



HP Spectre Notebook PC (model numbers 13-v100 through 13-v199)

Maintenance and Service Guide
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Product notice

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

Not all features are available in all editions of Windows. This computer may require upgraded and/or separately purchased hardware, drivers, and/or software to take full advantage of Windows functionality. See <http://www.microsoft.com> for details.

Software terms

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

For any further information or to request a full refund of the computer, please contact your local point of sale (the seller).

Safety warning notice

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

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1 Product description

Category	Description
Product Name	HP Spectre Notebook PC (model numbers 13-v100 through 13-v199)
Processors	- Intel® Core™ i7-7500U 2.70-GHz (SC turbo up to 3.50-GHz) processor (2133-MHz FSB, 4.0-MB L3 cache, dual core, 15 W) - Intel Core i5-7200U 2.50-GHz (SC turbo up to 3.10-GHz) processor (2133-MHz FSB, 3.0-MB L3 cache, dual core, 15 W) - Intel Core i7-6500U 2.50-GHz (SC turbo up to 3.10-GHz) processor (1866-MHz FSB, 4.0-MB L3 cache, dual core, 15 W) - Intel Core i5-6200U 2.30-GHz (SC turbo up to 2.80-GHz) processor (1866-MHz FSB, 3.0-MB L3 cache, dual core, 15 W)
Chipset	Integrated soldered-on-circuit (SOC)
Graphics	Internal graphics: Intel HD Graphics 620 on computer models equipped with an Intel Core i7-7500U or Intel Core i5-7200U processor Intel HD Graphics 520 on computer models equipped with an Intel Core i7-6500U or Intel Core i5-6200U processor Support for HD Decode, DX12, and DisplayPort 1.2
Panel	16:9 Ultra Wide Aspect Ratio 13.3-in, ultra high-definition (UHD), white light-emitting diode (WLED), BrightView (3840×2160), ultraslim-flat (2.0-mm, 2.2-mm panel PCA), UWVA, eDP+PSR display panel; typical brightness: 340 nits 13.3-in, full high-definition (FHD), WLED, BrightView (1920×1080), uslim-flat (2.0-mm panel, 2.2 mm panel PCA), UWVA display panel; eDP+PSR; typical brightness: 300 nits Flush glass panel cover with direct bonding
Memory	On-board system memory Support for LPDDR3-1866 dual channel support Support for 8192-MB maximum system memory
Storage	Support for solid-state drives in the following configurations: 1-TB, 2280, PCIe, 3×4, NVMe, 3LC, 1 side, SN 512-GB, M.2, 2280, NVMe, supporting triple-level cell (TLC) 256-GB, M.2, 2280, NVMe, supporting TLC
Camera and microphone	HP TrueVision HD webcam – indicator LED, USB 2.0, BSI sensor, f2.4 1280×720 by 30 frames per second Integrated dual-array digital microphones with appropriate beam-forming, echo-cancellation, noise-reduction software Enable HP Noise Cancellation with automatic speech recognition (ASR)
Audio	Bang & Olufsen

Category	Description
Audio <i>(continued)</i>	Quad speakers Supports Smart Amp functionality
Wireless	Integrated Wireless options with dual antennas (LGA/PCIe 1216) Support for the following WLAN module: Intel Dual band wireless-AC 8260 802.11ac 2x2 WiFi + BT 4.2 Combo Adaptor (non-vPro) Intel WiDi support Compatible with Miracast-certified devices
Internal card expansion	One M.2 slot for solid-state drive
Ports	Hot plug/unplug and auto detect for correct output to wide-aspect vs. standard aspect video (auto adjust panel resolution to fit embedded panel and external monitor connected) Headphone/microphone combo USB Type-C ports on unit: • (2) USB 3.1 Gen 2 with Thunderbolt™ Gen 3 technology - rear, middle • (1) USB 3.1 Gen 1 (i.e. USB 3.0) - rear • Intel Alpine Ridge DP design • All ports support data transfer, power delivery, Display Port 1.2 out up to 4096×2304 (60Hz) and HDMI 1.4 out through dongle • All ports support USB Boost
Keyboard/pointing devices	Full-size, backlit, island-style keyboard TouchPad requirements: • Image sensor ClickPad with glass surface • MultiTouch gestures enabled • Support for modern TrackPad gestures • Taps enabled as default
Power requirements	AC adapter Support for 45-W USB Type-C straight type adapter Duck head power cord 1.8-meter (6-foot) power cord Battery Support for 4-cell, 38-Wh, 4.95-Ah, li-ion battery
Security	Support for Trusted Platform Module (TPM) 2.0
Operating system	Preinstalled: Windows 10 and Windows 10 Professional For Developed Market (ML): Windows 10 Home High End ML For Emerging Market (EM/SL): • Windows 10 Home High End EM/SL • CPPP Windows 10 Home China Language Edition

Category	Description
Operating system <i>(continued)</i>	• SEAP Windows 10 Home High End EM/SL
Serviceability	End user replaceable part: AC adapter

2 External component identification

Locating hardware

To find out what hardware is installed on your computer:

- ▲ Type `device manager` in the taskbar search box, and then select the **Device Manager** app.

A list displays all the devices installed on your computer.

For information about system hardware components and the system BIOS version number, press `fn+esc` (select products only).

Locating software

To find out what software is installed on your computer:

- ▲ Select the **Start** button, and then select **All apps**.

— or —

Right-click the **Start** button, and then select **Programs and Features**.

Display



Component		Description
(1)	WLAN antennas*	Send and receive wireless signals to communicate with wireless local area networks (WLANs).
(2)	Internal microphones (2)	Record sound.
(3)	Webcam light	On: The webcam is in use.
(4)	Webcam	Records video and captures photographs. Some products allow you to video conference and chat online using streaming video. To use a webcam (integrated camera): ▲ Type <code>camera</code> in the taskbar search box, and then select Camera .

*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:

▲ Select the **Start** button, select **All apps**, select **HP Help and Support**, and then select **HP Documentation**.

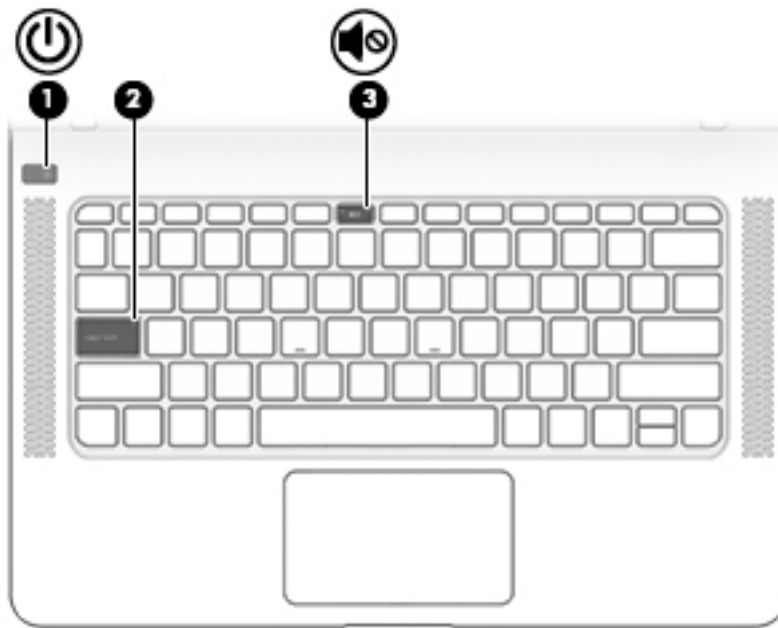
Top

TouchPad



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

Lights



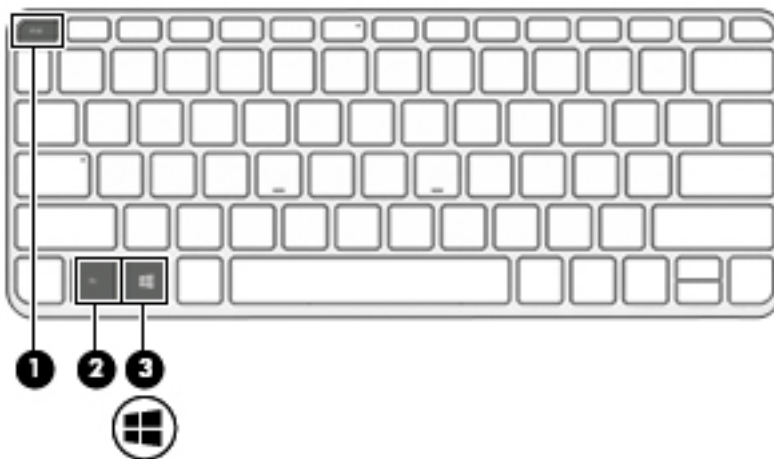
Component		Description
(1)	 Power light	- On: The computer is on. - Blinking: The computer is in the Sleep state, a power-saving state. The computer shuts off power to the display and other unneeded components. - Off: The computer is off or in Hibernation. Hibernation is a power-saving state that uses the least amount of power.
(2)	Caps lock light	On: Caps lock is on, which switches the key input to all capital letters.
(3)	 Mute light	- Amber: Computer sound is off. - Off: Computer sound is on.

Button and speakers



Component		Description
(1)	 Power button	- 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. - When the computer is in Hibernation, press the button briefly to exit Hibernation. CAUTION: Pressing and holding down the power button results in the loss of unsaved information. If the computer has stopped responding and shutdown procedures are ineffective, press and hold the power button down for at least 5 seconds to turn off the computer. To learn more about your power settings, see your power options. ▲ Type <code>power</code> in the taskbar search box, and then select Power and sleep settings. — or — Right-click the Start button, and then select Power Options.
(2)	Speakers (4)	Produce sound.

Keys



Component		Description
(1)	esc key	Displays system information when pressed in combination with the fn key.
(2)	fn key	Executes frequently used system functions when pressed in combination with the esc key or one of the action keys.
(3)	 Windows key	Opens the Start menu. NOTE: Pressing the Windows key again will close the Start menu.
(4)	Action keys	Execute frequently used system functions. NOTE: On select products, the f5 action key turns the keyboard backlight feature off or on.

Using the action keys

- An action key performs an assigned function.
- The icon on each action key illustrates the function for that key.
- To use an action key, press and hold the key.

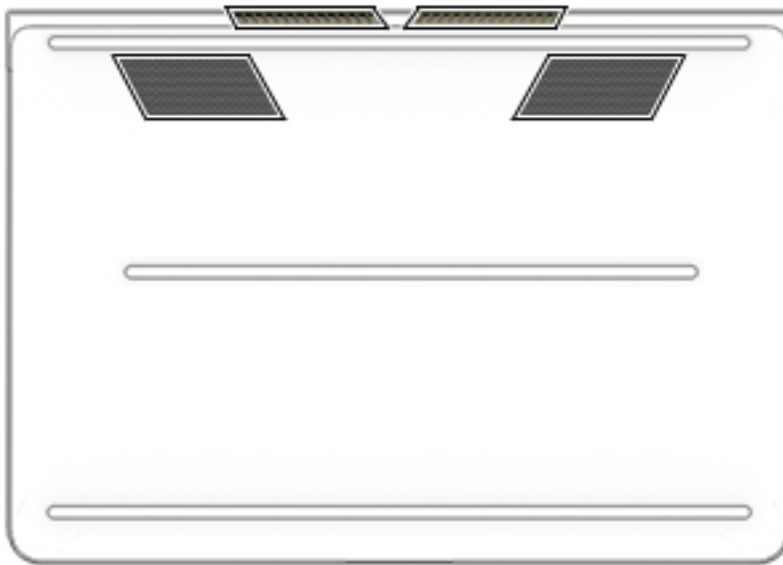
Icon	Description
	Decreases the screen brightness incrementally as long as you hold down the key.
	Increases the screen brightness incrementally as long as you hold down the key.
	Switches the screen image between display devices connected to the system. For example, if a monitor is connected to the computer, repeatedly pressing this key alternates the screen image from the computer display to the monitor display to a simultaneous display on both the computer and the monitor.
	Turns the keyboard backlight off or on. NOTE: To conserve battery power, turn off this feature.
	Plays the previous track.
	Starts, pauses, or resumes playback.
	Plays the next track.
	Decreases speaker volume incrementally while you hold down the key.
	Increases speaker volume incrementally while you hold down the key.
	Mutes or restores speaker sound.
	Turns the airplane mode and wireless feature on or off. NOTE: The airplane mode key is also referred to as the wireless button. NOTE: A wireless network must be set up before a wireless connection is possible.

Rear side



Component	Description
(1)  AC adapter and battery light	- White: The AC adapter is connected and the battery is fully charged. - Blinking white: The AC adapter is disconnected and the battery has reached a low battery level. - Amber: The AC adapter is connected and the battery is charging. - Off: The battery is not charging.
(2)  USB Type-C power connector and charging port	Connects a USB device with a Type-C connector to an AC adapter to provide power to the computer and can provide video output. This port can also charge products such as cell phones, laptops, tablets, and MP3 players, even when the computer is off. NOTE: Adapters (purchased separately) may be required.
(3)  USB Type-C power connector and Thunderbolt ports (2)	Connect USB devices with a Type-C connector to an AC adapter to provide power to the computer and can provide video or high-resolution display output. These ports can also charge products such as cell phones, laptops, tablets, and MP3 players, even when the computer is off. NOTE: Your computer may also support a Thunderbolt docking station. NOTE: Adapters (purchased separately) may be required.
(4)  Audio-out (headphone)/Audio-in (microphone) combo jack	Connects optional powered stereo speakers, headphones, earbuds, a headset, or a television audio cable. Also connects an optional headset microphone. This jack does not support optional standalone microphones. WARNING! To reduce the risk of personal injury, adjust the volume before putting on headphones, earbuds, or a headset. For additional safety information, refer to the <i>Regulatory, Safety, and Environmental Notices</i>. To access this guide: ▲ Select the Start button, select All apps, select HP Help and Support, and then select HP Documentation. NOTE: When a device is connected to the jack, the computer speakers are disabled.

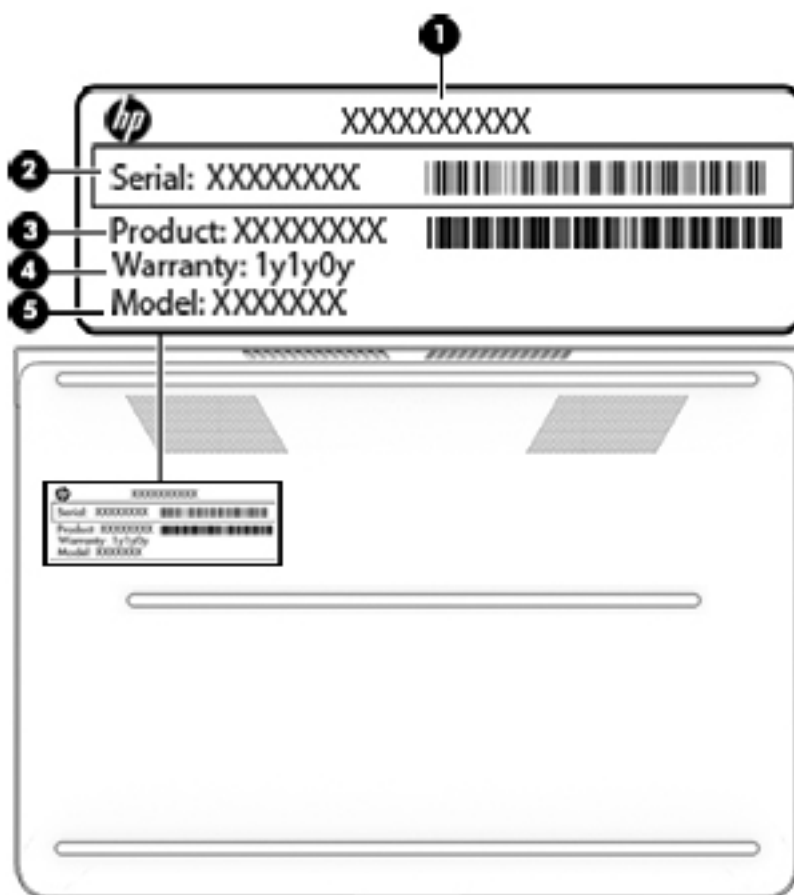
Bottom



Component	Description
Vents (4)	Enable airflow to cool internal components. NOTE: The computer fan starts up automatically to cool internal components and prevent overheating. It is normal for the internal fan to cycle on and off during routine operation.

Service tag

When ordering parts or requesting information, provide the computer serial number and model number provided on the service tag.

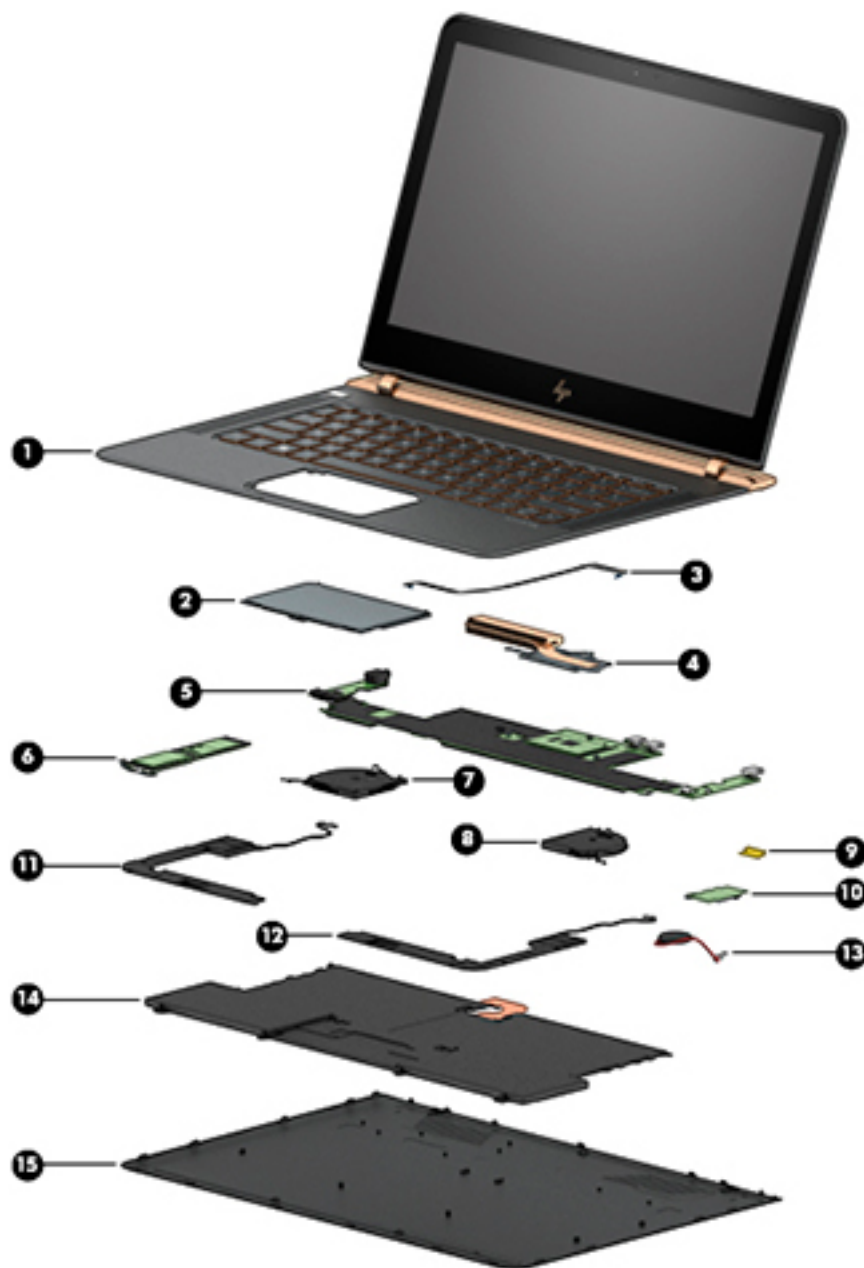


Item	Description	Function
(1)	Product name	This is the product name affixed to the front of the computer.
(2)	Serial number (s/n)	This is an alphanumeric identifier that is unique to each product.
(3)	Part number/Product number (p/n)	This number provides specific information about the product's hardware components. The part number helps a service technician to determine what components and parts are needed.
(4)	Warranty period	This number describes the duration of the warranty period for the computer.
(5)	Model description	This is the alphanumeric identifier used to locate documents, drivers, and support for the computer.

3 Illustrated parts catalog

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

Computer major components

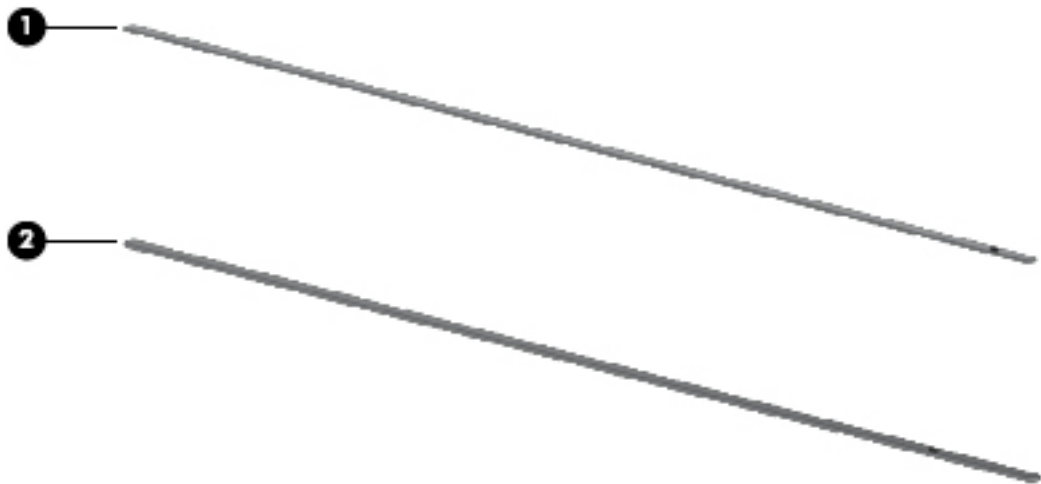


Item	Component	Spare part number
(1)	Display assembly with keyboard and top cover:	
	Equipped with a 13.3-in, UHD, WLED, BrightView (3840×2160), ultraslim-flat (2.0-mm, 2.2-mm panel PCA), UWVA, eDP +PSR display panel	
	For use in Belgium	909170-A41
	For use in Bulgaria	909170-261
	For use in Canada	909170-DB1
	For use in the Czech Republic and Slovakia	909170-FL1
	For use in Denmark, Finland, and Norway	909170-DH1
	For use in France	909170-051
	For use in Germany	909170-041
	For use in Greece	909170-151
	For use in Hungary	909170-211
	For use in Israel	909170-BB1
	For use in Italy	909170-061
	For use in Japan	909170-291
	For use in Latin America	909170-161
	For use in the Netherlands	909170-B31
	For use in Portugal	909170-131
	For use in Romania	909170-271
	For use in Russia	909170-251
	For use in Saudi Arabia	909170-171
	For use in Slovenia	909170-BA1
	For use in South Korea	909170-AD1
	For use in Spain	909170-071
	For use in Switzerland	909170-BG1
	For use in Taiwan	909170-AB1
	For use in Thailand	909170-281
	For use in Turkey	909170-141
	For use in the United Kingdom and Singapore	909170-031
	For use in the United States	909170-001
	Equipped with a 13.3-in, FHD, WLED, BrightView (1920×1080), ultraslim-flat (2.0-mm, 2.2-mm panel PCA), UWVA, eDP +PSR display panel:	
	For use in Belgium	855641-A41
	For use in Bulgaria	855641-261
	For use in Canada	855641-DB1

Item	Component	Spare part number
	For use in the Czech Republic and Slovakia	855641-FL1
	For use in Denmark, Finland, and Norway	855641-DH1
	For use in France	855641-051
	For use in Germany	855641-041
	For use in Greece	855641-151
	For use in Hungary	855641-211
	For use in Israel	855641-BB1
	For use in Italy	855641-061
	For use in Japan	855641-291
	For use in Latin America	855641-161
	For use in the Netherlands	855641-B31
	For use in Portugal	855641-131
	For use in Romania	855641-271
	For use in Russia	855641-251
	For use in Saudi Arabia	855641-171
	For use in Slovenia	855641-BA1
	For use in South Korea	855641-AD1
	For use in Spain	855641-071
	For use in Switzerland	855641-BG1
	For use in Taiwan	855641-AB1
	For use in Thailand	855641-281
	For use in Turkey	855641-141
	For use in the United Kingdom and Singapore	855641-031
	For use in the United States	855641-001
(2)	TouchPad board	855632-001
(3)	TouchPad board cable	855627-001
(4)	Heat sink (includes replacement thermal material)	854752-001
(5)	System board (includes processor and replacement thermal material):	
	Equipped with an Intel Core i7-7500U 2.70-GHz (SC turbo up to 3.50-GHz) processor (2133-MHz FSB, 4.0-MB L3 cache, dual core, 15 W), 8-GB of system memory, and the Windows 10 Professional operating system for use only on computer models equipped with a UHD display assembly	909201-601
	Equipped with an Intel Core i7-7500U 2.70-GHz (SC turbo up to 3.50-GHz) processor (2133-MHz FSB, 4.0-MB L3 cache, dual core, 15 W), 8-GB of system memory, 8-GB of system memory, and a non-Windows operating system for use only on computer models equipped with a UHD display assembly	909201-001

Item	Component	Spare part number
	Equipped with an Intel Core i7-7500U 2.70-GHz (SC turbo up to 3.50-GHz) processor (2133-MHz FSB, 4.0-MB L3 cache, dual core, 15 W), 8-GB of system memory, and the Windows 10 Professional operating system for use only on computer models equipped with an FHD display assembly	901720-601
	Equipped with an Intel Core i7-7500U 2.70-GHz (SC turbo up to 3.50-GHz) processor (2133-MHz FSB, 4.0-MB L3 cache, dual core, 15 W), 8-GB of system memory, 8-GB of system memory, and a non-Windows operating system for use only on computer models equipped with an FHD display assembly	901720-001
	Equipped with an Intel Core i5-7200U 2.50-GHz (SC turbo up to 3.10-GHz) processor (2133-MHz FSB, 3.0-MB L3 cache, dual core, 15 W), 8-GB of system memory, and the Windows 10 Professional operating system	901719-601
	Equipped with an Intel Core i5-7200U 2.50-GHz (SC turbo up to 3.10-GHz) processor (2133-MHz FSB, 3.0-MB L3 cache, dual core, 15 W), 8-GB of system memory, 8-GB of system memory, and a non-Windows operating system	901719-001
	Equipped with an Intel Core i7-6500U processor, 8 GB of system RAM, and the Windows 10 Professional operating system	854753-601
	Equipped with an Intel Core i7-6500U 2.50-GHz processor, 8 GB of system RAM, and a non-Windows operating system	854753-001
	Equipped with an Intel Core i5-6200U 2.30-GHz processor, 8 GB of system RAM, and the Windows 10 Professional operating system	860825-601
	Equipped with an Intel Core i5-6200U 2.30-GHz processor, 8 GB of system RAM, and a non-Windows operating system	860825-001
(6)	Solid-state drive	
	1-TB, 2280, PCIe, 3×4, NVMe, 3LC, 1 side, SN solid-state drive	908359-002
	512-GB, M.2, 2280, NVMe solid-state drive supporting TLC	855609-001
	256-GB, M.2, 2280, NVMe solid-state drive supporting TLC	855608-001
	Fans (includes left and right fans)	855629-001
(7)	Left fan	
(8)	Right fan	
(9)	WLAN board cable	855628-001
(10)	WLAN module , Intel Dual band wireless-AC 8260 802.11ac 2x2 WiFi + BT 4.2 Combo Adaptor (non-vPro)	855631-001
(11)	Left speaker	855634-001
(12)	Right speaker	855633-001
(13)	4-cell, 38-WHr, 1.66-AHr, Li-ion battery (includes cable)	844199-855
(14)	Bottom cover	855626-001

Rubber Kit



Item	Component	Spare part number
	Rubber Kit	854832-001
(1)	Top rubber strip	
(2)	Bottom rubber strip	

Miscellaneous parts

Component	Spare part number
AC adapter:	
45-W AC adapter, non-PFC, wall-mount, USB-C, 3-pin	860210-850
45-W HP Smart adapter, non-PFC, wall-mount, USB-C	848293-850
Adapters:	
HP USB-C-to-HDMI adapter	831752-001
HP USB-C-to-RJ45 Gigabit adapter	855560-001
HP USB-C-to-VGA adapter	831751-001
HP 13.3-in computer sleeve	862374-001
Power cord (C5 receptacle, 1.8-m (6.0-ft), 3-wire conductor):	
For use in Australia	213356-014 and 213356-015
For use in Europe (Austria, Belgium, Finland, France, Germany, the Netherlands, Norway and Sweden)	213350-015 and 213350-016
For use in Denmark	213353-014 and 213353-015
For use in India	404827-009 and 404827-010
For use in Israel	398063-009 and 398063-010
For use in Japan	349756-007 and 349756-008
For use in North America	213349-016 and 213349-017
For use in the People's Republic of China	286497-014 and 286497-015
For use in South Africa	361240-008 and 361240-009
For use in Switzerland	213354-014 and 213354-015
For use in Taiwan	393313-008 and 393313-009
For use in Thailand	285096-013 and 285096-014
For use in the United Kingdom	213351-014 and 213351-015
Duckhead power adapter:	
For use in South Korea	854703-001 and 854222-001

Component	Spare part number
For use in the United States	854702-001 and 854576-001
C5 connector, 3-pin, duckhead power cord for use in South Korea	846250-009
C5 connector, 2-pin, duckhead power cord for use in the United States	840802-001
Screw Kit	854833-001

4 Removal and replacement procedures preliminary requirements

Tools required

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

- Case utility tool or similar plastic, flat-tipped tool
- Flat-bladed screwdriver
- Magnetic screwdriver
- Phillips P0 and P1 screwdrivers

Service considerations

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



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

Plastic parts



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

Cables and connectors

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

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

Drive handling

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

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

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

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

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

Avoid dropping drives from any height onto any surface.

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

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

Avoid exposing a drive to temperature extremes or liquids.

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

Grounding guidelines

Electrostatic discharge damage

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

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

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

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

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

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

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

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

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

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

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

Packaging and transporting guidelines

Follow these grounding guidelines when packaging and transporting equipment:

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

Workstation guidelines

Follow these grounding workstation guidelines:

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

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