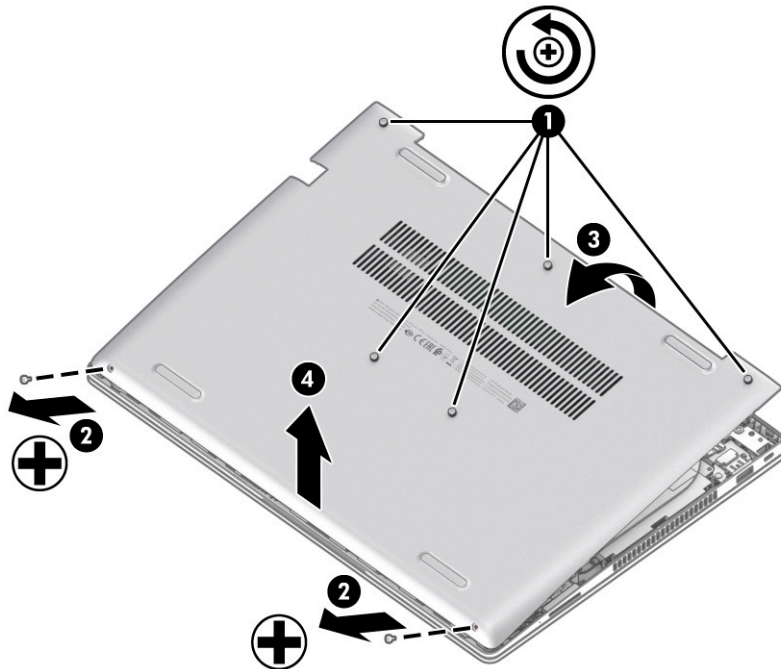
1. Prepare the computer for disassembly ([Preparation for disassembly on page 29](#)).
2. Place the computer in Battery Safe mode ([Battery Safe mode on page 29](#)).

Remove the bottom cover:

1. Loosen the five captive Phillips screws **(1)**.

 **NOTE:** It is possible to remove the captive screws.

2. Remove the two Phillips M2.0 × 5.0 screws **(2)** that secure the bottom cover to the computer.
3. Starting under the display, use a nonconductive, nonmarking tool to pry the cover up **(3)**, and then remove the cover from the computer **(4)**.



Reverse these procedures to install the bottom cover.

Battery

Table 5-2 Battery description and part number

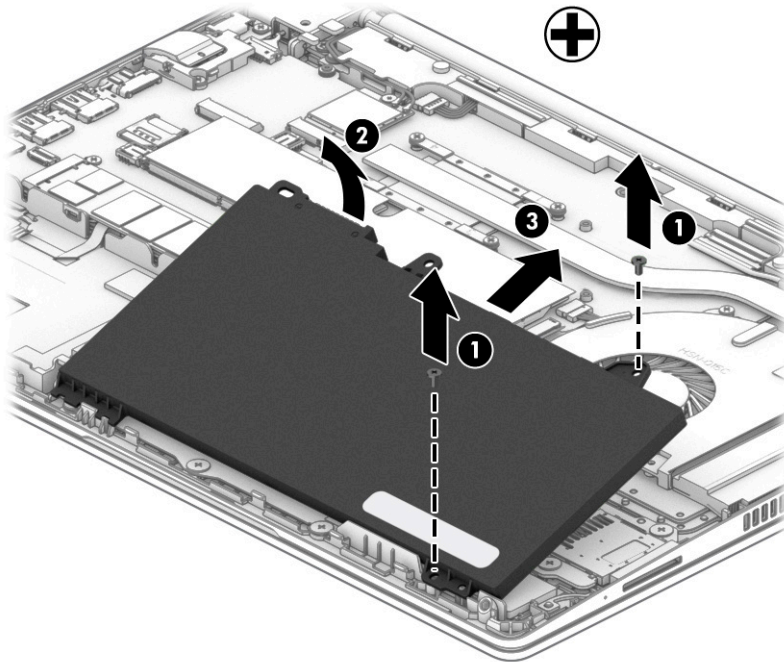
Description	Spare part number
Battery, 3 cell, 45 Wh	L32656-005

Before removing the battery, follow these steps:

1. Prepare the computer for disassembly ([Preparation for disassembly on page 29](#)).
2. Place the computer in Battery Safe mode ([Battery Safe mode on page 29](#)).
3. Remove the bottom cover ([Bottom cover on page 30](#)).

Remove the battery:

1. Remove the two Phillips M2.0 × 4.0 screws **(1)** that secure the battery to the computer.
2. Lift top (connector side) of the battery up to an approximate 45° angle **(2)**, and then remove the battery from the computer **(3)**.




Reverse this procedure to install the battery.

Memory modules

Table 5-3 Memory modules descriptions and part numbers

Description	Spare part number
Memory module, DDR4-2400, 4 GB	L10598-852


 **IMPORTANT:** Before adding new memory, be sure to update the computer to the latest BIOS from www.hp.com. Failure to update the computer to the latest BIOS before installing new memory may result in various system problems.

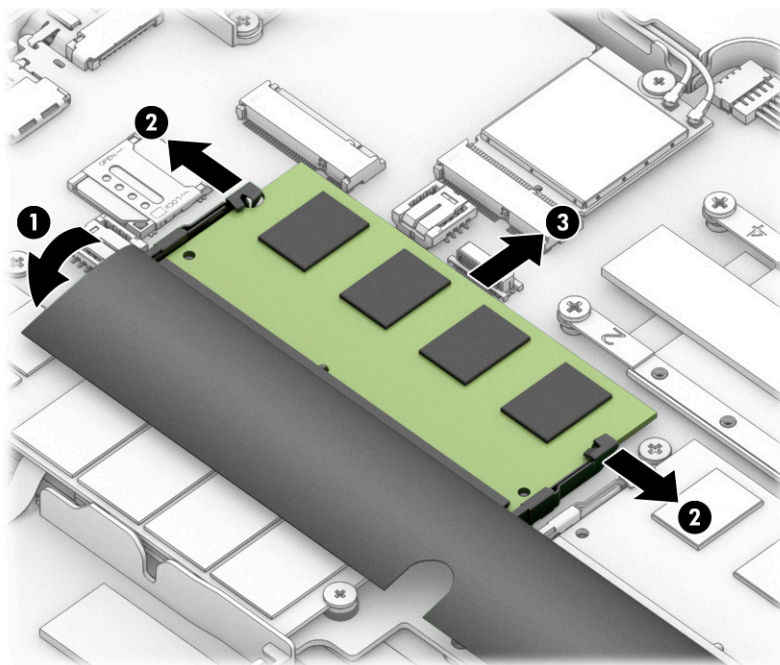
Before removing the memory module, follow these steps:

1. Prepare the computer for disassembly ([Preparation for disassembly on page 29](#)).
2. Place the computer in Battery Safe mode ([Battery Safe mode on page 29](#)).
3. Remove the bottom cover ([Bottom cover on page 30](#)).
4. Remove the battery ([Battery on page 31](#)).

Remove the memory module:

1. Lift the protective tape from on top of the memory modules **(1)**.
2. Spread the retaining tabs **(2)** 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.)
3. Remove the memory module **(3)** 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.

Table 5-4 WLAN module description and part number

Description	Spare part number
Intel dual-band wireless-AC 9560 802.11ac 2 × 2 Wi-Fi + Bluetooth 5.0 combo adaptor (non-vPro)	L22634-001

Before removing the WLAN module, follow these steps:

1. Prepare the computer for disassembly ([Preparation for disassembly on page 29](#)).
2. Place the computer in Battery Safe mode ([Battery Safe mode on page 29](#)).
3. Remove the bottom cover ([Bottom cover on page 30](#)).
4. Remove the battery ([Battery on page 31](#)).

Remove the WLAN module:


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

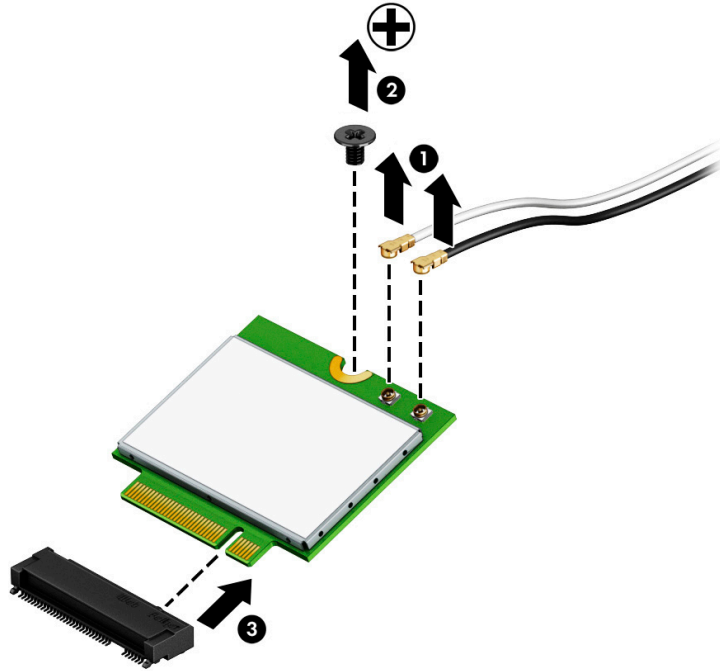



NOTE: The WLAN antenna cable labeled **1** connects to the WLAN module **Main** terminal labeled **1**. The WLAN antenna cable labeled **2** connects to the WLAN module **Aux** terminal labeled **2**. If the computer is equipped with an 802.11a/b/g/n WLAN module, the yellow WLAN antenna cable connects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

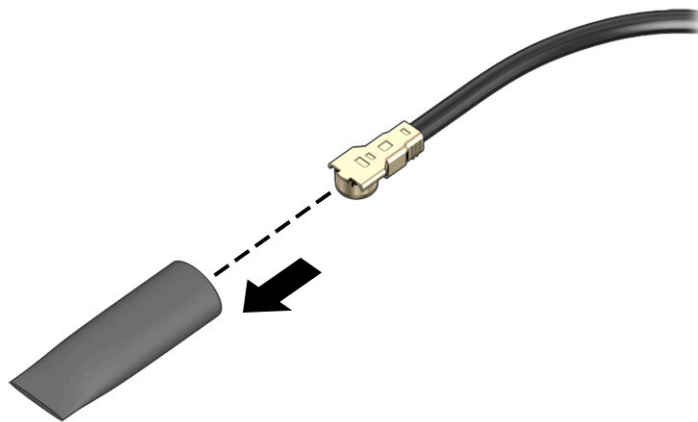
2. Remove the Phillips M2.0 × 2.5 screw (**2**) that secures the WLAN module to the computer. (The edge of the module opposite the slot rises away from the computer.)

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

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

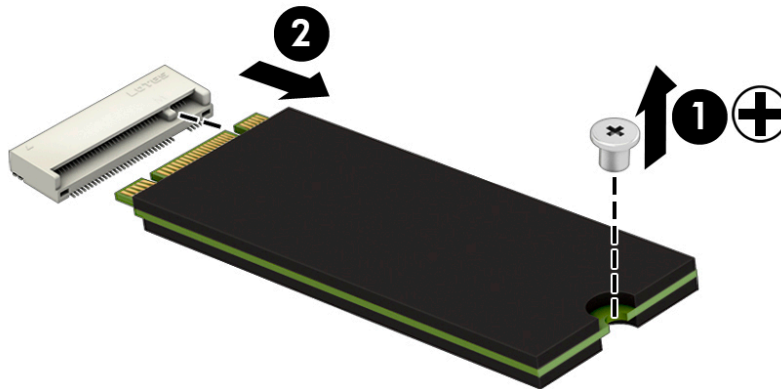
Description	Spare part number
128 GB, SATA-3, TLC	L85346-002

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

1. Prepare the computer for disassembly ([Preparation for disassembly on page 29](#)).
2. Place the computer in Battery Safe mode ([Battery Safe mode on page 29](#)).
3. Remove the bottom cover ([Bottom cover on page 30](#)).
4. Remove the battery ([Battery on page 31](#)).

Remove the solid-state drive:

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

Speaker assembly

Table 5-6 Speaker assembly description and part number

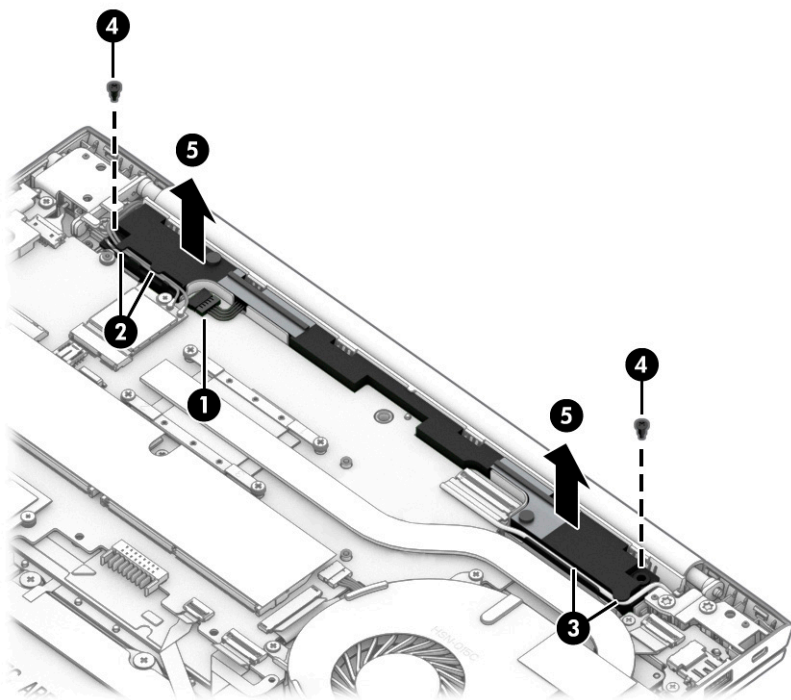
Description	Spare part number
Speaker assembly	L44554-001

Before removing the speaker assembly, follow these steps:

1. Prepare the computer for disassembly ([Preparation for disassembly on page 29](#)).
2. Place the computer in Battery Safe mode ([Battery Safe mode on page 29](#)).
3. Remove the bottom cover ([Bottom cover on page 30](#)).
4. Remove the battery ([Battery on page 31](#)).

Remove the speaker assembly:

1. Disconnect the speaker cable from the system board **(1)**.
2. Remove the antenna cables from the channel in the right speaker **(2)**.
3. Remove the display cable from the channel in the left speaker **(3)**.
4. Remove the two Phillips M2.0 × 5.5 screws **(4)** that secure the speakers to the computer.
5. Remove the speakers from the computer **(5)**.




Reverse this procedure to install the speaker assembly.

Fan

Table 5-7 Fan description and part number

Description	Spare part number
Fan	L44556-001

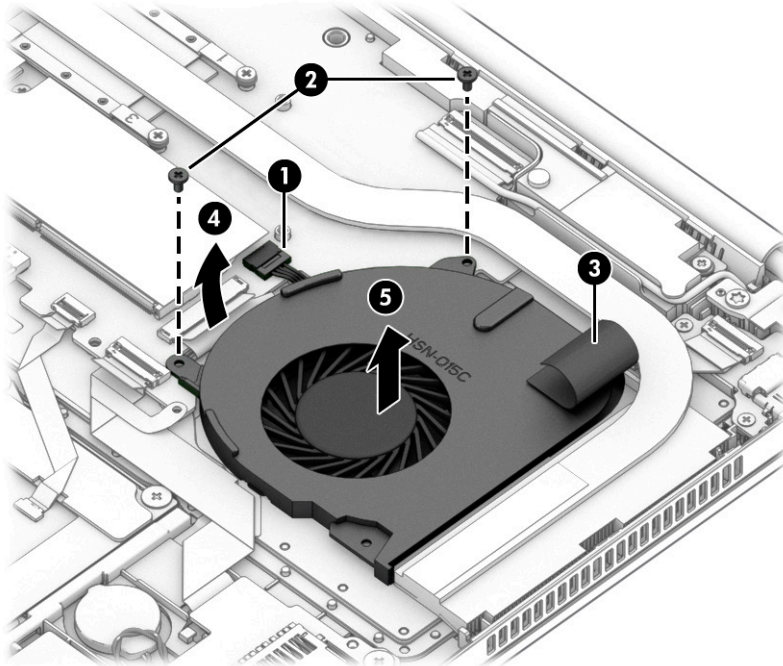
 **NOTE:** To properly ventilate the computer, allow at least **7.6 cm (3.0 in)** of clearance on the sides of the computer. The computer uses an electric fan for ventilation. The fan is controlled by a temperature sensor and is designed to turn on automatically when high temperature conditions exist. 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.

Before removing the fan, follow these steps:

1. Prepare the computer for disassembly ([Preparation for disassembly on page 29](#)).
2. Place the computer in Battery Safe mode ([Battery Safe mode on page 29](#)).
3. Remove the bottom cover ([Bottom cover on page 30](#)).
4. Remove the battery ([Battery on page 31](#)).

Remove the fan:

1. Disconnect the fan cable **(1)** from the system board.
2. Remove the two Phillips M2.0 × 4.0 screws **(2)** that secure the fan to the computer.
3. Lift the tape that secures the fan to the heat sink **(3)**.
4. Rotate the left side of the fan upward **(4)**, and then lift the fan from the computer **(5)**.



Reverse this procedure to install the fan.

Heat sink


 **NOTE:** All heat sink spare part kits include replacement thermal material.

Table 5-8 Heat sink descriptions and part numbers

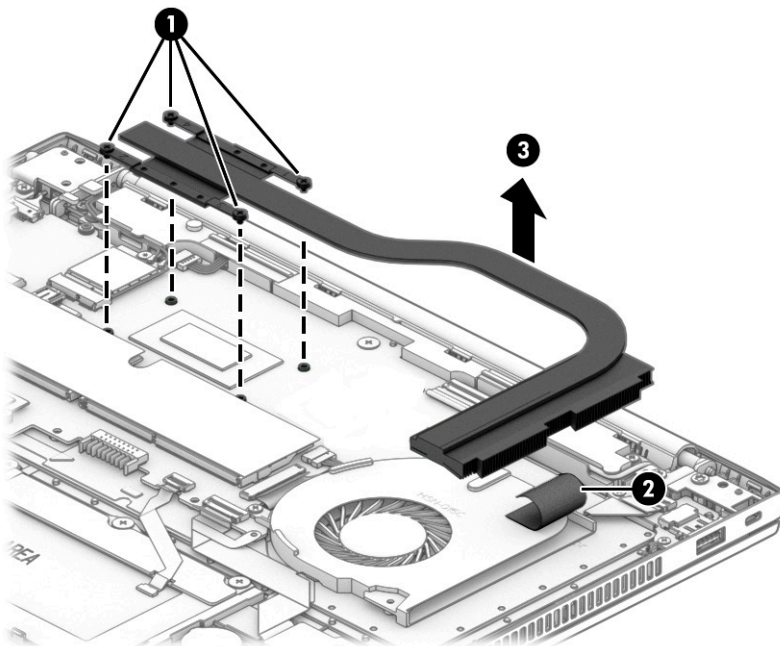
Description	Spare part number
Heat sink	L44552-001

Before removing the heat sink, follow these steps:

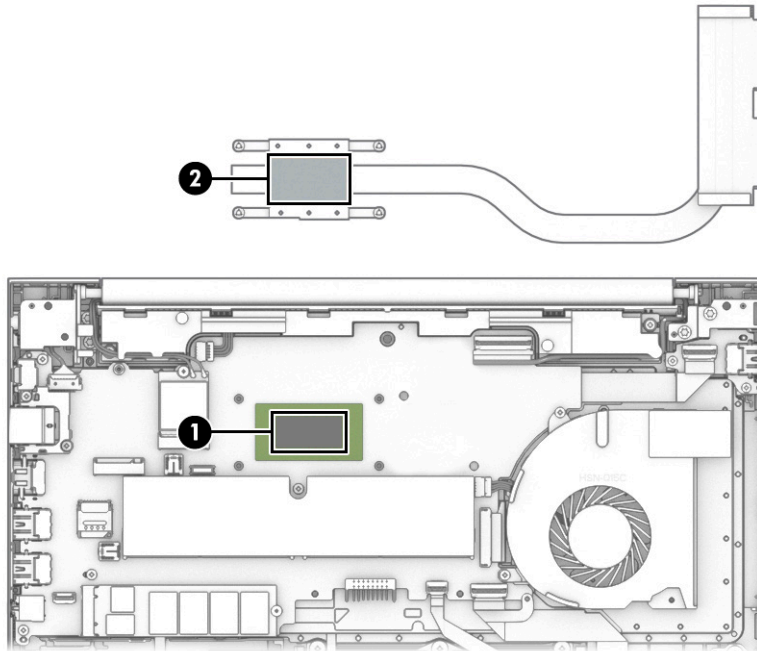
1. Prepare the computer for disassembly ([Preparation for disassembly on page 29](#)).
2. Place the computer in Battery Safe mode ([Battery Safe mode on page 29](#)).
3. Remove the bottom cover ([Bottom cover on page 30](#)).
4. Remove the battery ([Battery on page 31](#)).

Remove the heat sink:

1. In the order indicated on the heat sink, loosen the four captive Phillips screws **(1)** that secure the heat sink to the system board.
2. Lift the tape that secures the heat sink to the fan **(2)**.
3. Remove the heat sink from the system board **(3)**.



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



Reverse this procedure to install the heat sink.

USB board

Table 5-9 USB board and cable descriptions and part numbers

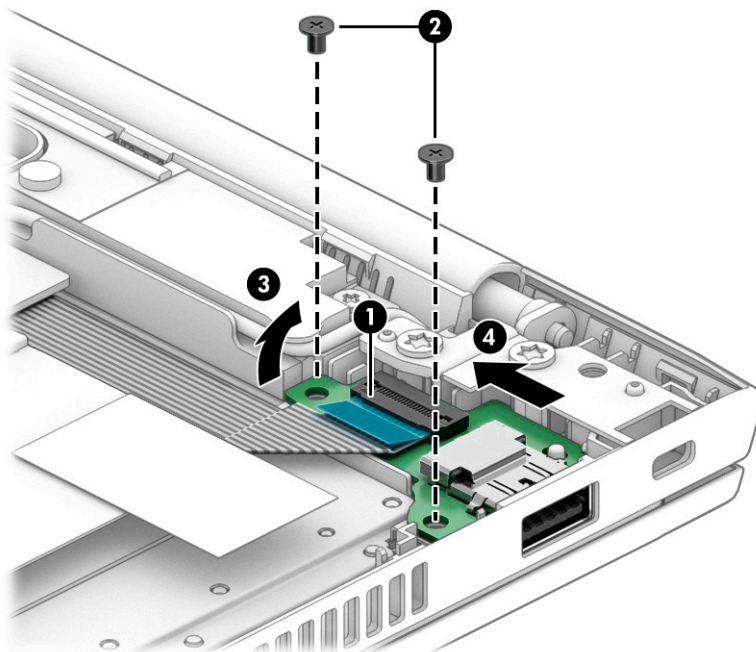
Description	Spare part number
USB board (includes cable)	L44578-001

Before removing the USB board, follow these steps:

1. Prepare the computer for disassembly ([Preparation for disassembly on page 29](#)).
2. Place the computer in Battery Safe mode ([Battery Safe mode on page 29](#)).
3. Remove the bottom cover ([Bottom cover on page 30](#)).
4. Remove the battery ([Battery on page 31](#)).

Remove the USB board:

1. Disconnect the cable from the ZIF connector on the USB board **(1)**.
2. Remove the two Phillips M2.0 × 4.0 screws **(2)** that secure the board to the computer.
3. Lift the rear of the board up **(3)**, and then pull the board away from the connector and out of the computer to remove it **(4)**.



Reverse this procedure to install the USB board.

Touchpad assembly

Table 5-10 Touchpad assembly description and part number

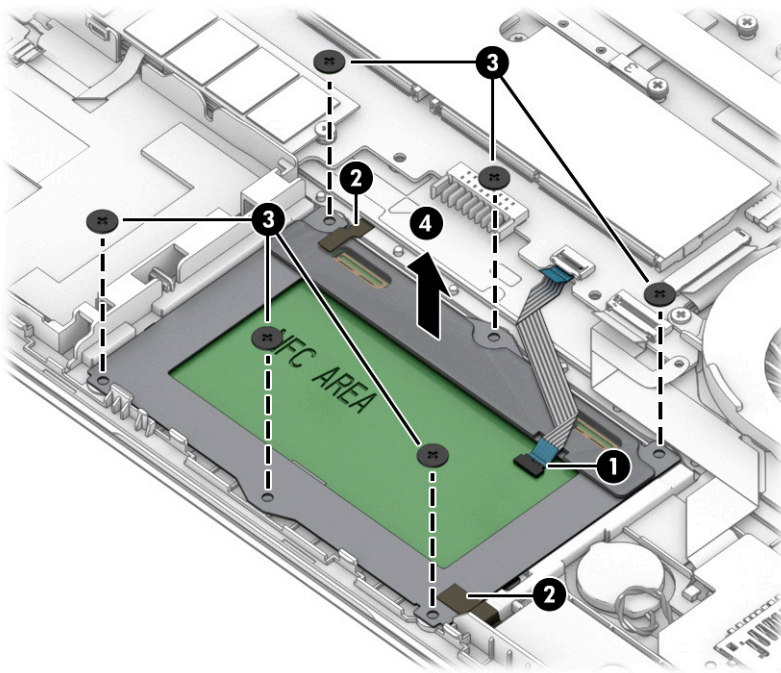
Description	Spare part number
Touchpad assembly (includes cable)	L77252-001

Before removing the touchpad assembly, follow these steps:

1. Prepare the computer for disassembly ([Preparation for disassembly on page 29](#)).
2. Place the computer in Battery Safe mode ([Battery Safe mode on page 29](#)).
3. Remove the bottom cover ([Bottom cover on page 30](#)).
4. Remove the battery ([Battery on page 31](#)).

Remove the touchpad assembly:

1. Disconnect the cable from the ZIF connector on the touchpad **(1)**.
2. Lift the silver tape from the two locations that secure touchpad to the computer **(2)**.
3. Remove the six broad head Phillips M2.0 × 2.0 screws **(3)** that secure the touchpad to the computer.
4. Lift the touchpad from the computer **(4)**.



Reverse this procedure to install the touchpad assembly.

Fingerprint sensor assembly

Table 5-11 Fingerprint sensor assembly descriptions and part numbers


Description	Spare part number
Fingerprint sensor assembly	L77229-001
Fingerprint sensor bracket (included in Bracket Kit)	L77264-001
Fingerprint sensor cable (included in the Cable Kit)	L77263-001
Fingerprint sensor insert (included in Plastics Kit; for use in models without a fingerprint sensor)	L77265-001

Before removing the fingerprint sensor assembly, follow these steps:

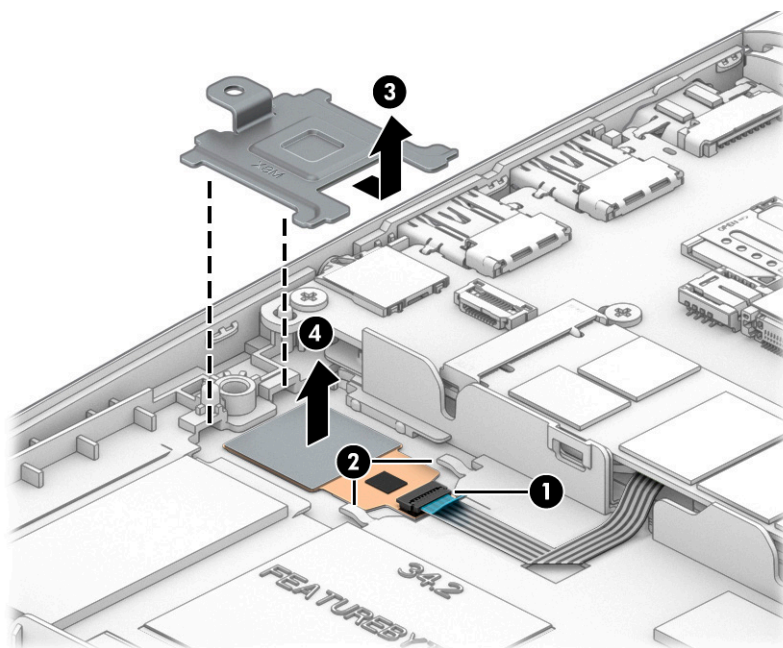
1. Prepare the computer for disassembly ([Preparation for disassembly on page 29](#)).
2. Place the computer in Battery Safe mode ([Battery Safe mode on page 29](#)).
3. Remove the following components:
 - a. Bottom cover ([Bottom cover on page 30](#)).
 - b. Battery ([Battery on page 31](#)).

Remove the fingerprint sensor assembly:

1. Disconnect the cable from the ZIF connector on the fingerprint sensor **(1)**.
2. Lift the two plastic tabs that hold the bracket in place **(2)**.
3. Slide the bracket toward the inside of the computer, and then lift it off the fingerprint sensor board **(3)**.

 **TIP:** You might need a tool to release the bracket.

4. Remove the fingerprint sensor from the computer **(4)**.



Reverse this procedure to install the fingerprint sensor assembly.

Card reader board

Table 5-12 Card reader board description and part number

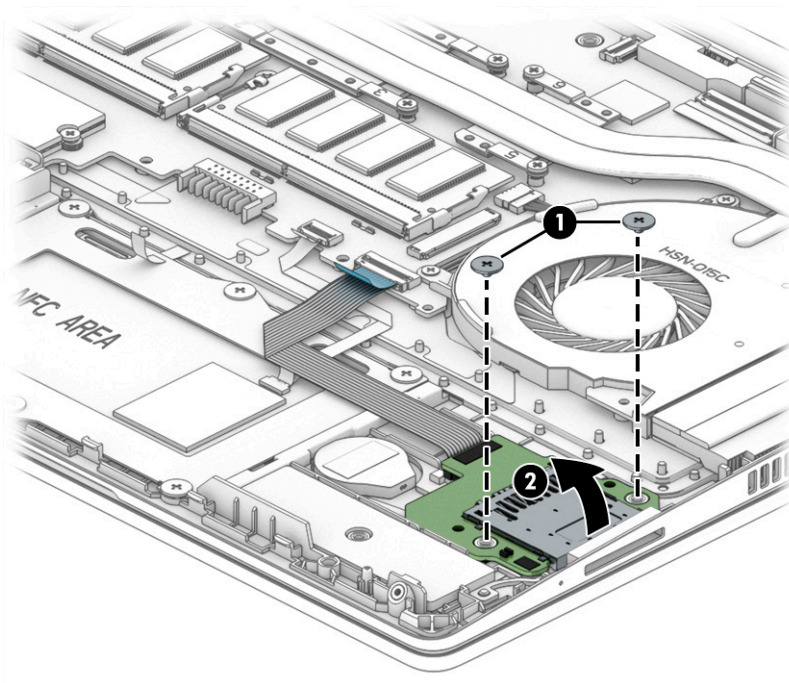
Description	Spare part number
Card reader board assembly (includes cable)	L44579-001

Before removing the card reader board, follow these steps:

1. Prepare the computer for disassembly ([Preparation for disassembly on page 29](#)).
2. Place the computer in Battery Safe mode ([Battery Safe mode on page 29](#)).
3. Remove the bottom cover ([Bottom cover on page 30](#)).
4. Remove the battery ([Battery on page 31](#)).

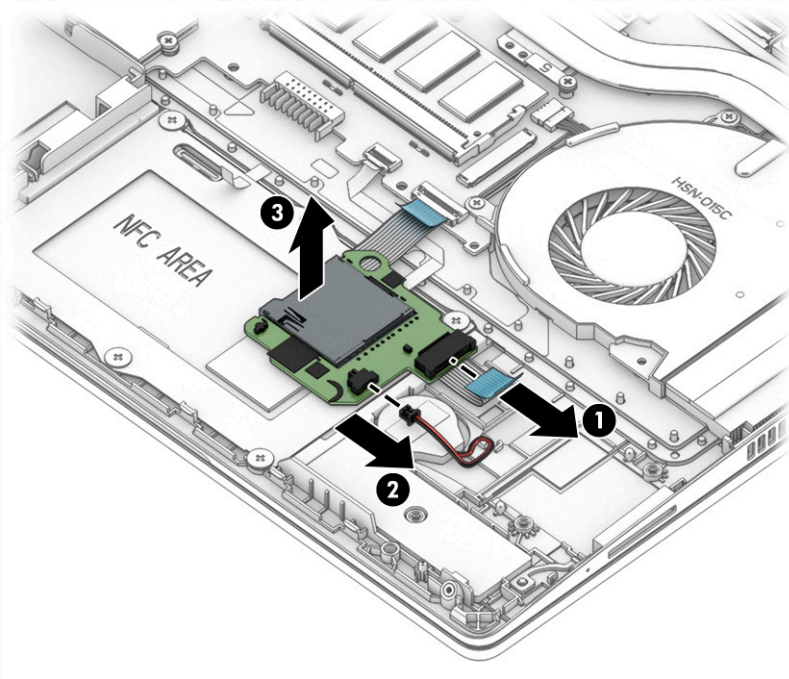
Remove the card reader board:

1. Remove the two Phillips M2.0 × 2.0 screws **(1)** that secure the card reader board to the computer.
2. Lift the board up so that you can access the connectors underneath **(2)**.



3. Disconnect the card reader board cable from the ZIF connector on the card reader board **(1)**.
4. Disconnect the RTC battery from the card reader board **(2)**.

5. Remove the card reader board from the computer (3).



Reverse this procedure to install the card reader board.

RTC battery

Table 5-13 RTC battery description and part number

Description	Spare part number
RTC battery	L02772-001

Before removing the RTC battery, follow these steps:

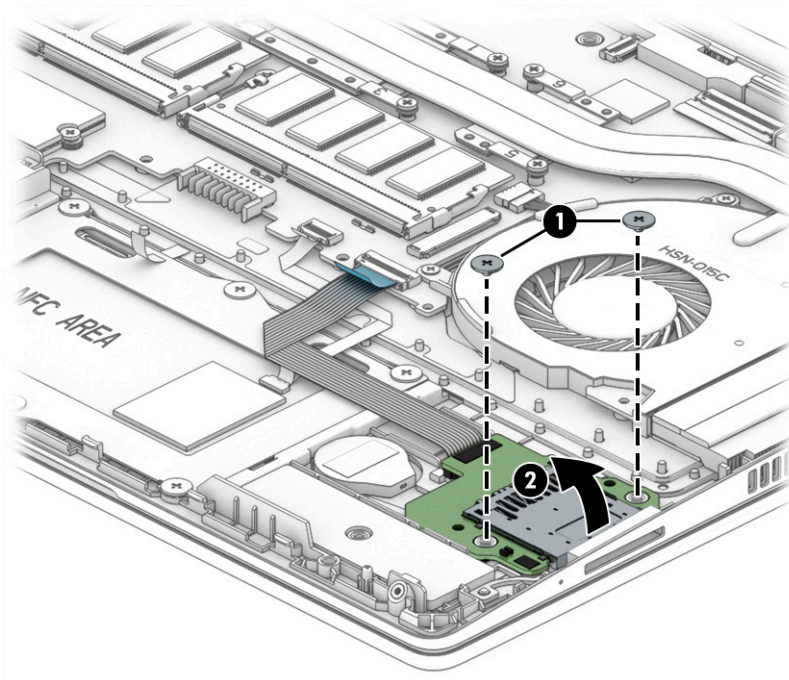
1. Prepare the computer for disassembly ([Preparation for disassembly on page 29](#)).
2. Place the computer in Battery Safe mode ([Battery Safe mode on page 29](#)).
3. Remove the bottom cover ([Bottom cover on page 30](#)).
4. Remove the battery ([Battery on page 31](#)).

Remove the RTC battery:



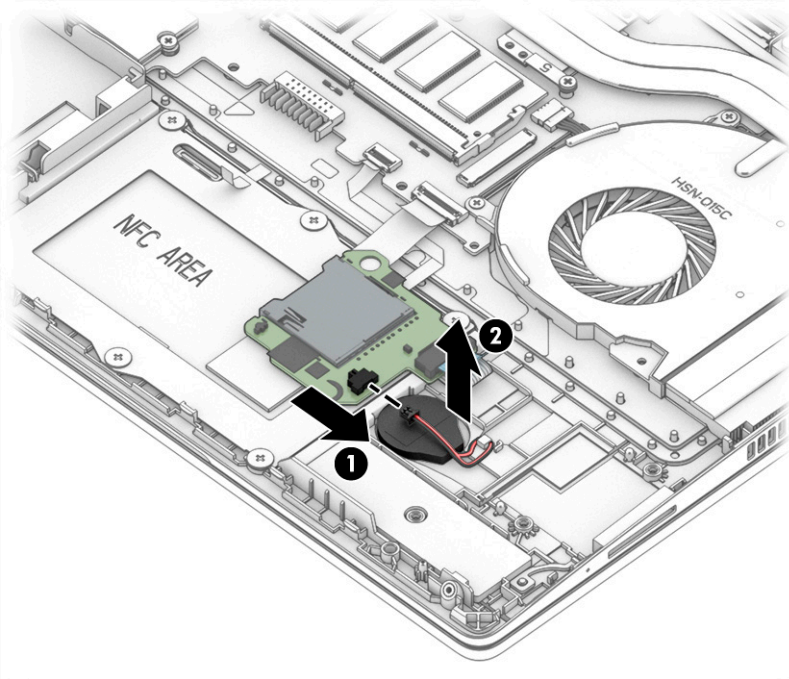
NOTE: The RTC battery connector is located on the bottom of the card reader board.

1. Remove the two Phillips M2.0 × 2.0 screws **(1)** that secure the card reader board to the computer.
2. Lift the board up so that you can access the connectors underneath **(2)**.



3. Disconnect the RTC battery from the card reader board **(1)**.

4. Lift the battery to disengage it from the adhesive that secures it to the computer **(2)**.



Reverse this procedure to install the RTC battery.

Power connector cable

Table 5-14 Power connector cable description and part number

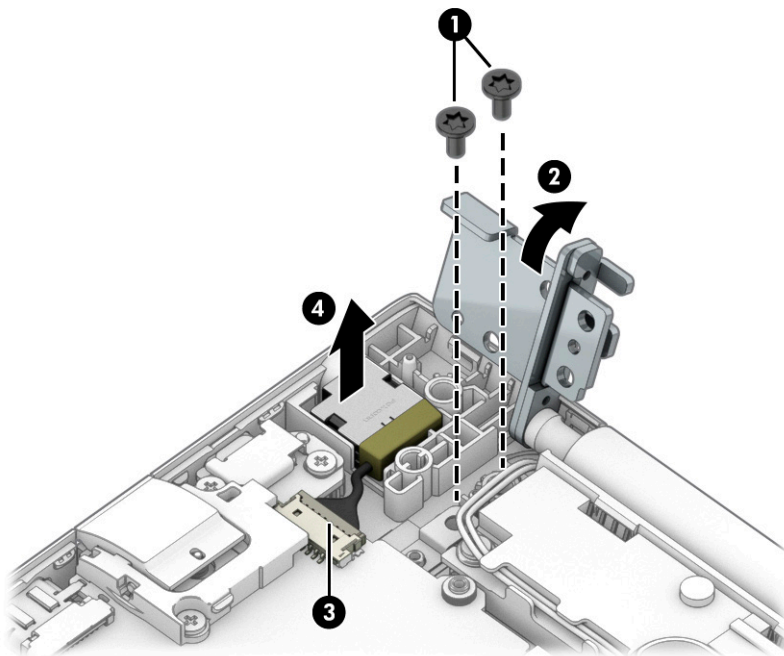
Description	Spare part number
Power connector cable	L01048-001

Before removing the power connector cable, follow these steps:

1. Prepare the computer for disassembly ([Preparation for disassembly on page 29](#)).
2. Place the computer in Battery Safe mode ([Battery Safe mode on page 29](#)).
3. Remove the bottom cover ([Bottom cover on page 30](#)).
4. Remove the battery ([Battery on page 31](#)).

Remove the power connector cable:

1. Remove the two Torx T8 2.5 × 4.0 screws (1) that secure the right hinge to the computer, and the rotate the hinge to the open position (2).
2. Disconnect the cable from the system board (3).
3. Remove the power connector cable from the computer (4).



Reverse this procedure to install the power connector cable.

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

Table 5-15 System board descriptions and part numbers

Description	Spare part number
System board with integrated Intel Celeron 5205U processor (non-Windows operating system)	L96032-001
System board with integrated Intel Celeron 5205U processor (Windows 10 IoT operating system)	L96032-301

Before removing the system board, follow these steps:

1. Prepare the computer for disassembly ([Preparation for disassembly on page 29](#)).
2. Place the computer in Battery Safe mode ([Battery Safe mode on page 29](#)).
3. Remove the following components:
 - a. Bottom cover ([Bottom cover on page 30](#)).
 - b. Battery ([Battery on page 31](#))
 - c. Fan ([Fan on page 37](#))

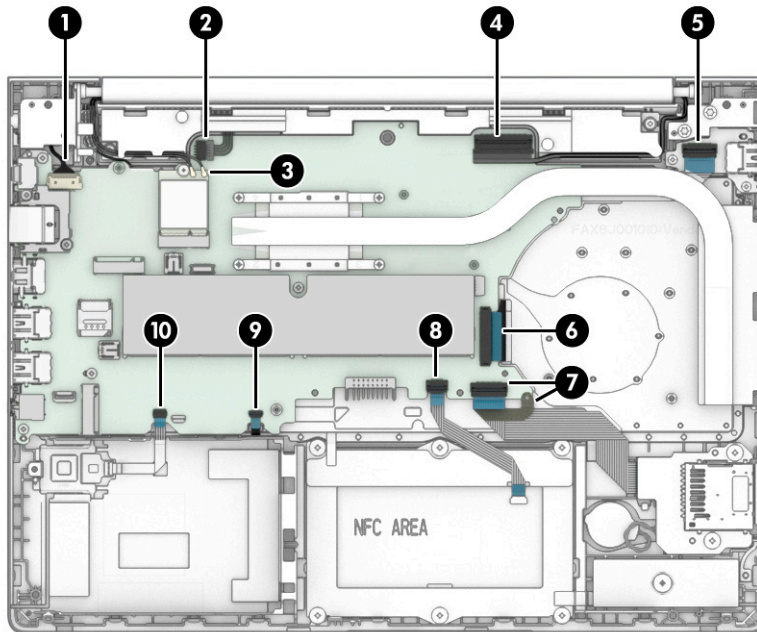
When replacing the system board, be sure to remove the following components (as applicable) from the defective system board and install on the replacement system board:

- Memory modules ([Memory modules on page 32](#))
- WLAN/Bluetooth module ([WLAN/Bluetooth combo card on page 33](#))
- M.2 solid-state drive ([M.2 solid-state drive on page 35](#))
- Heat sink ([Heat sink on page 38](#))

Remove the system board:

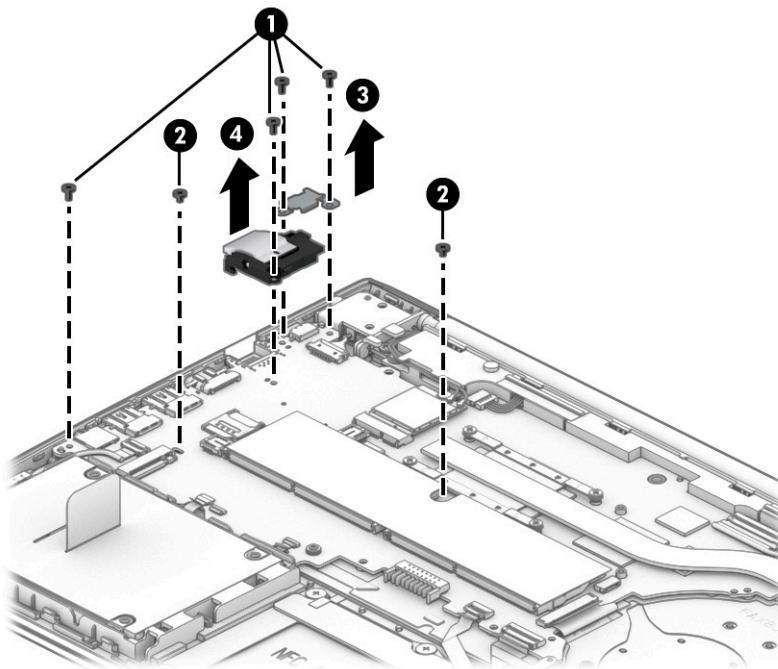
1. Disconnect the following cables from the system board:
 - (1) Power connector cable
 - (2) Speaker cable
 - (3) Antennas from WLAN module (select models only)
 - (4) Display cable (ZIF)
 - (5) USB cable from USB board (ZIF)
 - (6) Keyboard cable (ZIF)
 - (7) Card reader cable (ZIF) and tape
 - (8) Touchpad cable (ZIF)
 - (9) Keyboard backlight cable (ZIF)

(10) Fingerprint sensor cable (ZIF)



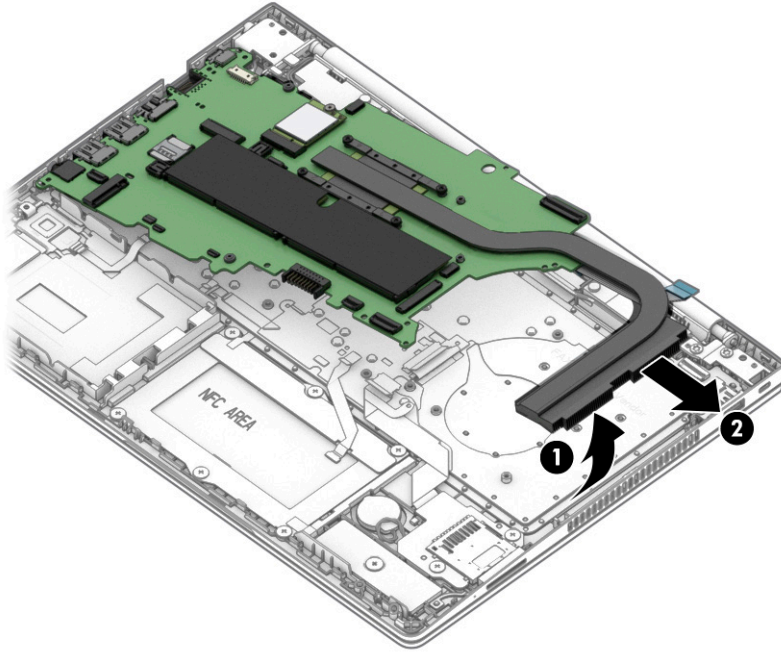
2. Remove the four Phillips M2.0 × 4.0 screws **(1)** that secure the system board to the computer.
3. Remove the two Phillips M2.0 × 2.5 screws **(2)** that secure the system board to the computer.
4. Remove the bracket that covers the USB-Type C port **(3)**.
5. Remove the RJ-45 jack cover **(4)**.

The USB bracket and RJ-45 jack cover are available in the Bracket Kit as spare part number L77264-001.



6. Rotate the right side of the system board upward **(1)**.

7. Pull the system board away from the connectors on the side of the chassis to remove it from the computer (2).



Reverse this procedure to install the system board.

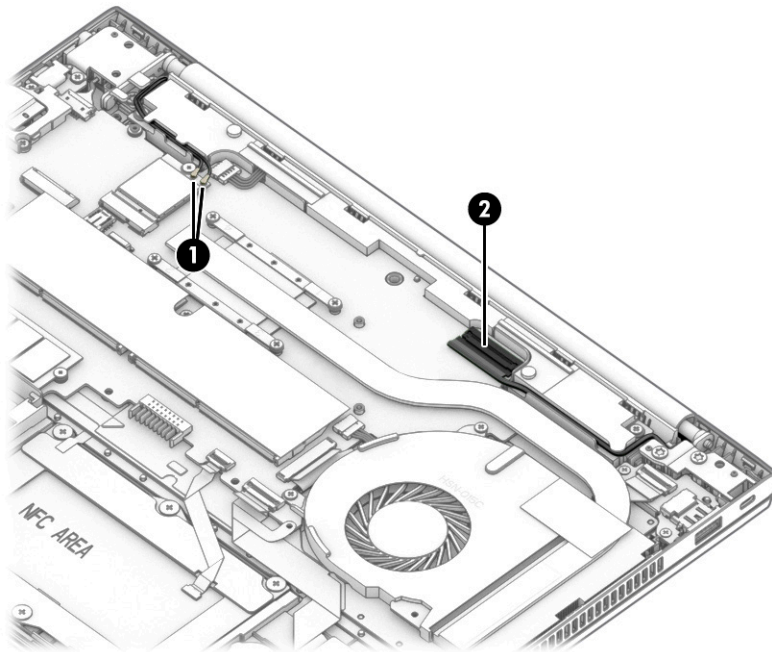
Display assembly

Before disassembling the display assembly, follow these steps:

1. Prepare the computer for disassembly ([Preparation for disassembly on page 29](#)).
2. Place the computer in Battery Safe mode ([Battery Safe mode on page 29](#)).
3. Remove the bottom cover ([Bottom cover on page 30](#)).
4. Remove the battery ([Battery on page 31](#)).

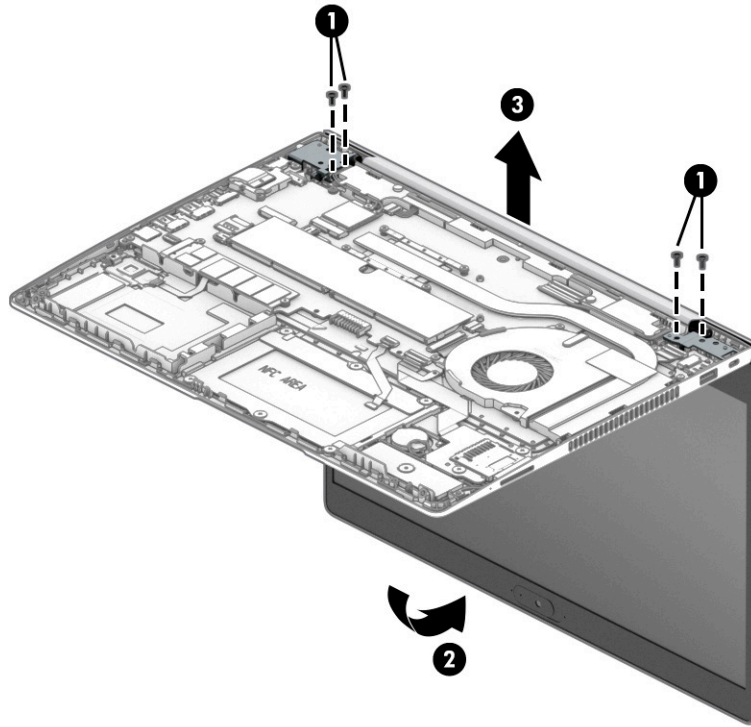
Disassemble the display assembly:

1. Remove the display assembly from the computer:
 - a. Disconnect the antenna cables from the WLAN module **(1)**.
 - b. Disconnect the display cable from the system board ZIF connector **(2)**.



- c. Remove the four Torx T8 2.5 × 4.0 screws **(1)** that secure the display assembly to the computer.

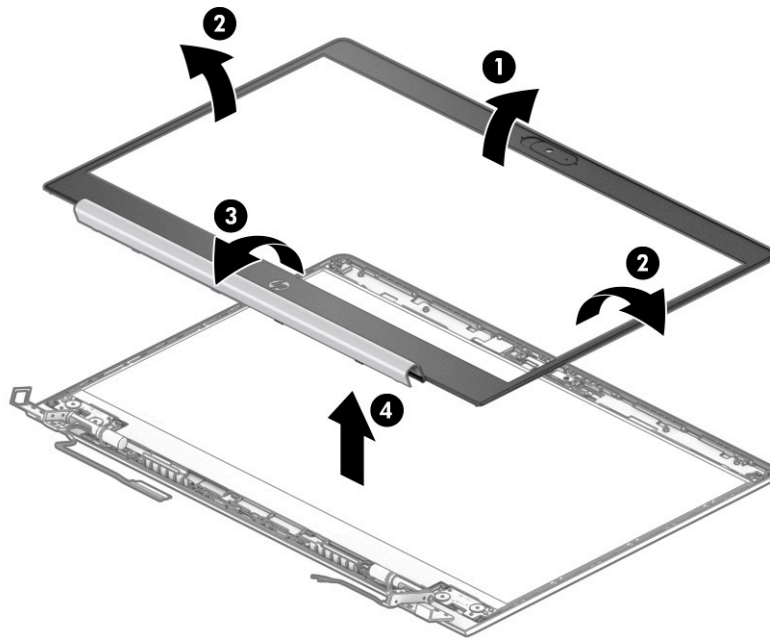
- d. Open the display to an approximate 90° angle **(2)**, and then separate the display from the computer **(3)**.




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

3. Remove the display bezel (4).

The bezel is available as spare part number L78090-001 for models without a camera and L78091-001 for models with an HD camera.



4. The display panel is secured to the display enclosure with tape that is installed under the left and right sides of the panel. To remove the panel, use tweezers to grasp the end of the tape (1). While turning the tweezers (2), wrap the tape around the tweezers (3) as you continue to pull the tape out from behind the display panel. You must pull the tape multiple times before it is completely removed.

 **IMPORTANT:** If the tape tears, do not attempt to pry the panel off the enclosure. Doing so might break the panel.

The ends of the tape are accessible at both the top and bottom of the display panel.

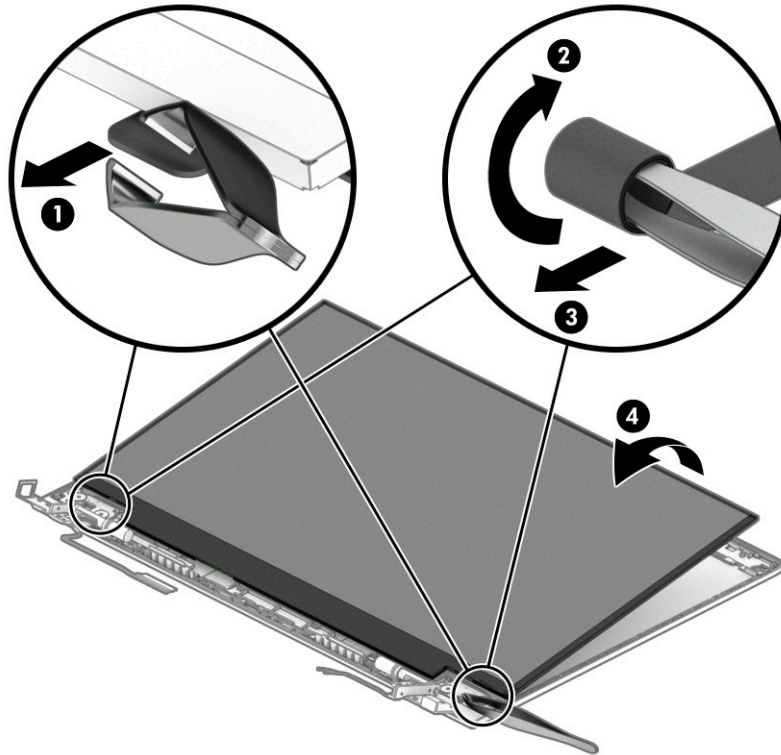
To avoid tearing the tape, do not pull on it with the sharp end of tweezers.

5. Rotate the display panel over and place next to the display enclosure (4).

Display panels are available as the following spare part numbers:

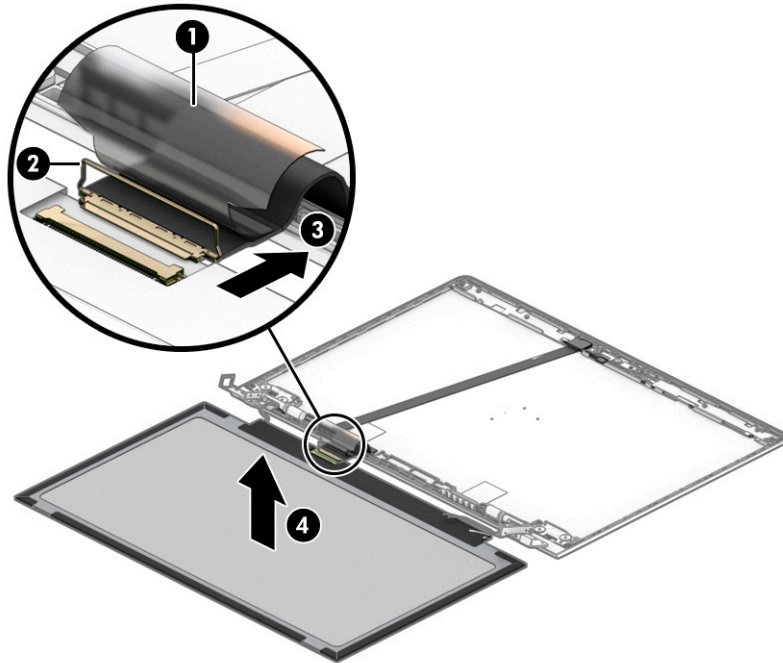
L97217-001: HD panel

L97216-001: FHD panel, touch-on panel (TOP)



6. Lift the tape from the connector on the display panel (1), lift the locking lever (2), and then disconnect the cable from the panel (3).

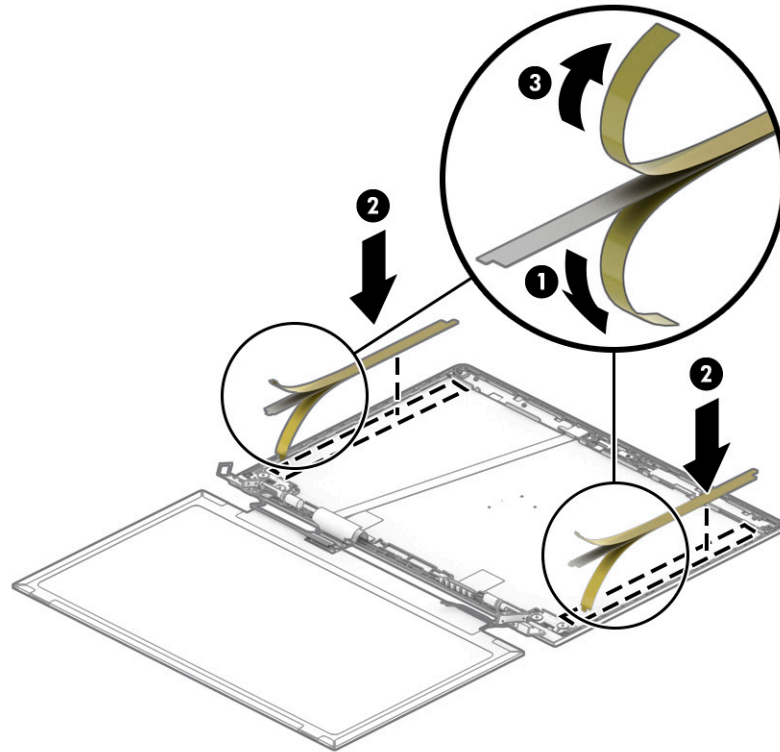
7. Remove the panel **(4)**.



8. Use the following steps to install a display panel:

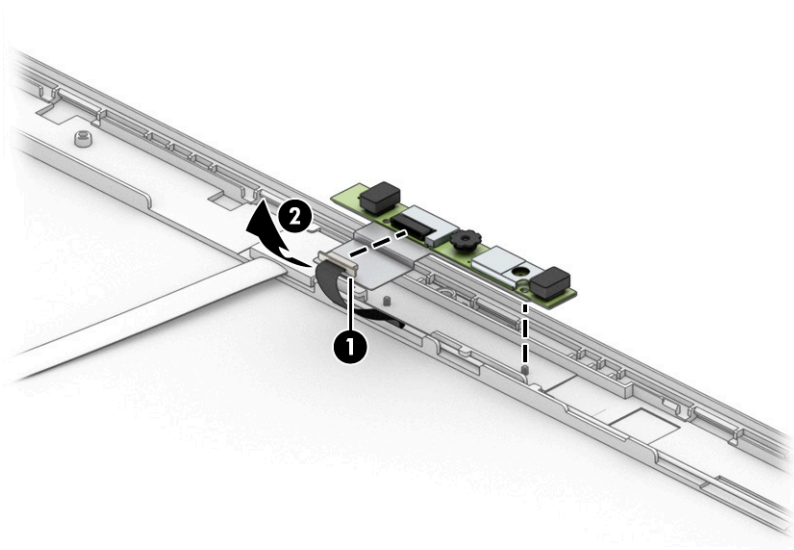
- a. Remove the backing from the bottom of the new tape to install in the display enclosure **(1)**.
- b. Locate the tape alignment marks, and then install the tape onto the left and right sides on the inside of the enclosure **(2)**.
- c. Remove the backing from the top of the installed tape **(3)**.

- d. Rotate the panel into place in the display enclosure.

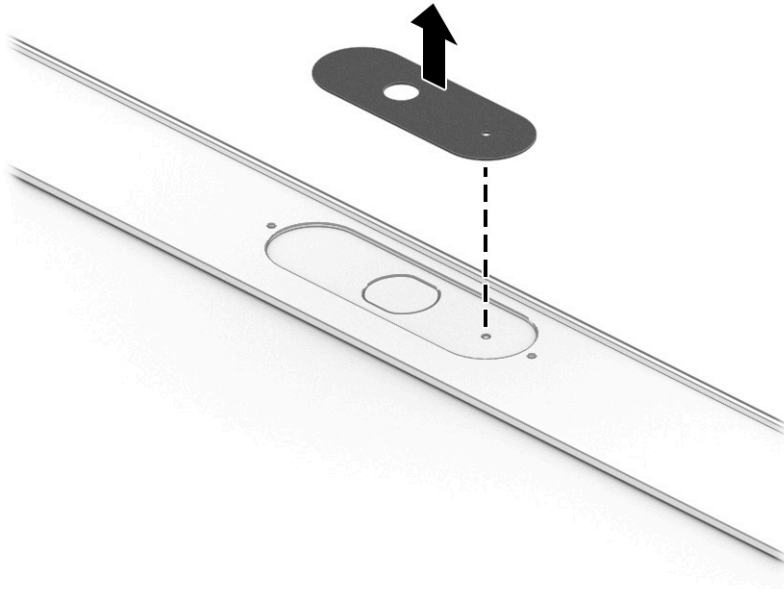


9. If it is necessary to remove or replace the HD camera, disconnect the cable from the camera (1), and then peel the silver tape up to remove the module from the enclosure (2).

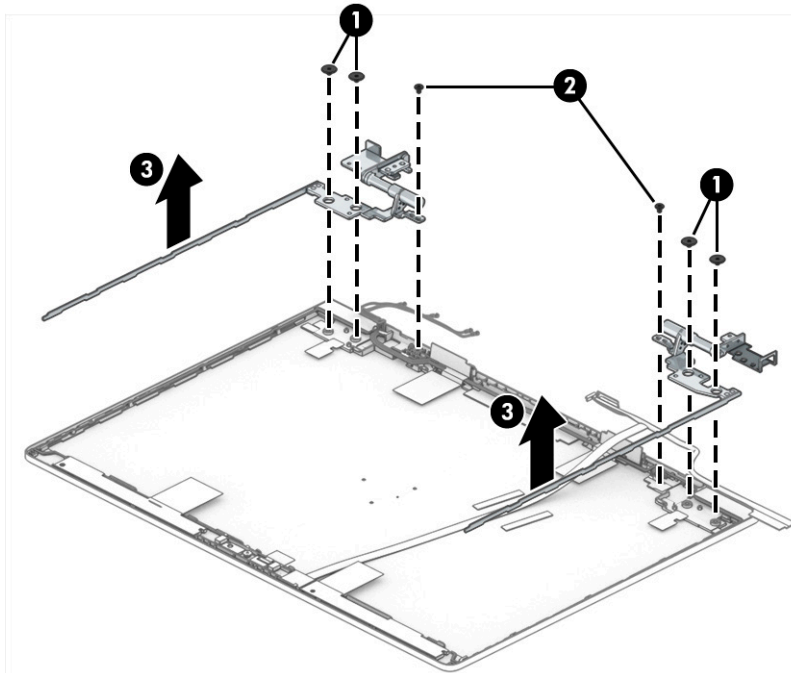
The HD camera is available as spare part number L81889-001.



- 10.** If it is necessary to remove the camera privacy cover, lift the cover straight up and off the display.
The camera privacy cover is available as spare part number L77237-001.

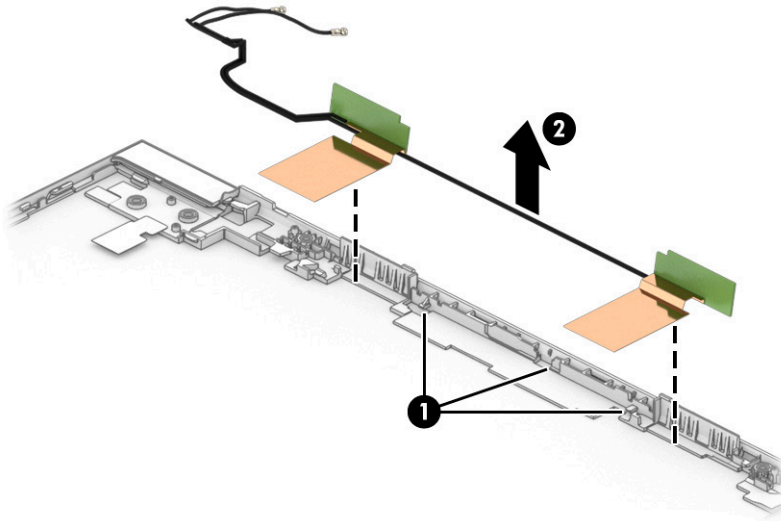


- 11.** If it is necessary to remove the hinges from the display enclosure, remove the two Phillips broad head M2.5 × 2.5 screws **(1)** and the Phillips M2.0 × 4.0 screw **(2)** from the bottom of each hinge.
- 12.** Remove the hinges from the enclosure **(3)**.
- The display hinges are available as spare part number L78093-001.



13. If it is necessary to replace the WLAN antennas, remove the cables from the clips in the bottom of the enclosure (1), and then peel the antennas and remove them from the display enclosure (2).

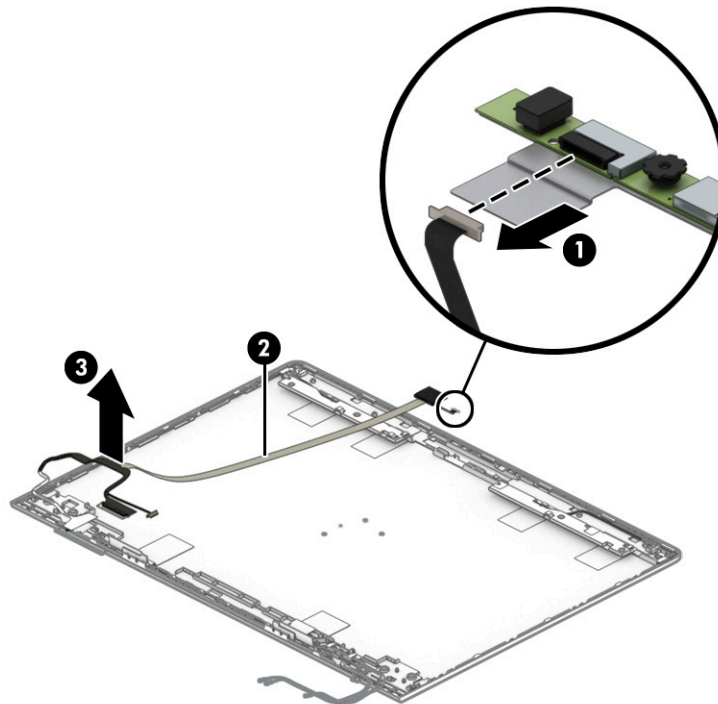
WLAN antennas are available as spare part number L78070-001.



14. If it is necessary to remove or replace the display/camera cable, use the following steps:

- a. Disconnect the cable from the ZIF connector on the camera module (1).
- b. Pull the cable up to disengage it from the adhesive that secures it to the inside of the enclosure (2), and then remove the cable from the enclosure (3).

The touch display cable is available as spare part number L78089-001.



Reverse this procedure to reassemble the display assembly.

Keyboard/top cover

The top cover with keyboard remains after removing all other spare parts from the computer.

The first table provides the main spare part number for the keyboards. The second table provides the country codes.

Table 5-16 Keyboard/top cover descriptions and part numbers

Description	Spare part number
Top cover with keyboard, with backlight	L65224-xx1
Top cover with keyboard, no backlight	L65225-xx1

Table 5-17 Spare part country codes

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

6 Computer Setup (BIOS), TPM, and HP Sure Start

Using Computer Setup

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

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

Starting Computer Setup

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

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, choose one of the following methods:

- To exit Computer Setup menus without saving your changes, select **Main**, select **Ignore Changes and Exit**, and then select **Yes**.

 **NOTE:** If you are using arrow keys to highlight your choice, you must then press **enter**.

- To save your changes and exit Computer Setup menus, select **Main**, select **Save Changes and Exit**, and then select **Yes**.

 **NOTE:** If you are using arrow keys to highlight your choice, you must 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 60](#).
2. Select **Main**, select **Apply Factory Defaults and Exit**, and then select **Yes**.

 **NOTE:** If you are using arrow keys to highlight your choice, you must then press **enter**.

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

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 might be available on the HP website.

Most BIOS updates on the HP website are packaged in compressed files called *SoftPaqs*.

Some download packages contain a file named *Readme.txt*, which contains information regarding installing and troubleshooting the file.

Determining the BIOS version

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


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

1. Start Computer Setup. See [Starting Computer Setup on page 60](#).
2. Select **Main**, and then select **System Information**.
3. To exit Computer Setup menus without saving your changes, select **Main**, select **Ignore Changes and Exit**, and then select **Yes**.

 **NOTE:** If you are using arrow keys to highlight your choice, you must then press **enter**.

To check for later BIOS versions, see [Downloading a BIOS update on page 61](#).

Downloading a BIOS update

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

Do not disconnect power on the computer by unplugging the power cord from the AC outlet.


Do not shut down the computer or initiate Sleep.

Do not insert, remove, connect, or disconnect any device, cable, or cord.

1. Type `support` in the taskbar search box, and then select the HP Support Assistant app.
– or –
Select the question mark icon in the taskbar.
2. Select **Updates**, and then select **Check for updates and messages**.
3. Follow the on-screen instructions.
4. At the download area, follow these steps:

- a. Identify the most recent BIOS update and compare it to the BIOS version currently installed on your computer. Make a note of the date, name, or other identifier. You might need this information to locate the update later, after it has been downloaded to your hard drive.
- b. Follow the on-screen instructions to download your selection to the hard drive.

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


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

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

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

The BIOS installation begins.

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


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

Changing the boot order using the f9 prompt


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

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

TPM BIOS settings (select products only)

 **IMPORTANT:** Before enabling Trusted Platform Module (TPM) functionality on this system, you must ensure that your intended use of TPM complies with relevant local laws, regulations and policies, and approvals or licenses must be obtained if applicable. For any compliance issues arising from your operation or usage of TPM that violates the previously 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 60](#).
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. Advanced users can customize the default configuration.

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.

7 Using HP PC Hardware Diagnostics

Using HP PC Hardware Diagnostics Windows (select products only)

HP PC Hardware Diagnostics Windows is a Windows-based utility that allows you to run diagnostic tests to determine whether the computer hardware is functioning properly. The tool runs within the Windows operating system to diagnose hardware failures.

If HP PC Hardware Diagnostics Windows is not installed on your computer, first you must download and install it. To download HP PC Hardware Diagnostics Windows, see [Downloading HP PC Hardware Diagnostics Windows on page 64](#).

After HP PC Hardware Diagnostics Windows is installed, follow these steps to access it from HP Help and Support or HP Support Assistant.

1. To access HP PC Hardware Diagnostics Windows from HP Help and Support:

- a. Select the **Start** button, and then select **HP Help and Support**.
- b. Select **HP PC Hardware Diagnostics Windows**.

– or –

To access HP PC Hardware Diagnostics Windows from HP Support Assistant:

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

– or –

Select the question mark icon in the taskbar.

- b. Select **Troubleshooting and fixes**.
- c. Select **Diagnostics**, and then select **HP PC Hardware Diagnostics Windows**.

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

 **NOTE:** To stop a diagnostic test, select **Cancel**.

When HP PC Hardware Diagnostics Windows detects a failure that requires hardware replacement, a 24-digit Failure ID code is generated. The screen displays one of the following options:

- A Failure ID link is displayed. Select the link and follow the on-screen instructions.
- Instructions for calling support are displayed. Follow those instructions.

Downloading HP PC Hardware Diagnostics Windows

- The HP PC Hardware Diagnostics Windows downloading instructions are provided in English only.
- You must use a Windows computer to download this tool because only .exe files are provided.

Downloading the latest HP PC Hardware Diagnostics Windows version

To download HP PC Hardware Diagnostics Windows, follow these steps:

1. Go to <http://www.hp.com/go/techcenter/pcdiags>. The HP PC Diagnostics home page is displayed.
2. Select **Download HP Diagnostics Windows**, and then select a location on your computer or a USB flash drive.

The tool downloads to the selected location.

– or –

You can use the following steps to download the HP PC Hardware Diagnostics Windows from the Microsoft Store:

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

The tool downloads to the selected location.

Downloading HP Hardware Diagnostics Windows by product name or number (select products only)



NOTE: For some products, you might have to download the software to a USB flash drive by using the product name or number.

To download HP PC Hardware Diagnostics Windows by product name or number, follow these steps:

1. Go to <http://www.hp.com/support>.
2. Select **Get software and drivers**, select your type of product, and then enter the product name or number in the search box that is displayed.
3. In the **Diagnostics** section, select **Download**, and then follow the on-screen instructions to select the specific Windows diagnostics version to be downloaded to your computer or USB flash drive.

The tool downloads to the selected location.

Installing HP PC Hardware Diagnostics Windows

To install HP PC Hardware Diagnostics Windows, follow these steps:

- ▲ Navigate to the folder on your computer or the USB flash drive where the .exe file downloaded, double-click the .exe file, and then follow the on-screen instructions.

Using HP PC Hardware Diagnostics UEFI



NOTE: For Windows 10 S computers, you must use a Windows computer and a USB flash drive to download and create the HP UEFI support environment because only .exe files are provided. For more information, see [Downloading HP PC Hardware Diagnostics UEFI to a USB flash drive on page 66](#).

HP PC Hardware Diagnostics UEFI (Unified Extensible Firmware Interface) 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.


If your PC does not start in Windows, you can use HP PC Hardware Diagnostics UEFI to diagnose hardware issues.

When HP PC Hardware Diagnostics UEFI detects a failure that requires hardware replacement, a 24-digit Failure ID code is generated. For assistance in solving the problem:

- ▲ Select **Contact HP**, accept the HP privacy disclaimer, and then use a mobile device to scan the Failure ID code that appears on the next screen. The HP Customer Support - Service Center page appears with your Failure ID and product number automatically filled in. Follow the on-screen instructions.

– or –

Contact support, and provide the Failure ID code.

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

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

Starting HP PC Hardware Diagnostics UEFI

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 flash drive

 **NOTE:** To download the HP PC Hardware Diagnostics UEFI tool to a USB flash drive, see [Downloading the latest HP PC Hardware Diagnostics UEFI version on page 66](#).

- b. Hard drive


- c. BIOS

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

Downloading HP PC Hardware Diagnostics UEFI to a USB flash drive

Downloading HP PC Hardware Diagnostics UEFI to a USB flash drive can be useful in the following situations:

- HP PC Hardware Diagnostics UEFI is not included in the preinstallation image.
- HP PC Hardware Diagnostics UEFI is not included in the HP Tool partition.
- The hard drive is damaged.

 **NOTE:** The HP PC Hardware Diagnostics UEFI downloading 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 provided.

Downloading the latest HP PC Hardware Diagnostics UEFI version

To download the latest HP PC Hardware Diagnostics UEFI version to a USB flash drive:

1. Go to <http://www.hp.com/go/techcenter/pcdiags>. The HP PC Diagnostics home page is displayed.
2. Select **Download HP Diagnostics UEFI**, and then select **Run**.

Downloading HP PC Hardware Diagnostics UEFI by product name or number (select products only)

 **NOTE:** For some products, you might have to download the software to a USB flash drive by using the product name or number.


To download HP PC Hardware Diagnostics UEFI by product name or number (select products only) to a USB flash drive:

1. Go to <http://www.hp.com/support>.
2. Enter the product name or number, select your computer, and then select your operating system.
3. In the **Diagnostics** section, follow the on-screen instructions to select and download the specific UEFI Diagnostics version for your computer.

Using Remote HP PC Hardware Diagnostics UEFI settings (select products only)

Remote HP PC Hardware Diagnostics UEFI is a firmware (BIOS) feature that downloads HP PC Hardware Diagnostics UEFI to your computer. It can then execute the diagnostics on your computer, and it might upload results to a preconfigured server. For more information about Remote HP PC Hardware Diagnostics UEFI, go to <http://www.hp.com/go/techcenter/pcdiags>, and then select **Find out more**.

Downloading Remote HP PC Hardware Diagnostics UEFI

 **NOTE:** HP Remote PC Hardware Diagnostics UEFI is also available as a SoftPaq that you can download to a server.

Downloading the latest Remote HP PC Hardware Diagnostics UEFI version

To download the latest Remote HP PC Hardware Diagnostics UEFI version, follow these steps:

1. Go to <http://www.hp.com/go/techcenter/pcdiags>. The HP PC Diagnostics home page is displayed.
2. Select **Download Remote Diagnostics**, and then select **Run**.

Downloading Remote HP PC Hardware Diagnostics UEFI by product name or number

 **NOTE:** For some products, you might have to download the software by using the product name or number.

To download HP Remote PC Hardware Diagnostics UEFI by product name or number, follow these steps:

1. Go to <http://www.hp.com/support>.
2. Select **Get software and drivers**, select your type of product, enter the product name or number in the search box that is displayed, select your computer, and then select your operating system.
3. In the **Diagnostics** section, follow the on-screen instructions to select and download the **Remote UEFI** version for the product.

Customizing Remote HP PC Hardware Diagnostics UEFI settings

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

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

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

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

Your changes take effect when the computer restarts.

8 Diagnostics and troubleshooting

LEDs

Table 8-1 Power and 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 stops, but the LED stays 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 100 MB speed connection.</p>	
IDE LED is Off	When the unit is turned on and the flash activity light is off, then there is no access to the system flash.
IDE LED blinks white	Indicates the system is accessing the internal IDE flash.

Wake-on LAN

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

To enable or disable WOL:

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



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

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

Power-on sequence

When you turn the thin client 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. Starts the operating system.

Resetting the Setup and Power-on passwords

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

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

Power-on diagnostic tests

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



NOTE: You can 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 8-2 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 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 8-3 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 2 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 2 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 2 second pause. Beeps stop after fifth iteration, but LEDs continue until problem is solved.	4	Power failure (power supply is overloaded). OR The incorrect external power supply adapter is being used on the unit.	<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 turn off the thin client and replace one device at a time. Repeat this procedure until failure occurs. Replace the device that is causing the failure. Continue adding devices one at a time to ensure that all devices are functioning properly.2. Replace the power supply.3. Replace the system board.
Red Power LED flashes five times, once every second, followed by a 2 second pause. Beeps stop after fifth iteration, but LEDs continue until problem is solved.	5	Prevideo memory error.	<p>IMPORTANT: 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.

Table 8-3 Diagnostic front panel LEDs and audible codes (continued)

Activity	Beeps	Possible Cause	Recommended Action
			<ol style="list-style-type: none">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 2 second pause. Beeps stop after fifth iteration, but LEDs continue until problem is solved.	6	Pre-video graphics error.	For systems with a graphics card: <ol style="list-style-type: none">1. Reseat the graphics card.2. Replace the graphics card.3. Replace the system board. For systems with integrated graphics, replace the system board.
Red Power LED flashes eight times, once every second, followed by a 2 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 turn on, and LEDs are not flashing.	None	System unable to turn on.	Press and hold the power button for less than 4 seconds. If the solid-state drive LED turns white, the power button is working correctly. Try the following: <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 beeps once after a POST text message is displayed on the screen.

Table 8-4 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. You might have to replace the RTC battery.	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. Confirm that 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 8-4 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. Verify that none of the keys are pressed.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 turn on, review the following items.

Table 8-5 Startup troubleshooting

Issue	Procedures
The thin client unit is experiencing operating problems.	Confirm 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 turn 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 turns 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 that 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 before the newly connected USB peripheral will not complete their device actions.	An unknown USB peripheral might 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 that 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 turn 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.

Discless (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 8-6 Discless unit troubleshooting

Item	Information	Action
MAC Address	NIC portion of the system board is OK	If there is no MAC Address, the system board is at fault. Contact the Call Center for service.
GUID	General system board information	If there is no GUID information, the system board is at fault and should be replaced.
Client ID	Information from server	If there is no Client ID information, there is no network connection. Possible causes include a bad cable, nonfunctioning server, or bad system board. Contact the Call Center for service for the bad system board.
MASK	Information from server	If there is no MASK information there is no network connection. Possible causes include a bad cable, nonfunctioning server, or bad system board. Contact the Call Center for service for the bad system board.
DHCP IP	Information from server	If there is no DHCP IP information there is no network connection. Possible causes include a bad cable, nonfunctioning server, or 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 restarts the boot cycle.

3. If you are running in a Linux environment, an error message appears 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 following services must be running, and they might 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.

9 Backup and recovery information

This chapter provides information about software to be used for backup and recovery. The information in the chapter is standard procedure for most Thin Client products.

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




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

Use HP ThinUpdate software for the following processes:

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

10 Using HP ThinUpdate to restore the image

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

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

Use HP ThinUpdate software for the following processes:

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

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

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

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

System requirements

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

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

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

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

11 Device management

The thin client includes a license for HP Device Manager and has a Device Manager agent preinstalled. 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 about HP Device Manager, visit www.hp.com/go/hpdm.

If you want 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

Table 12-1 Computer specifications

	Metric	U.S.
Dimensions		
Depth	237.70 mm	9.36 in
Width	324.20 mm	12.76 in
Height	17.95 mm	0.71 in
Weight		
M.2 SSD models	1.6 kg	3.53 lbs
Hard drive models	1.7 kg	3.75 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	125 g, 2 ms, half-sine	
Nonoperating	200 g, 2 ms, half-sine	
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

Table 12-2 Display specifications

	Metric	U.S.
Active diagonal size	35.6 cm	14.0 in
Resolution	1366 × 768 (HD) 1920 × 1080 (FHD)	
Surface treatment	Antiglare	
Brightness	220 nits (HD panels) 250 nits (FHD, nonprivacy panels) 1000 nits (FHD, privacy panels)	
Viewing angle	SVA (HD) UWVA (FHD)	
Backlight	LED	
Display panel interface	eDP	

Solid-state drive specifications

Table 12-3 Solid-state drive specifications

	128 GB*
Height	1.0 mm
Length	50.8 mm
Width	28.9 mm
Weight	< 10 g
Transfer rate	
Sequential read	up to 2150 MB/s
Random read	Up to 300,000 IOPs
Sequential write	up to 1260 MB/s
Random write	Up to 100,000 IOPs
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 hard drive storage capacity. Actual accessible capacity is less. Actual drive specifications may differ slightly.


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

13 Statement of memory volatility

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


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


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


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

Current BIOS steps

1. Follow steps (a) through (l) to restore the nonvolatile memory that can contain personal data. Restoring or reprogramming nonvolatile memory that does not store personal data is neither necessary nor recommended.
 - a. Turn on or restart the computer, and then press **esc** while the “Press the ESC key for Startup Menu” message is displayed at the bottom of the screen.

 **NOTE:** If the system has a BIOS administrator password, enter the password at the prompt.
 - b. Select **Main**, select **Apply Factory Defaults and Exit**, and then select **Yes** to load defaults.
The computer reboots.
 - 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 reboots.
 - e. During the reboot, press **esc** while the “Press the ESC key for Startup Menu” message is displayed at the bottom of the screen.

 **NOTE:** If the system has a BIOS administrator password, enter the password at the prompt.
 - f. If an asset or ownership tag is set, select the **Security** menu and scroll down to the **Utilities** menu. Select **System IDs**, and then select **Asset Tracking Number**. Clear the tag, and then make the selection to return to the prior menu.

- g. If a DriveLock password is set, select the **Security** menu, and scroll down to **Hard Drive Utilities** under the **Utilities** menu. Select **Hard Drive Utilities**, select **DriveLock**, then clear the check box for **DriveLock password on restart**. Select **OK** to proceed.
- h. Select the **Main** menu, and then select **Reset BIOS Security to factory default**. Click **Yes** at the warning message.
The computer reboots.
- i. During the reboot, press **esc** while the “Press the ESC key for Startup Menu” message is displayed at the bottom of the screen.



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

- j. Select the **Main** menu, select **Apply Factory Defaults and Exit**, select **Yes** to save changes and exit, and then select **Shutdown**.
 - k. Reboot the system. If the system has a Trusted Platform Module (TPM), fingerprint reader, or both, one or two prompts will appear—one to clear the TPM and the other to Reset Fingerprint Sensor. Press or tap **f1** to accept or **f2** to reject.
 - l. Remove all power and system batteries for at least 24 hours.
2. Complete one of the following:
- Remove and retain the storage drive.
 - or –
 - Clear the drive contents by using a third-party utility designed to erase data from an SSD.
 - or –
 - Clear the contents of the drive by using the following BIOS Setup Secure Erase command option steps:



IMPORTANT: If you clear data using Secure Erase, you cannot recover the data.

- a. Turn on or restart the computer, and then press **esc** while the “Press the ESC key for Startup Menu” message is displayed at the bottom of the screen.
 - b. Select the **Security** menu and scroll down to the **Utilities** menu.
 - c. Select **Hard Drive Utilities**.
 - d. Under **Utilities**, select **Secure Erase**, select the hard drive storing the data you want to clear, and then follow the on-screen instructions to continue.
- or –
- Clear the contents of the drive using the following Disk Sanitizer commands steps:



IMPORTANT: If you clear data using Disk Sanitizer, you cannot recover the data.



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 Utilities**.
- 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

Table 13-1 Troubleshooting steps for 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 entered into this memory?	How is this memory write-protected?
HP Sure Start flash (select models only)	8 MB	No	Yes	Provides protected backup of critical System BIOS code, EC firmware, and critical computer configuration data for select platforms that support HP Sure Start. For more information, see Using HP Sure Start (select models only) on page 90.	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 Computer Setup (BIOS), or by changing the Windows date & time.	This memory is not write-protected.
Controller (NIC) EEPROM	64 KB (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.	You must use a utility for writing data to this memory that is available from the NIC vendor. Writing data to this ROM in an inappropriate manner will render the NIC non-functional.
DIMM Serial Presence Detect (SPD) configuration data	256 bytes per memory module, 128 bytes programmable (not customer accessible)	No	Yes	Stores memory module information.	DIMM SPD is programmed by the memory vendor.	Data cannot be written to this memory when the module is installed in a computer. The specific write-protection method varies by memory vendor.

Table 13-1 Troubleshooting steps for nonvolatile memory usage (continued)


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 entered into this memory?	How is this memory write-protected?
System BIOS	9 MB	Yes	Yes	Stores system BIOS code and computer configuration data.	System BIOS code is programmed at the factory. Code is updated when the system BIOS is updated. Configuration data and settings are entered using the Computer Setup (BIOS) or a custom utility.	NOTE: Writing data to this ROM in an inappropriate manner can render the computer non-functional. You must use a utility for writing data to this memory that 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 only in select Elite or Z models. For more information, go to http://www.hp.com/support . Select Find your product , and then follow the on-screen instructions.)	1.5 MB or 7 MB	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 must be used for updating the firmware. Only firmware updates digitally signed by Intel can be applied using this utility.
Bluetooth flash (select products only)	2 Mb	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 must be used 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 kilobit to 8 kilobit	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.	You must use a utility for writing data to this memory that is typically not made available to the public unless a firmware upgrade is necessary to address a unique issue.
Webcam (select products only)	64 kilobit	No	Yes	Stores webcam configuration and firmware.	Webcam memory is programmed using a utility from the device manufacturer that can be run from Windows.	You must use a utility for writing data to this memory that is typically not made available to the public unless a firmware

Table 13-1 Troubleshooting steps for nonvolatile memory usage (continued)

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 entered into this memory?	How is this memory write-protected?
Fingerprint reader (select products only)	512 KB 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.

- a. Turn on or restart the computer, and then press **esc** while the “Press the ESC key for Startup Menu” message is displayed at the bottom of the screen.
- b. Select **Main**, and then select **Apply Factory Defaults and Exit**.
- c. Follow the on-screen instructions.
- d. Select **Main**, select **Save Changes and Exit**, and then follow the on-screen instructions.

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

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

Like the legacy BIOS, the UEFI BIOS provides an interface to display the system information and configuration settings and to change the configuration of your computer before an OS is loaded. BIOS provides a secure run-time environment that supports a Graphic User Interface (GUI). In this environment, you can use either a pointing device (touch screen, 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 is the UEFI BIOS located?

The UEFI BIOS is located on a flash memory chip. You must use a utility to write to the chip.

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

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

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

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

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

 **IMPORTANT:** Resetting results in the loss of information.

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

- a. Turn on or restart the computer, and then press **esc** while the “Press the ESC key for Startup Menu” message is displayed at the bottom of the screen.
- b. Select **Main**, and then select **Reset Security to Factory Defaults**.
- c. Follow the on-screen instructions.
- d. Select **Main**, select **Save Changes and Exit**, and then follow the on-screen instructions.

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

Secure Boot is a feature to ensure that only authenticated code can start on a platform. If you enabled Secure Boot and created Custom Secure Boot Keys, disabling Secure Boot does 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 V ac, or from 220 to 240 V ac.

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

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

Requirements for all countries

The following requirements are applicable to all countries and regions:

- The length of the power cord set must be at least **1.0 m** (3.3 ft) and no more than **2.0 m** (6.5 ft).
- All power cord sets must be approved by an acceptable accredited agency responsible for evaluation in the country or region where the power cord set will be used.
- The power cord sets must have a minimum current capacity of 10 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

Table 14-1 Power cord requirements for specific countries and regions

Country/region	Accredited agency	Applicable note number
Argentina	IRAM	1
Australia	SAA	1
Austria	OVE	1
Belgium	CEBEC	1
Brazil	ABNT	1
Canada	CSA	2
Chile	IMQ	1
Denmark	DEMKO	1
Finland	FIMKO	1
France	UTE	1
Germany	VDE	1
India	BIS	1
Israel	SII	1
Italy	IMQ	1
Japan	JIS	3
The Netherlands	KEMA	1
New Zealand	SANZ	1
Norway	NEMKO	1
The People's Republic of China	CCC	4
Saudi Arabia	SASO	7
Singapore	PSB	1
South Africa	SABS	1
South Korea	KTL	5
Sweden	SEMKO	1
Switzerland	SEV	1
Taiwan	BSMI	6
Thailand	TISI	1
The United Kingdom	ASTA	1
The United States	UL	2

1. The flexible cord must be Type H05VV-F, 3-conductor, 0.75 mm² conductor size. Power cord set fittings (appliance coupler and wall plug) must bear the certification mark of the agency responsible for evaluation in the country or region where it will be used.

Table 14-1 Power cord requirements for specific countries and regions (continued)

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

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