Overview

HP ProBook 650 G4

Right

1. Webcam (Select models)
2. Webcam LED (Select models)
3. Internal microphones (2)
4. Power connector
5. MicroSD card slot
6. Docking connector
7. VGA or Serial port
8. Ethernet port

9. HDMI port (Cable not included)
10. USB 3.1 Gen 1 port
11. USB 3.1 Gen 1 charging port
12. USB Type-C™ charging port (PD+DP 1.2, Gen1)
13. Audio combo jack
14. HDD LED indicator
15. Fingerprint reader (Select models)
16. Clickpad

Overview

Left

1. Smart Card Reader (Select models)
2. Optical drive (Select models)

3. Security lock slot
4. Power button

Overview

AT A GLANCE

- Windows 10 versions, or FreeDOS 2.0
- Precision-crafted slim design with fingerprint resistant modern, fresh and comfortable natural silver finish
- Choice of 8th Generation Intel® Core™ processors, with integrated graphics or optional AMD RX540 128 bit Discrete Graphics
- HP Advanced keyboard, spill resistant with optional backlit design
- Large Clickpad with gestures support
- Enhanced security features including TPM2.0, HP Privacy Camera, optional Smart Card Reader, optional FingerPrint[2] Reader (select models), and HP Sure Start Gen4.
- LED-backlit display
- 39.6 cm (15.6") diagonal HD and FHD or Touch FHD with camera and with WWAN
- HDMI port for connecting to high-resolution displays
- Optional Integrated ODD
- Optional HD webcam with dual-microphone array for video conferencing
- Two USB 3.1 Gen1 ports (1 charging) and one USB-C port (PD+DP 1.2, Gen1)
- VGA or Serial Port
- Flexible wireless connectivity options
- Battery hours up to 14.5 hours with fast charging technology
- Dual storage combines SSD fast boot up and app access with cost effective HDD mass storage
- Passed MIL-STD 810G testing[1]
- Compliance with FCC (Class B)

1. MIL STD 810G testing is not intended to demonstrate fitness for U.S. Department of Defense contract requirements or for military use. Test results are not a guarantee of future performance under these test conditions. Damage under the MIL STD test conditions or any accidental damage requires an optional HP Accidental Damage Protection Care Pack
2. HP Fingerprint Sensor is an optional feature and requires configuration at purchase.

NOTE: See important legal disclosures for all listed specs in their respective features sections.

Features

PRODUCT NAME

HP ProBook 650 G4

OPERATING SYSTEM

Preinstalled   Windows 10 Pro 64[1]
Windows 10 Pro (National Academic only)[1,2]
Windows 10 Home 64[1]
Windows 10 Home Single Language 64[1]
FreeDOS 2.0

1. 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. See http://www.windows.com/.
2. Some devices for academic use will automatically be updated to Windows 10 Pro Education with the Windows 10 Anniversary Update. Features vary; see https://aka.ms/ProEducation for Windows 10 Pro Education feature information.

PROCESSORS

Intel® Core™ i7 8650U with Intel® UHD graphics 620 (1.9 GHz base frequency, up to 3.9 GHz with Intel® Turbo Boost Technology, 8 MB cache, 4 cores) [3,4,5]
Intel® Core™ i7 8550U with Intel® UHD graphics 620 (1.8 GHz base frequency, up to 4 GHz with Intel® Turbo Boost Technology, 8 MB cache, 4 cores) [3,4,5]
Intel® Core™ i5 8350U with Intel® UHD Graphics 620 (1.7 GHz base frequency, up to 3.6 GHz with Intel® Turbo Boost Technology, 6 MB cache, 4 cores) [3,4,5]
Intel® Core™ i5 8250U with Intel® UHD Graphics 620 (1.6 GHz base frequency, up to 3.4 GHz with Intel® Turbo Boost Technology, 6 MB cache, 4 cores) [3,4,5]
Intel® Core™ i5 7300U with Intel® HD Graphics 620 (2.6 GHz base frequency, up to 3.5 GHz with Intel® Turbo Boost Technology, 3 MB cache, 2 cores) [3,4,5]
Intel® Core™ i5 7200U with Intel® HD Graphics 620 (2.5 GHz base frequency, up to 3.1 GHz with Intel® Turbo Boost Technology, 3 MB cache, 2 cores) [3,4,5]
Intel® Core™ i3 8130U with Intel® HD Graphics 620 (2.2 GHz, 4 MB cache, 2 cores) [3,4,5]
Intel® Core™ i7 8850H vPro™ processor with Intel® UHD Graphics 630 (2.6 GHz base frequency, up to 4.3 GHz with Intel® Turbo Boost Technology, 9 MB L3 cache, 6 cores) [3,4,5]

Processor Family
8th Generation Intel® Core™ i7 processor (i7 8850H, i7 8650U, i7 8550U models) [5]
8th Generation Intel® Core™ i5 processor (i5 8350U, i5 8250U models) [5]
8th Generation Intel® Core™ i3 processor (i3 8130U model) [5]
7th Generation Intel® Core™ i5 processor (i5 7300U, i5 7200U models) [5]

3. Multicore is designed to improve performance of certain software products. Not all customers or software applications will necessarily benefit from use of this technology. Performance and clock frequency will vary depending on application workload and your hardware and software configurations. Intel's numbering branding and/or naming is not a measurement of higher performance.
4. Processor speed denotes maximum performance mode; processors will run at lower speeds in battery optimization mode.
5. In accordance with Microsoft's support policy, HP does not support the Windows 8 or Windows 7 operating system on products configured with Intel and AMD 7th generation and forward processors or provide any Windows 8 or Windows 7 drivers on http://www.support.hp.com.

Features

6. Intel® Optane™ memory system acceleration does not replace or increase the DRAM in your system.
7. Intel® Turbo Boost performance varies depending on hardware, software and overall system configuration. See http://www.intel.com/technology/turboboost for more information.

CHIPSET

Chipset is integrated with processor

GRAPHICS

Integrated
Intel® UHD Graphics 630 [8]
Intel® UHD Graphics 620 [8]
Intel® HD Graphics 620 [8]

Discrete
AMD Radeon™ RX540 (2 GB GDDR5 dedicated) (Not available with H series CPUs)

8. HD content required to view HD images.
9. AMD Dynamic Switchable Graphics technology requires an Intel processor, plus an AMD Radeon™ discrete graphics configuration and is not available on FreeDOS and Linux OS. With AMD Dynamic Switchable Graphics technology, full enablement of all discrete graphics video and display features may not be supported on all systems (e.g. OpenGL applications will run on the integrated GPU or the APU as the case may be).

Features

DISPLAY

Non-Touch HD
39.6 cm (15.6") diagonal HD SVA eDP anti-glare LED-backlit, 220 cd/m², 45% NTSC, (1366 x 768) [8,10,11]
39.6 cm (15.6") diagonal HD SVA eDP anti-glare LED-backlit, 220 cd/m², 45% NTSC, for camera (1366 x 768) [8,10,11]
39.6 cm (15.6") diagonal HD SVA eDP anti-glare LED-backlit, 220 cd/m², 45% NTSC, for WWAN (1366 x 768) [8,10,11]
39.6 cm (15.6") diagonal HD SVA eDP anti-glare LED-backlit, 220 cd/m², 45% NTSC, for camera and WWAN (1366 x 768) [8,10,11]

Non-Touch FHD
39.6 cm (15.6") diagonal FHD IPS eDP anti-glare LED-backlit, 220 cd/m², 45% NTSC, (1920 x 1080) [8,10,11]
39.6 cm (15.6") diagonal FHD IPS eDP anti-glare LED-backlit, 220 cd/m², 45% NTSC, for camera (1920 x 1080) [8,10,11]
39.6 cm (15.6") diagonal FHD IPS eDP anti-glare LED-backlit, 220 cd/m², 45% NTSC, for WWAN (1920 x 1080) [8,10,11]
39.6 cm (15.6") diagonal FHD IPS eDP anti-glare LED-backlit, 220 cd/m², 45% NTSC, for camera and WWAN (1920 x 1080) [8,10,11]

Touch FHD
39.6 cm (15.6") diagonal FHD IPS eDP LED-backlit touch screen, 220 cd/m², 45% NTSC, for camera and WWAN (1920 x 1080) [7,9]

8. HD content required to view HD images.
9. Sold separately or as an optional feature.
10. Resolutions are dependent upon monitor capability, and resolution and color depth settings.
11. Sold separately or as an optional feature.

Docking station model	Total number of supported displays (incl. the notebook display)	Max. resolutions supported	Dock Connectors	Technical limitations
HP UltraSlim Docking Station	3	Dual 2.5K @ 60Hz	2xDP, 1xVGA	Dual 2.5k only with both displays into DP
HP Thunderbolt Dock G2	3	Single 2.5K @60Hz (2560 x 1440)	2xDP, 1xVGA, 1xTB, 1xUSB-C alt-mode	System will perform at USB 3.0 Gen1 speeds when connected to the dock (5Gbits) Thunderbolt port will function as a USB 2.0 port with data and power out (15W) only.
HP USB-C Dock G4	3	Dual 2K @ 60Hz Single 4K @ 60Hz (3840 x 1440)	1xHDMI, 2xDP	
HP USB-C Universal Dock	3	Dual 4K @ 60Hz Single 5K @ 60Hz	2xDP	
HP USB-C Travel Dock	2	Single 2K @ 60Hz	1xHDMI, 1xVGA	Single external display Only HDMI or VGA at the time
HP USB-C Mini Dock	2	Single 4K @ 30Hz	1xHDMI, 1xVGA	Single external display Only HDMI or VGA at the time

Features

STORAGE AND DRIVES

Primary Storage
500 GB 7200 rpm SATA[12]
500 GB 7200 rpm SATA FIPS 140-2 SED[12,13]
1 TB 7200 rpm SATA[12]

Primary M.2 Storage
16 GB Intel® Optane™ memory[45]
118 GB Intel® Optane™ SSD[12]
128 GB SATA-3 SS TLC[12]
256 GB SATA-3 TLC OPAL2[12]
256 GB PCIe NVMe SS Value[12]
256 GB PCIe Gen3x4 NVMe SS TLC[12]
512 GB SATA SS TLC (FIPS)[12]
512 GB PCIe Gen3x4 NVMe SS TLC[12]
1 TB PCIe Gen3x4 NVMe SS TLC[12]

12. For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 30 GB
(for Windows 10) is reserved for system recovery software.
13. Not available with Intel® Optane™ Memory or Intel® Optane™ SSD.
45. Intel® Optane™ memory system acceleration does not replace or increase the DRAM in your system.

Features

MEMORY

Maximum Memory
32 GB DDR4-2400 SDRAM[14]

Memory
4 GB Total System Memory (4 GB x 1)[14]
8 GB Total System Memory (4 GB x 2)[14]
8 GB Total System Memory (8 GB x 1)[14]
12 GB Total System Memory (8 GB + 4 GB)[14]
16 GB Total System Memory (16 GB x 1)[14]
16 GB Total System Memory (8 GB x 2)[14]
32 GB Total System Memory (16 GB x2)[14]

Memory Slots
2 SODIMM
Both slots are customer accessible / upgradeable
DDR4 PC4 SODIMMS - System supports run rate at 2133 in 7th Gen Processor, 2400 in 8th Gen processor
Supports Dual Channel Memory

14. Due to the non-industry standard nature of some third-party memory modules, we recommend HP branded memory to ensure compatibility. If you mix memory speeds, the system will perform at the lower memory speed.

Features

NETWORKING/COMMUNICATIONS

WLAN
Intel® Dual Band Wireless-AC 3168 802.11a/b/g/n/ac (1x1) Wi-Fi® and Bluetooth® 4.2 Combo, non-vPro™ [15,16]
Intel® Dual Band Wireless-AC 8265 802.11a/b/g/n/ac (2x2) Wi-Fi® and Bluetooth® 4.2 Combo, vPro™ [15,16]
Intel® Dual Band Wireless-AC 8265 802.11a/b/g/n/ac (2x2) Wi-Fi® and Bluetooth® 4.2 Combo, non-vPro™ [15,16]
Intel® Dual Band Wireless-AC 9560 802.11a/b/g/n/ac (2x2) Wi-Fi® and Bluetooth® 5 Combo, vPro™ [15,16]
Realtek RTL8822BE 802.11ac 2x2 Wi-Fi + Bluetooth® 4.2 Combo Adapter [15,16]
Realtek RTL8821CE 802.11ac 1x1 Wi-Fi + Bluetooth® 4.2 Combo Adapter [15,16]

WWAN
LTE CAT4: Huawei HP lt4132, LTE/HSPA+ w/GPS M.2 [17]
LTE CAT9: Fibocom Intel(R) XMM(TM) 7360 LTE-Advanced lt4210 LTE/HSPA+ w/GPS [17]

NFC
NXP NPC300 Near Field Communication Module [11]

WPAN Bluetooth®
BT 4.2 supported via all supported WLAN modules [15]

Ethernet
Intel® Ethernet Connection I219-LM 10/100/1000 (vPro™) [18]
Intel® Ethernet Connection I219-V 10/100/1000 (Non-vPro™) [18]

11. Sold separately or as an optional feature.
15. Wireless access point and Internet service required and sold separately. Availability of public wireless access points limited. The specifications for the 802.11ac WLAN are draft specifications and are not final. If the final specifications differ from the draft specifications, it may affect the ability of the notebook to communicate with other 802.11ac WLAN devices.
16. Dynamic Regulatory Solution will auto-change AC WLAN to abgn by passive scan when entering Indonesia.
17. WWAN module requires separately purchased service contract. Check with service provider for coverage and availability in your area. Connection speeds will vary due to location, environment, network conditions, and other factors. 4G LTE not available on all products, in all regions.
18. The term "10/100/1000" or "Gigabit" Ethernet indicates compatibility with IEEE standard 802.3ab for Gigabit Ethernet, and does not connote actual operating speed of 1 Gb/s. For high-speed transmission, connection to a Gigabit Ethernet server and network infrastructure is required.

Features

AUDIO/MULTIMEDIA

Audio
2 Integrated stereo speakers
Integrated dual array microphone

Webcam
720p HD HP Privacy Camera [8,11,19]

Optical Drive
DVD-ROM (Defeatured combo) [20]
DVD Writer SATA [20]

8. HD content required to view HD images.
11. Sold separately or as an optional feature.
19. Internet access required.
20. DVD-Writer does not support DVD RAM. Don't copy copyright protected materials.

KEYBOARDS/POINTING DEVICES/BUTTONS & FUNCTION KEYS

Keyboard
HP Advanced Keyboard with Numeric Keypad

Pointing Device
ClickPad, Spill-resistant with drain
ClickPad, Spill-resistant with drain, DuraKeys & Backlit
Dual Point, Spill-resistant with drain, DuraKeys & Backlit
Dual Point, Spill-resistant with drain, DuraKeys & Backlit Privacy

Function Keys
ESC: system information
F1 - Display Switching
F2 - Blank or Privacy
F3 - Brightness Down
F4 - Brightness Up
F5 - Speaker Mute
F6 - Volume Down
F7 – Volume Up
F8 - Mic Mute
F9 - Backlight Toggle (for backlit keyboard) or Blank
F10 - Blank
F11 - Wifi Toggle
F12 – Sleep

Clickpad requirements:
On/off control by driver
Taps enabled as default

Gestures:
(Win 10):
Disabled by default:
3 Finger Flick
2 Finger Rotate
Momentum Motion

Features

1 Finger Vertical Scroll
Win 10:
Support PTP with Miniport driver
Settings enabled by default by MSFT:
2 Finger Scrolling
2 Finger Zoom (Pinch)
OSD (enable/disable)
3 finger tap - Cortana
3 finger flick –App switch
4 finger tap – Action Center

SOFTWARE AND SECURITY

Preinstalled Software

BIOS

HP BIOSphere Gen4[21]

HP DriveLock & Automatic DriveLock

BIOS Update via Network

Master Boot Record Security

Power On Authentication

Secure Erase[22]

Absolute Persistence Module[23]

Pre-boot Authentication

HP Wireless Wakeup

Software

HP Native Miracast Support[20]

HP LAN-Wireless Protection

HP Velocity

HP 3D DriveGuard

HP ePrint Driver + JetAdvantage[24]

HP Hotkey Support - CMIT

HP Recovery Manager

HP Jumpstart

HP Support Assistant[25]

HP Noise Cancellation Software

HP Host Based MAC Address Manager

Buy Office (Sold separately)

Features

Manageability Features
HP Driver Packs[26]

HP System Software Manager (SSM)

HP BIOS Config Utility (BCU)

HP Client Catalog

HP Manageability Integration Kit Gen2[27]

Ivanti Management Suite[28]

Client Security Software
HP Client Security Suite Gen4 including:[29]

HP Security Manager[30] (including Credential Manager, HP Password Manager, HP Spare Key)

Power On Authentication

HP Fingerprint Sensor[32] (select models)

HP Device Access Manager

Microsoft Defender[31]

Security Management
Secure Erase[22]

TPM 2.0 Embedded Security Chip shipped with Windows 10 (Common Criteria EAL4+ Certified)

SATA 0,1 port disablement (viaBIOS)

RAID configurations[33]

Serial, USB enable/disable (viaBIOS)

Power-on password (viaBIOS)

Setup password (viaBIOS)

Support for chassis padlocks and cable lock devices

Integrated hood sensor

HP Sure Click[34]

HP Sure Start Gen4[35]

Security
TPM
Model: TPM SLB9670 VQ2.0 FW7.62 913310-002

Version: TPM 2.0

Revision: 1.16

FIPS 140-2 Compliant: Yes (select models only)

Smartcard Reader
Model number: Alcor AU9560

FIPS 201 Compliant: Yes

IPv6 Compliance
Yes

Features

MD5 Hash

Please follow the instructions below to access MD5 Hash.

Log-on to http://hp.com/support, enter your product name, select software and drivers, select OS, select driver. After selecting the driver, click on "Associated files" and then click on "Download". When opening the file, under "Purpose" you should see the appropriate "SOFTPAQ MD5:" Field

Is the BIOS on this notebook ISO/IEC 19678:2015 (formerly NIST 800-147) compliant?

Yes

UEFI version: 2.5 or 2.6 (for Intel Hexa-core processor)

20. Miracast is a wireless technology your PC can use to project your screen to TVs, projectors, and streaming
21. HP BIOSphere Gen4 features may vary depending on the PC platform and configurations requires 8th Gen Intel® processors.
22. Secure Erase for the methods outlined in the National Institute of Standards and Technology Special Publication 800-88 "Clear" sanitation method.
23. Absolute agent is shipped turned off, and will be activated when customers activate a purchased subscription. Subscriptions can be purchased for terms ranging multiple years. Service is limited, check with Absolute for availability outside the U.S. The Absolute Recovery Guarantee is a limited warranty. Certain conditions apply. For full details visit: http://www.absolute.com/company/legal/agreements/computrace-agreement. Data Delete is an optional service provided by Absolute Software. If utilized, the Recovery Guarantee is null and void. In order to use the Data Delete service, customers must first sign a Pre-Authorization Agreement and either obtain a PIN or purchase one or more RSA SecurID tokens from Absolute Software.
24. HP ePrint Driver requires an Internet connection to HP web-enabled printer and HP ePrint account registration (for a list of eligible printers, supported documents and image types and other HP ePrint details, see www.hp.com/go/eprintcenter). Print times and connection speeds may vary.
25. HP Support Assistant requires Windows and Internet access.
26. HP Driver Packs not preinstalled, however available for download at http://www.hp.com/go/clientmanagement.
27. HP Manageability Integration Kit can be downloaded from http://www8.hp.com/us/en/ads/clientmanagement/overview.html
28. Ivanti Management Suite subscription required.
29. HP Client Security Suite Gen 4 requires Windows and Intel® or AMD 8th generation processors.
30. HP Password Manager requires Internet Explorer or Chrome or FireFox. Some websites and applications may not be supported. User may need to enable or allow the add-on / extension in the internet browser.
31. Microsoft Defender Opt in and internet connection required for updates.
32. HP Fingerprint Sensor is an optional feature and requires configuration at purchase.
33. RAID configuration is optional and does require a second hard drive.
34. HP Sure Click is available on select HP platforms and supports Microsoft® Internet Explorer, Google Chrome, and Chromium™. Supported attachments include Microsoft Office (Word, Excel, PowerPoint) and PDF files in read only mode. Check http://h20195.www2.hp.com/v2/GetDocument.aspx?docname=4AA7-0922ENW for all compatible platforms as they become available.
35. HP Sure Start Gen4 is available on HP EliteBook products equipped with Intel® 8th generation processors.

Features

POWER

Power Supply
HP Smart 45 W right angle 4.5 mm AC Adapter[36]

HP Smart 90 W External AC power adapter [35,37]

HP Smart 90 W External AC power adapter w/Dongle [35,37]

HP Smart 65 W right angle 4.5 mm AC Adapter[36]

HP Smart 45 W right angle 4.5 mm AC Adapter 2-prong (Japan only)[36]

HP Smart 65 W USB Type-C™ adapter[36]

HP Smart 45 W USB Type-C™ adapter[36]

90 W USB Type-C™ adapter[36,37]

HP Smart 90 W External AC power adapter[36,37]

HP Smart 90 W External AC power adapter w/Dongle[36,37]

Primary Battery
HP Long Life 3-cell, 48 Wh Li-ion[37,38]
HP Fast Charge Technology - 90% in 90 minutes[40]

Power Cord
3-wire plug (C5), 1.8 m, Sticker, Conventional[36]
3-wire plug (C5), 1 m, Sticker, Conventional[36]
2-wire plug (C5), 1 m, Sticker, Conventional (Japan only)[36]

Battery Life
Up to 14 hours 15 mins (With Intel® 7th Gen CPU) (with SSD)[39]
Up to 14 hours and 30 minutes With Intel® 8th Gen CPU (with SSD)[39]
Up to 10 hours (With 8th Gen Intel® Hexa-Core processor)[39]

36. Availability may vary by country.
37. Supports HP Fast Charging.
38. Battery is internal and not replaceable by customer. Serviceable by warranty.
39. Windows 10 MM14 battery life will vary depending on various factors including product model, configuration, loaded applications, features, use, wireless functionality, and power management settings. The maximum capacity of the battery will naturally decrease with time and usage. See http://www.bapco.com for additional details.
40. Recharges the battery up to 90% within 90 minutes when the system is off or in standby mode when used with the power adapter provided with the notebook. After charging has reached 90% capacity, charging speed will return to normal. Charging time may vary +/-10% due to System tolerance.

Features

WEIGHTS & DIMENSIONS

Weight
Starting at 4.8 lb (non-touch); Starting at 5.29 lb (touch)[41]
Starting at 2.18 kg (non-touch); Starting at 2.37 kg (touch)[41]

Dimensions (W x D x H)
Non-touch
14.85 x 10.12 x 0.95 in
37.7 x 25.7 x 2.395 cm
Touch
14.85 x 10.12 x 0.99 in
37.7 x 25.7 x 2.495 cm

41. Weight will vary by configuration.

PORTS/SLOTS

Ports
1 USB 3.1 Type-C™ Gen 1 (Power delivery, DisplayPort™ 1.2)
1 USB 3.1 Gen 1 (charging)
1 USB 3.1
1 HDMI 1.4[42]
1 RJ-45
1 VGA or Serial Port
1 headphone/microphone combo
1 AC power

Expansion Slots
1 docking connector
1 microSD (multi-format digital media reader)

42. HDMI cable sold separately.

SERVICE AND SUPPORT

HP Services offers 3 year and 1 year limited warranties and 90 day support options depending on country. Long Life batteries will have the same 1-year or 3-year limited warranty as the platform. On-site service and extended coverage is also available. HP Care Pack Services are optional extended service contracts that go beyond the standard limited warranties. To choose the right level of service for your HP product, use the HP Care Pack Services Lookup Tool at: http://www.hp.com/go/cpc[43]

43. HP Care Packs are sold separately. Service levels and response times for HP Care Packs may vary depending on your geographic location. Service starts on date of hardware purchase. Restrictions and limitations apply. For details, visit www.hp.com/go/cpc. HP services are governed by the applicable HP terms and conditions of service provided or indicated to Customer at the time of purchase. Customer may have additional statutory rights according to applicable local laws, and such rights are not in any way affected by the HP terms and conditions of service or the HP Limited Warranty provided with your HP Product.

Features

ENVIRONMENTAL & INDUSTRY

HP ProBook 650 G4 Notebook PC

Eco-Label Certifications & declarations	This product has received or is in the process of being certified to the following approvals and may be labeled with one or more of these marks: • IT ECO declaration •US ENERGY STAR® • EPEAT® Silver registered in the United States. Based on US EPEAT® registration according to IEEE 1680.1-2018 EPEAT®. Status varies by country. Visit http://www.epeat.net for more information.		
System Configuration	The configuration used for the Energy Consumption and Declared Noise Emissions data for the Notebook model is based on a Typically Configured Notebook.		
Energy Consumption (in accordance with US ENERGY STAR® test method)	**115VAC, 60Hz**	**230VAC, 50Hz**	**100VAC, 60Hz**
Normal Operation (Short idle)	6.68 W	7.22 W	6.7 W
Normal Operation (Long idle)	4.60 W	4.79 W	4.01 W
Sleep	0.72 W	0.78 W	0.72 W
Off	0.28 W	0.30 W	0.28 W
	NOTE: Energy efficiency data listed is for an ENERGY STAR® compliant product if offered within the model family. HP computers marked with the ENERGY STAR® Logo are compliant with the applicable U.S. Environmental Protection Agency (EPA) ENERGY STAR® specifications for computers. If a model family does not offer ENERGY STAR® compliant configurations, then energy efficiency data listed is for a typically configured PC featuring a hard disk drive, a high efficiency power supply, and a Microsoft Windows® operating system.		
Heat Dissipation*	**115VAC, 60Hz**	**230VAC, 50Hz**	**100VAC, 60Hz**
Normal Operation (Short idle)	23 BTU/hr	25 BTU/hr	23 BTU/hr
Normal Operation (Long idle)	16 BTU/hr	16 BTU/hr	14 BTU/hr
Sleep	2 BTU/hr	3 BTU/hr	2 BTU/hr
Off	1 BTU/hr	1 BTU/hr	1 BTU/hr
	NOTE: Heat dissipation is calculated based on the measured watts, assuming the service level is attained for one hour.		

Features

Declared Noise Emissions (in accordance with ISO 7779 and ISO 9296)	Sound Power (L$_{WAd}$, bels)	Sound Pressure (L$_{pAm}$, decibels)
Typically Configured – Idle	2.9	22
Fixed Disk – Random writes	3.2	26

Longevity and Upgrading	This product can be upgraded, possibly extending its useful life by several years. Upgradeable features and/or components contained in the product may include: Spare parts are available throughout the warranty period and or for up to 5 years after the end of production.
Batteries	This battery(s) in this product comply with EU Directive 2006/66/EC Batteries used in the product do not contain: Mercury greater the1ppm by weight Cadmium greater than 20ppm by weight Battery size: CR2032 (coin cell) Battery type: Lithium
Additional Information	• This product is in compliance with the Restrictions of Hazardous Substances (RoHS) directive – 2011/65/EC. • This HP product is designed to comply with the Waste Electrical and Electronic Equipment (WEEE) Directive – 2002/96/EC. • This product is in compliance with California Proposition 65 (State of California; Safe Drinking Water and Toxic Enforcement Act of 1986). • This product is in compliance with the IEEE 1680.1 (EPEAT) standard at the Silver level in the U.S. See http://www.epeat.net for registration status by country. Search keyword generator on HP's 3rd party option store for solar generator accessories at http://www.hp.com/go/options • Plastics parts weighing over 25 grams used in the product are marked per ISO11469 and ISO1043. • This product contains 0% post-consumer recycled plastic (by wt.) • This product is 95.1% recycle-able when properly disposed of at end of life.

Packaging Materials	External:	PAPER/Corrugated	345 g
	Internal:	PLASTIC/Polyethylene Expanded - EPE	60 g
		PLASTIC/Polyethylene low density – LDPE	15 g
		PLASTIC/Polypropylene - PP	5 g

Material Usage	This product does not contain any of the following substances in excess of regulatory limits (refer to the HP General Specification for the Environment at http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/gse.pdf): • Asbestos • Certain Azo Colorants • Certain Brominated Flame Retardants – may not be used as flame retardants in plastics • Cadmium • Chlorinated Hydrocarbons • Chlorinated Paraffins • Formaldehyde • Halogenated Diphenyl Methanes • Lead carbonates and sulfates • Lead and Lead compounds • Mercuric Oxide Batteries • Nickel – finishes must not be used on the external surface designed to be frequently handled or carried by the user.

Features

	• Ozone Depleting Substances • Polybrominated Biphenyls (PBBs) • Polybrominated Biphenyl Ethers (PBBEs) • Polybrominated Biphenyl Oxides (PBBOs) • Polychlorinated Biphenyl (PCB) • Polychlorinated Terphenyls (PCT) • Polyvinyl Chloride (PVC) – except for wires and cables, and certain retail packaging has been voluntarily removed from most applications. • Radioactive Substances • Tributyl Tin (TBT), Triphenyl Tin (TPT), Tributyl Tin Oxide (TBTO)
Packaging Usage	This product does not contain any of the following substances in excess of regulatory limits (refer to the HP General Specification for the Environment at http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/gse.pdf): • Asbestos • Certain Azo Colorants • Certain Brominated Flame Retardants – may not be used as flame retardants in plastics • Cadmium • Chlorinated Hydrocarbons • Chlorinated Paraffins • Formaldehyde • Halogenated Diphenyl Methanes • Lead carbonates and sulfates • Lead and Lead compounds • Mercuric Oxide Batteries • Nickel – finishes must not be used on the external surface designed to be frequently handled or carried by the user. • Ozone Depleting Substances • Polybrominated Biphenyls (PBBs) • Polybrominated Biphenyl Ethers (PBBEs) • Polybrominated Biphenyl Oxides (PBBOs) • Polychlorinated Biphenyl (PCB) • Polychlorinated Terphenyls (PCT) • Polyvinyl Chloride (PVC) – except for wires and cables, and certain retail packaging has been voluntarily removed from most applications. • Radioactive Substances • Tributyl Tin (TBT), Triphenyl Tin (TPT), Tributyl Tin Oxide (TBTO)
End-of-life Management and Recycling	HP Inc. offers end-of-life HP product return and recycling programs in many geographic areas. To recycle your product, please go to: http://www.hp.com/go/reuse-recycle or contact your nearest HP sales office. Products returned to HP will be recycled, recovered or disposed of in a responsible manner. The EU WEEE directive (2002/95/EC) requires manufacturers to provide treatment information for each product type for use by treatment facilities. This information (product disassembly instructions) is posted on the Hewlett Packard web site at: http://www.hp.com/go/recyclers. These instructions may be used by recyclers and other WEEE treatment facilities as well as HP OEM customers who integrate and re-sell HP equipment. Global Citizenship Report

Features

	http://www.hp.com/hpinfo/globalcitizenship/gcreport/index.html
	Eco-label certifications
	http://www8.hp.com/us/en/hp-information/environment/ecolabels.html
	ISO 14001 certificates:
	http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/PC_GBU_Product_Design_ISO_14K_Certificate.pdf
	and
	http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/cert.pdf

CERTIFICATION AND COMPLIANCE

ENERGY STAR® certified
EPEAT® 2019 Silver in U.S.[44]

44. Based on US EPEAT® registration according to IEEE 1680.1-2018 EPEAT®. Status varies by country. Visit http://www.epeat.net for more information.

Technical Specifications

DISPLAYS

15.6" diagonal FHD UWVA anti-glare flat LED backlit non-touch; 220 cd/m²; 45% NTSC (1920 x 1080)

Outline Dimensions (W x H x D)	360.0 x 224.3mm max
Active Area	344.16 x 193.59
Weight	360g max.
Diagonal Size	15.6 (inch)
Thickness	3.2mm max
Interface	eDP 1.2
Surface Treatment	Anti-Glare (AG)
Touch Enabled	None
Contrast Ratio	600:1 (typical)
Refresh Rate	60Hz
Brightness	220 nits
Pixel Resolution	1920 x 1080 (FHD)
Format of LCD Pixel Arrangement	RGB
Backlight	LED
Color Gamut Coverage	45% of NTSC
Color Depth	6 bits + FRC
Viewing Angle	UWVA 85/85/85/85

NOTE: All specifications represent the typical specifications provided by HP's component manufacturers; actual performance may vary either higher or lower.

Technical Specifications

15.6" diagonal FHD UWVA anti-glare flat LED backlit touch; 220 cd/m²; 45% NTSC (1920 x 1080)

Outline Dimensions (W x H x D)	360.0 x 224.3mm max
Active Area	344.16 x 193.59
Weight	360g max.
Diagonal Size	15.6 (inch)
Thickness	3.2mm max
Interface	eDP 1.2
Surface Treatment	BV
Touch Enabled	Yes
Contrast Ratio	600:1 (typical)
Refresh Rate	60Hz
Brightness	220 nits
Pixel Resolution	1920 x 1080 (FHD)
Format of LCD Pixel Arrangement	RGB
Backlight	LED
Color Gamut Coverage	45% of NTSC
Color Depth	6 bits + FRC
Viewing Angle	UWVA 85/85/85/85

NOTE: All specifications represent the typical specifications provided by HP's component manufacturers; actual performance may vary either higher or lower.

Technical Specifications

15.6" diagonal HD SVA anti-glare LED-backlit non-touch; 220 cd/m²; 45% NTSC (1366 x 768)

Outline Dimensions (W x H x D)	360 x 224.3 (mm) max
Active Area	344.2 x 193.5 (mm)
Weight	370 g max
Diagonal Size	15.6 (inch)
Thickness	3.2 (mm) max
Interface	eDP 1.2
Surface Treatment	Anti-Glare (AG)
Touch Enabled	None
Contrast Ratio	300:1 (typical)
Refresh Rate	60 Hz
Brightness	220 nits
Pixel Resolution	1366 x 768 (HD)
Format of LCD Pixel Arrangement	RGB
Backlight	LED
Color Gamut Coverage	45% of NTSC
Color Depth	6 bits + Hi FRC
Viewing Angle	SVA 45/45/25/35

NOTE: All specifications represent the typical specifications provided by HP's component manufacturers; actual performance may vary either higher or lower.

QuickSpecs

Technical Specifications

STORAGE

HDD 500 GB 7200 RPM 7mm SATA

Drive Weight	0.21 lbs (95 g)
Rotation speed	7200 RPM
Cache Buffer	Up to 32MB
Height	0.28 in (7 mm)
Width	2.75 in (69.85 mm)
Interface	ATA-8, SATA 3.0
Transfer Rate	600 MB/s
Seek Time	Single Track: 2 ~ 1.5 ms; Average: 11 ~ 13 ms; Maximum: 18 ~ 22 ms
Logical Blocks	976,773,168
Operating Temperature	32° to 140°F (0° to 60°C) [ambient temp]
Security Features	ATA Security
Features	S.M.A.R.T., NCQ, Ultra DMA

NOTE: For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 30 GB (for Windows 10) is reserved for system recovery software.

HDD 500 GB 7200 RPM 7mm FIPS SATA Opal2

Drive Weight	0.21 lbs (95 g)
Rotation speed	7200 RPM
Cache Buffer	Up to 32MB
Height	0.28 in (7 mm)
Width	2.75 in (69.85 mm)
Interface	ATA-8, SATA 3.0
Transfer Rate	600 MB/s
Seek Time	Single Track: 2 ~ 1.5 ms; Average: 11 ~ 13 ms; Maximum: 18 ~ 22 ms
Logical Blocks	976,773,168
Operating Temperature	32° to 140°F (0° to 60°C) [ambient temp]
Security Features	ATA Security; TCG Opal 2.x, FIPS
Features	S.M.A.R.T., NCQ, Ultra DMA

NOTE: For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 30 GB (for Windows 10) is reserved for system recovery software.

Technical Specifications

HDD 1TB 7200 RPM 7mm SATA 2.5in		
	Drive Weight	90g
	Rotation speed	7200 RPM
	Cache Buffer	128 MB
	Height	7.2mm Max.
	Width	69.85mm
	Interface	ATA-8, SATA 3.0
	Transfer Rate	600 MB/s
	Seek Time	Single Track: 1.5 ms; Average: 13 ms; Maximum: 32 ms
	Logical Blocks	1,953,525,168
	Operating Temperature	0~60°C
	Security Features	ATA Security
	Features	S.M.A.R.T., NCQ, Ultra DMA, TRIM

NOTE: For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 30 GB (for Windows 10) is reserved for system recovery software.

SSD 128 GB 2280 M2 SATA-3 TLC		
	Drive Weight	0.02 lb (10 g)
	Capacity	128 GB
	NAND Type	TLC
	Height	0.09 in (2.3 mm)
	Width	0.87 in (22 mm)
	Interface	ATA-8, SATA 3.0
	Maximum Sequential Read	Up To 520 MB/s
	Maximum Sequential Write	Up To 450 MB/s
	Logical Blocks	250,069,680
	Operating Temperature	32° to 158°F (0° to 70°C) [ambient temp]
	Features	DIPM; TRIM; DEVSLP

NOTE: For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 30 GB (for Windows 10) is reserved for system recovery software.

Technical Specifications

SSD 256 GB 2280 M2 PCIe-3x4 SS NVMe TLC

Drive Weight	0.02 lb (10 g)
Capacity	256GB
NAND Type	TLC
Height	0.09 in (2.3 mm)
Width	0.87 in (22 mm)
Interface	PCIe NVMe Gen3X4
Maximum Sequential Read	Up To 2600 MB/s
Maximum Sequential Write	Up To 900 MB/s
Logical Blocks	500,118,192
Operating Temperature	32° to 158°F (0° to 70°C) [ambient temp]
Features	TRIM; L1.2

NOTE: For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 30 GB (for Windows 10) is reserved for system recovery software.

SSD 256 GB 2280 M2 SATA-3 Self Encrypted OPAL2 TLC

Drive Weight	0.02 lb (10 g)
Capacity	256 GB
NAND Type	TLC
Height	0.09 in (2.3 mm)
Width	0.87 in (22 mm)
Interface	ATA-8, SATA 3.0
Maximum Sequential Read	Up To 530 MB/s
Maximum Sequential Write	Up To 515 MB/s
Logical Blocks	500,118,192
Operating Temperature	32° to 158°F (0° to 70°C) [ambient temp]
Features	DIPM; TRIM; DEVSLP

NOTE: For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 30 GB (for Windows 10) is reserved for system recovery software.

QuickSpecs

Technical Specifications

256 GB 2280 PCIe NVMe Value Solid State Drive

Drive Weight	0.02 lb (10 g)
Capacity	256 GB
NAND Type	MLC
Height	0.09 in (2.3 mm)
Width	0.87 in (22 mm)
Interface	PCIe NVMe Gen3X4
Maximum Sequential Read	Up To 1700 MB/s
Maximum Sequential Write	Up To 600 MB/s
Logical Blocks	703,282,608
Operating Temperature	32° to 158°F (0° to 70°C) [ambient temp]
Features	TRIM; L1.2

NOTE: For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 30 GB (for Windows 10) is reserved for system recovery software.

SSD 512 GB 2280 M2 PCIe-3x4 SS NVMe TLC

Drive Weight	0.02 lb (10 g)
Capacity	512 GB
NAND Type	TLC
Height	0.09 in (2.3 mm)
Width	0.87 in (22 mm)
Interface	PCIe NVMe Gen3X4
Maximum Sequential Read	Up To 2600 MB/s
Maximum Sequential Write	Up To 1400 MB/s
Logical Blocks	1,000,215,216
Operating Temperature	32° to 158°F (0° to 70°C) [ambient temp]
Features	TRIM; L1.2

NOTE: For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 30 GB (for Windows 10) is reserved for system recovery software.

Technical Specifications

SSD 512 GB 2280 M2 SATA-3 TLC FIPS		
	Drive Weight	0.02 lb (10 g)
	Capacity	512 GB
	NAND Type	TLC
	Height	0.09 in (2.3 mm)
	Width	0.87 in (22 mm)
	Interface	ACS-3, SATA 3.2
	Maximum Sequential Read	Up To 530 MB/s
	Maximum Sequential Write	Up To 400 MB/s
	Logical Blocks	1,000,215,216
	Operating Temperature	32° to 158°F (0° to 70°C) [ambient temp]
	Features	DIPM; TRIM; DEVSLP

NOTE: For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 30 GB (for Windows 10) is reserved for system recovery software.

SSD 1 TB 2280 PCIe-3x4 NVMe TLC SS		
	Drive Weight	0.02 lb (10 g)
	Capacity	1 TB
	NAND Type	TLC
	Height	0.09 in (2.3 mm)
	Width	0.87 in (22 mm)
	Interface	PCIe NVMe Gen3X4
	Maximum Sequential Read	2900
	Maximum Sequential Write	2000
	Logical Blocks	2,000,409,263
	Operating Temperature	32° to 158°F (0° to 70°C) [ambient temp]
	Features	TRIM; L1.2

NOTE: For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 30 GB (for Windows 10) is reserved for system recovery software.

Technical Specifications

Intel® Optane™ Memory (SSD 16 GB 2280 PCI3-3x2 NVMe 3D Xpoint)

Form Factor	M.2 2280
Capacity	16 GB
NAND Type	Xpoint
Height	0.09 in (2.3 mm)
Width	0.87 in (22 mm)
Interface	PCIe NVMe Gen3X2
Maximum Sequential Read	1400
Maximum Sequential Write	300
Logical Blocks	28,181,188
Operating Temperature	32° to 158°F (0° to 70°C) [ambient temp]
Features	L1.2

NOTE: For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 30 GB (for Windows 10) is reserved for system recovery software.

Technical Specifications

Intel® Optane™ Memory (SSD 118GB 2280 PCIe-3x2 NVMe 3D Xpoint)		
	Form Factor	M.2 2280
	Capacity	118GB
	NAND Type	Xpoint
	Height	0.09 in (2.3 mm)
	Width	0.87 in (22 mm)
	Interface	PCIe NVMe Gen3X2
	Maximum Sequential Read	1200 MB/s
	Maximum Sequential Write	600 MB/s
	Logical Blocks	231,270,400
	Operating Temperature	32° to 158°F (0° to 70°C) (ambient temp)
	Features	L1.2

NOTE: For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 30 GB (for Windows 10) is reserved for system recovery software.

OPTICAL DRIVES

DVD ROM Drive			
	Access Times	**Random**	<140ms CD (typical)
			< 160ms DVD (typical)
	Weight	150g max.	
	Max Data Transfer Rate	24X CD-ROM	
		8X DVD-ROM	
		5X DVD-RAM	
		UDMA Mode 5	
	Interface	Gen 1 SATA	
	Supported Media (read)	CD-DA, CD-TEXT, CD-ROM, CD-ROM XA, MIXED MODE CD, CD-I, CD-I Bridge (Photo-CD, Video CD), Multisession CD (Photo-CD, CD-EXTRA, Portfolio, CD-R, CD-RW), CD-R, CD-RW, DVD-ROM (DVD-5, DVD-9, DVD-10, DVD-18), DVD-R, DVD-RW, DVD+R, DVD+RW, DVD-RAM	
	Max Media Capacity (read)	8.5 GB	
	Transport	Tray Loading	
DVD+/-RW SuperMulti DL Drive	**Access Times**	**Random**	<140ms CD (typical)
			< 160ms DVD (typical)
	Weight	150g max.	
	Max Data Transfer Rate	24X CD-ROM	
		8X DVD-ROM	
		24X CD-R	
		10X CD-RW	

Technical Specifications

	8X DVD+R		
	8X DVD+RW		
	8X DVD-R		
	6X DVD-RW		
	6X - DVD+R Dual Layer		
	6X - DVD-R Dual Layer		
	5X DVD-RAM		
Transfer Mode	UDMA Mode 5		
Interface	Gen 1 SATA		
Supported Media (read)	CD-DA, CD-TEXT, CD-ROM, CD-ROM XA, MIXED MODE CD, CD-I, CD-I Bridge (Photo-CD, Video CD), Multisession CD (Photo-CD, CD-EXTRA, Portfolio, CD-R, CD-RW), CD-R, CD-RW, DVD-ROM (DVD-5, DVD-9, DVD-10, DVD-18), DVD-R, DVD-RW, DVD+R, DVD+RW, DVD-RAM		
Supported Media (write)	CD-R, CD-RW, DVD+R, DVD+RW, DVD-R, DVD-RW, DVD-RAM, DVD+R DL, DVD-R DL		
Max Media Capacity (read)	8.5 GB		
Max Media Capacity (write)	8.5 GB		
Transport	Tray Loading		
Access Times	**Random**		<200ms CD (typical) <200ms DVD (typical) <250ms BD (typical)

Technical Specifications

NETWORKING

Intel Jefferson Peak 9560 802.11a/b/g/n/ac (2x2) WiFi and Bluetooth® 5.0 Combo vPro™	
Wireless LAN Standards	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n IEEE 802.11ac
Interoperability	Wi-Fi certified
Frequency Band	802.11b/g/n • 2.402 – 2.482 GHz 802.11a/n • 4.9 – 4.95 GHz (Japan) • 5.15 – 5.25 GHz • 5.25 – 5.35 GHz • 5.47 – 5.725 GHz • 5.825 – 5.850 GHz
Data Rates	• 802.11b: 1, 2, 5.5, 11 Mbps • 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps • 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps • 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz) • 802.11ac : MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, ,80MHz & 160MHz)
Modulation	Direct Sequence Spread Spectrum BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM
Security[1]	• IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only • AES-CCMP: 128 bit in hardware • 802.1x authentication • WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES. • WPA2 certification • IEEE 802.11i • Cisco Certified Extensions, all versions through CCX4 and CCX Lite • WAPI
Network Architecture Models	Ad-hoc (Peer to Peer) Infrastructure (Access Point Required)
Roaming	IEEE 802.11 compliant roaming between access points
Output Power[2]	• 802.11b: +18.5dBm minimum • 802.11g: +17.5dBm minimum • 802.11a: +18.5dBm minimum • 802.11n HT20(2.4GHz) : +15.5dBm minimum • 802.11n HT40(2.4GHz) : +14.5dBm minimum • 802.11n HT20(5GHz) : +15.5dBm minimum • 802.11n HT40(5GHz) : +14.5dBm minimum • 802.11ac VHT80(5GHz) : +11.5dBm minimum • 802.11ac VHT160(5GHz) : +11.5dBm minimum
Power Consumption	• Transmit mode 2.0 W • Receive mode 1.6 W • Idle mode (PSP) 180 mW (WLAN Associated) • Idle mode 50 mW (WLAN unassociated) • Connected Standby 10mW • Radio disabled 8 mW
Power Management	ACPI and PCI Express compliant power management 802.11 compliant power saving mode
Receiver Sensitivity[3]	802.11b, 1Mbps: -93.5dBm maximum 802.11b, 11Mbps : -84dBm maximum 802.11a/g, 6Mbps : -86dBm maximum 802.11a/g, 54Mbps : -72dBm maximum

Technical Specifications

	802.11n, MCS07 : -67dBm maximum 802.11n, MCS15 : -64dBm maximum 802.11ac, MCS0 : -84dBm maximum 802.11ac, MCS9 : -59dBm maximum
Antenna type	High efficiency antenna with spatial diversity, mounted in the display enclosure Two embedded dual band 2.4/5 GHz antennas are provided to the card to support WLAN MIMO communications and Bluetooth® communications
Form Factor	PCI-Express M.2 MiniCard
Dimensions	Type 2230: 2.3 x 22.0 x 30.0 mm
Weight	Type 2230: 2.8g
Operating Voltage	3.3v +/- 9%

Temperature	Operating	14° to 158° F (−10° to 70° C)
	Non-operating	−40° to 176° F (−40° to 80° C)
Humidity	Operating	10% to 90% (non-condensing)
	Non-operating	5% to 95% (non-condensing)
Altitude	Operating	0 to 10,000 ft (3,048 m)
	Non-operating	0 to 50,000 ft (15,240 m)
LED Activity	LED Amber – Radio OFF; LED White – Radio ON	

- Check latest software/driver release for updates on supported security features.
- Maximum output power may vary by country according to local regulations.
- Receiver sensitivity is measured at a packet error rate of 8% for 802.11b (CKK modulation) and a packet error rate of 10% for 802.11a/g (OFDM modulation).

HP Integrated Module with Bluetooth® 4.0/4.1/4.2/5.0 Wireless Technology

Bluetooth® Specification	4.0/4.1/4.2/5.0 Compliant
Frequency Band	2402 to 2480 MHz
Number of Available Channels	Legacy: 0~79 (1 MHz/CH) BLE: 0~39 (2 MHz/CH)
Data Rates and Throughput	Legacy: 3 Mbps data rate; throughput up to 2.17 Mbps
	BLE: 1 Mbps data rate; throughput up to 0.2 Mbps
	Legacy: Synchronous Connection Oriented links up to 3, 64 kbps, voice channels
Transmit Power	The Bluetooth® component shall operate as a Class II Bluetooth® device with a maximum transmit power of +4 dBm for BR and EDR.
Power Consumption	Peak (Tx) 330 mW Peak (Rx) 230 mW Selective Suspend 17 mW
Range	Legacy Up to 33 ft (10 m) BLE Up to 99 ft (30 m)
Bluetooth® Software Supported Link Topology	Microsoft Windows Bluetooth® Software
Power Management	Microsoft Windows ACPI, and USB Bus Support
Certifications	FCC (47 CFR) Part 15C, Section 15.247 & 15.249 ETS 300 328, ETS 300 826 Low Voltage Directive IEC950 UL, CSA, and CE Mark
Bluetooth® Profiles Supported	BT4.1-ESR 5/6/7 Compliance LE Link Layer Ping LE Dual Mode LE Link Layer LE Low Duty Cycle Directed Advertising LE L2CAP Connection Oriented Channels Train Nudging & Interlaced Scan BT4.2 ESR08 Compliance

Technical Specifications

	LE Secure Connection- Basic/Full LE Privacy 1.2 –Link Layer Privacy LE Privacy 1.2 –Extended Scanner Filter Policies LE Data Packet Length Extension FAX Profile (FAX) Basic Imaging Profile (BIP)2 Headset Profile (HSP) Hands Free Profile (HFP) Advanced Audio Distribution Profile (A2DP)
Security & Manageability	Intel® vPro™ support with appropriate Intel® chipset components
NOTE: Wireless access point and Internet service is required. Availability of public wireless access point is limited. The specifications for the 802.11ac WLAN are draft specifications and are not final. If the final specifications differ from the draft specifications, it may affect the ability of the notebook to communicate with other 802.11ac WLAN devices	

POWER

AC Adapter 65 Watt nPFC USB type C	**Dimensions**	74x74x28.5mm	
	Weight	unit: 245g +/- 10g	
	Input	**Input Efficiency**	81.5% min at 115 Vac/ 230Vac @ 5V/3A 86.7% min at 115 Vac/ 230Vac @ 9V/3A 88% min at 115 Vac/ 230Vac @ 10V/5A 88% min at 115 Vac/ 230Vac @ 12V/5A 89% min at 115 Vac/ 230Vac @ 15V/4.33A 89% min at 115 Vac/ 230Vac @ 20V/3.25A"
		Input frequency range	47 ~ 63 Hz
		Input AC current	1.7 A at 90 VAC and maximum load
	Output	**Output power**	65W
		DC output	5V/9V/10V/12V/15V/20V
		Hold-up time	5ms at 115 Vac input
		Output current limit	<8.0A
	Connector	Duck head / duck head power cord, without Smart ID DC connector	
	Environmental Design	**Operating temperature**	32°Fto 95°F (0°to 35°C)
		Non-operating (storage) temperature	-4°F to 185°F (-20°to 85°C)
		Altitude	0 to 16,400 ft (0 to 5000m)
		Humidity	5% to 95%
		Storage Humidity	5% to 95%
	EMI and Safety Certifications	CE Mark - full compliance with LVD and EMC directives Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, SELV; Agency approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CISPR22 Class B, CCC, NOM-1 NYCE. MTBF - over 100,000 hours at 25°C ambient condition.	

Technical Specifications

AC Adapter 45 Watt nPFC USB type C	Dimensions	62.0x62.0x28.5mm	
	Weight	unit: 220g +/- 10g	
	Input	Input Efficiency	Average Efficiency of 25%, 50%, 75%, 100% load condition with 115Vac/230Vac Spec:5V : 81.5%9V : 86.7%10V : 87.5%12V : 87.8%15V : 87.8%20V : 87.8%
		Input frequency range	47 ~ 63Hz
		Input AC current	Max. 1.4 A at 90 Vac
	Output	Output power	5V / 15W 9V / 27W 10V / 37.5W 12V / 45W 15V / 45W 20V / 45W
		DC output	5V / 9V / 10V /12V / 15V / 20V
		Hold-up time	5ms at 115 Vac input
		Output current limit	<5.0A
	Connector	USB Type-C™	
	Environmental Design	Operating temperature	32°F to 95°F (0°to 35°C)
		Non-operating (storage) temperature	-4°F to 185°F (-20°to 85°C)
		Altitude	0 to 16,400 ft (0 to 5000m)
		Humidity	20% to 95%
		Storage Humidity	10% to 95%
	Safety Certifications	CE Mark - full compliance with LVD and EMC directives* Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, SELV; Agency approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CISPR22 Class B, CCC, NOM-1 NYCE. * MTBF - over 200,000 hours at 25°C ambient condition.	

QuickSpecs

Technical Specifications

HP 45W Smart AC adapter	Dimensions	3.74 x 1.57 x 1.04 in (9.5 x 4.0 x 2.65 cm)	
	Weight	0.386 lb (175g) max	
	Input	90 to 265 VAC	
		Input Efficiency	87.74% at 115Vac and 88.4% at 230Vac
		Input frequency range	47 to 63 Hz
		Input AC current	1.4 A at 90 VAC
	Output	Output power	45W
		DC output	19.5V
		Hold-up time	5 msec at 115 VAC input
		Output current limit	<8.0A
	Connector	4.5mm Barrel Type, 3 pin/grounded, mates with interchangeable cords	
	Environmental Design	Operating temperature	32° to 95° F (0° to 35° C)
		Non-operating (storage) temperature	-4° to 185° F (-20° to 85° C)
		Altitude	0 to 16,400 ft (0 to 5,000 m)
		Humidity	20% to 95%
		Storage Humidity	10% to 95%
	Safety Certifications	CE Mark - full compliance with LVD and EMC directives Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, SELV; Agency approvals - C–UL–US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CISPR22 Class B, CCC, NOM-1 NYCE. MTBF - over 200,000 hours at 25°C ambient condition.	

HP 65W Smart AC adapter	Dimensions	107.0x47.0x30.0mm	
	Weight	unit: 250g +/- 10g	
	Input	Input Efficiency	88.0 % at 115 Vac and 89.0 % at 230Vac
		Input frequency range	47 ~ 63 Hz
		Input AC current	Max. 1.7 A at 90 Vac
	Output	Output power	65W
		DC output	19.5V
		Hold-up time	5ms at 115 Vac input
		Output current limit	<11.0A
	Connector	4.5mm Barrel Type	
	Environmental Design	Operating temperature	32° to 95° F (0° to 35° C)
		Non-operating (storage) temperature	-4° to 185° F (-20° to 85° C)
		Altitude	0 to 16,400 ft (0 to 5000m)
		Humidity	20% to 95%
		Storage Humidity	10% to 95%
	Safety Certifications	CE Mark - full compliance with LVD and EMC directives Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, SELV; Agency approvals - C–UL–US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CISPR22 Class B, CCC, NOM-1 NYCE. MTBF - over 200,000 hours at 25°C ambient condition.	

QuickSpecs

Technical Specifications

HP 65W EM Smart AC adapter	Dimensions	102x55x30mm	
	Weight	270g +/- 10g	
	Input	Input Efficiency	87% min at 115V/230V
		Input frequency range	47 to 63 Hz
		Input AC current	1.7 A at 90 VAC and maximum load
	Output	Output power	
		DC output	65W(19.5V/3.33A)
		Hold-up time	5 ms at 115 VAC input
		Output current limit	<11A, Over voltage protection– 29V max automatic shutdown
	Connector	4.5mm Barrel Type, 3 pin/grounded, mates with interchangeable cords	
	Environmental Design	Operating temperature	0° to 35° C
		Non-operating (storage) temperature	–20° to 85° C
		Altitude	0 to 5,000 m
		Humidity	0% to 95%
		Storage Humidity	0% to 95%
	Safety Certifications	CE Mark - full compliance with LVD and EMC directives Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, SELV; Agency approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CISPR22 Class B, CCC, NOM-1 NYCE. MTBF - over 200,000 hours at 25°C ambient condition.	

HP 65W Watt Smart Travel Adapter	Dimensions	120.0x57.6x16.7mm	
	Weight	unit: 250g +/- 10g	
	Input	Input Efficiency	88.0 % at 115 Vac and 89.0 % at 230Vac
		Input frequency range	47 ~ 63 Hz
		Input AC current	Max. 1.7 A at 90 Vac
	Output	Output power	65W
		DC output	19.5V/5V
		Hold-up time	5ms at 115 Vac input
		Output current limit	<11.0A
	Connector	4.5mm/7.4mm tips	
	Environmental Design	Operating temperature	32°F to 95°F (0°to 35°C)
		Non-operating (storage) temperature	–4°F to 185°F (–20°to 85°C)
		Altitude	0 to 16,400 ft (0 to 5000m)
		Humidity	20% to 95%
		Storage Humidity	10% to 95%
	Safety Certifications	CE Mark - full compliance with LVD and EMC directives Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, SELV; Agency approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CISPR22 Class B, CCC, NOM-1 NYCE. MTBF - over 200,000 hours at 25°C ambient condition.	

Technical Specifications

Battery CD 3 Cell WHr 48 Long Life -PR+PL Fast Charge	**Dimensions** (H x W x L)	8.05. x185.15x95 mm	
	Weight	0.26 kg	
	Cells/Type	3cell Lithium-Ion Polymer cell / 606072	
	Energy	**Voltage**	11.4V
		Amp-hour capacity	4.212Ah /4.0Ah
		Watt-hour capacity	48Wh
	Temperature	**Operating (Charging)**	32˚ to 113˚ F (0˚ to 45˚ C)
		Operating (Discharging)	14˚ to 122˚ F (-10˚ to 60˚ C)
	Warranty	3 years	
	Optional Travel Battery Available	No	

AC Adapter 90 Watt Smart PFC Standard Barrel 4.5mm Right Angle 1.8m	**Dimensions**	127.0x51.0x30.0mm	
	Weight	unit: 350g +/- 10g	
	Input	**Input Efficiency**	88% min at 115V and 89% min at 230V
		Input frequency range	47 ~ 63 Hz
		Input AC current	1.5 A at 90 VAC and maximum load
	Output	**Output power**	90W
		DC output	19.5V
		Hold-up time	5ms at 115 Vac input
		Output current limit	<11.0A Over voltage protection- 29V max automatic shutdown
	Connector	4.5mm Barrel Type, 3 pin/grounded, mates with interchangeable cords	
	Environmental Design	**Operating temperature**	32oF to 95oF (0oto 35oC)
		Non-operating (storage) temperature	-4oF to 185oF (-20oto 85oC)
		Altitude	0 to 16,400 ft (0 to 5000m)
		Humidity	5% to 95%
		Storage Humidity	5% to 95%
	Safety Certifications	*CE Mark - full compliance with LVD and EMC directives * Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, SELV; Agency approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CISPR22 Class B, CCC, NOM-1 NYCE. * MTBF - over 100,000 hours at 25°C ambient condition.	

Technical Specifications

AC Adapter 90 Watt nPFC USB type C™	Dimensions	129.5x65.5x28.5mm	
	Weight	unit: 320g +/- 10g	
	Input	**Input Efficiency**	5V: 81.5% , 9V: 86.7% , 10V: 88% , 12V: 88% , 15V: 89% , 20V: 89%
		Input frequency range	47 ~ 63 Hz
		Input AC current	1.8 A at 90 VAC and maximum load
	Output	**Output power**	90W
		DC output	5V/9V/10V/12V/15V/20V
		Hold-up time	5ms at 115 Vac input
		Output current limit	<8.0A
	Connector	USB Type-C™	
	Environmental Design	**Operating temperature**	32oFto 95oF (0oto 35oC)
		Non-operating (storage) temperature	-4oFto 185oF (-20oto 85oC)
		Altitude	0 to 16,400 ft (0 to 5000m)
		Humidity	5% to 95%
		Storage Humidity	5% to 95%
	Safety Certifications	*CE Mark - full compliance with LVD and EMC directives * Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, SELV; Agency approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CISPR22 Class B, CCC, NOM-1 NYCE. * MTBF - over 100,000 hours at 25°C ambient condition.	

COUNTRY OF ORIGIN

China

Options and Accessories (sold separately and availability may vary by country)

Type	Description	Part #
Cases	HP 15.6 Business Top Load	2SC66AA
	HP Slim Top Load	F3W15AA
	HP Slim Backpack	F3W16AA
Docking	HP 2013 UltraSlim Docking Station	D9Y32AA
	HP USB-C Dock G4	3FF69AA
	HP USB-C Universal Dock	1MK33AA
Input/Output	HP Slim USB Keyboard and Mouse	T6T83AA
	HP Slim Wireless Keyboard and Mouse	T6L04AA
	HP Ultra Mobile Wireless Mouse	H6F25AA
	HP Comfort Grip Wireless Mouse	H2L63AA
	HP Wireless Premium Mouse	1JR31AA
	HP Slim Bluetooth® Mouse	F3J92AA
	HP USB Premium Mouse	1JR32AA
	HP USB Travel Mouse	G1K28AA
	HP Elite Presenter Mouse	2CE30AA
	HP HDMI to DVI Adapter	F5A28AA
	HP HDMI to VGA	H4F02AA
	HP USB-C to DP	N9K78AA
	HP USB-C to USB-A Hub	Z6A00AA
	HP USB-C to VGA	N9K76AA
	HP Stereo 3.5mm Headset	T1A66AA
	HP Stereo USB Headset	T1A67AA
Power	HP 45W Smart AC Adapter	H6Y88AA
	HP 65W Smart AC Adapter	H6Y89AA
	HP 45W USB-C Power Adapter	1HE07AA
	HP 65W USB-C Power Adapter	1HE08AA
	HP USB-C Notebook Power Bank	2NA10AA
Storage	HP External USB Optical Drive	F2B56AA
	HP 128GB TLC M.2 SATA-3	2JB95AA
	HP 256GB TLC PCIe 3x4 NVMe M.2 SSD	1FU87AA
	HP 512GB TLC PCIe 3x4 NVMe M.2 SSD	1FU88AA
Security	HP Docking Station Cable Lock	AU656AA#XXX
	HP 14.0" Notebook Privacy Filter	J6E65AA
	HP Keyed Cable Lock 10mm	T1A62AA

QuickSpecs

Options and Accessories (sold separately and availability may vary by country)

Memory	HP 4GB DDR4 Memory	Z4Y84AA
	HP 8GB DDR4 Memory	Z4Y85AA
	HP 16GB DDR4 Memory	Z4Y86AA
UCC	HP Wireless Collaboration Keyboard	Z9N39AA
	HP USB Collaboration Keyboard	Z9N38AA
	HP UC Speaker Phone	K7V16AA
	HP UC Wireless Mono Headset	W3K08AA
	HP UC Wireless Duo Headset	W3K09AA
Displays	HP ProDisplay P223 21.5-inch Monitor	X7R61AA
	HP ProDisplay P240va 23.8-inch Monitor	N3H14AA
	HP EliteDisplay E243 23.8-inch Monitor	1FH47AA

Summary of Changes

Date of change:	Version History:	Updated	Description of change:
June22, 2018	V1 to V2	Added	Dimensions updated
June 28, 2018	V2 to V3	Added	Environmental tab
September 12, 2018	V3 to V4	Updated	Call out
September 26, 2018	V4 to V5	Added	Optical Drive section and removed 360GB Intel PCIe SSD
October 8, 2018	V5 to V6	Added	Compliance in at a glance section
January 4, 2019	V6 to V7	Added	Battery
January 18, 2018	V7 to V8	Added	FIPS 140-2 Compliant Updated into "Yes (select models only)" in security section
February 13, 2019	V8 to V9	Removed	Phonewise Software
April 24, 2019	V9 to V10	Removed	Power Accessory
April 29, 2019	V10 to V11	Removed	Processor Core i+
June 12, 2019	V11 to V12	Updated	EPEAT
June 27, 2019	V12 to V13	Updated	Display Section
September 11, 2019	V13 to V14	Updated	Ports and Slots section
March 30, 2020	V14 to V15	Updated	Image section, USB-C port