Overview

HP ProBook 450 G6 Notebook PC

Left

1. **Internal microphones (2)**
2. **Webcam**
3. **Webcam LED**
4. **Clickpad**
5. **Hard drive LED**
6. **SD card reader**
7. **Thermal vent**
8. **USB 2.0 port**
9. **Security lock slot (Lock sold separately)**
10. **Power button**

Overview

Right

1. **Power connector**
2. **USB Type-C™ 3.1 Gen 1 port**
3. **Ethernet port (RJ-45)**
4. **HDMI port (Cable not included)**
5. **USB 3.1 Gen 1 port**
6. **USB 3.1 Gen 1 port**
7. **Headphone/microphone combo jack**
8. **HP Fingerprint Sensor**

Overview

At a Glance

- Preinstall with Windows 10 versions or FreeDOS 3.0
- Choice of 8th Generation Intel® Core™ i7, i5, i3 processors
- Display include your choice of 39.62 cm (15.6") diagonal HD, Ultra Wide Viewing Angle FHD, Touch or Non-Touch
- Optional Nvidia GeForce MX130 with 2 GB GDDR5 dedicated video memory or integrated Intel® HD Graphics 610 or Intel® UHD 620
- Enhanced security features including TPM2.0, HP BIOSphere, Hardware enforced Firmware Protection, optional Fingerprint sensor, and optional IR camera
- Passed 19 items of MIL-STD 810G testing plus an additional 120,000 hours of reliability testing through HP's Total Test Process1
- Weight starting at 4.41 lbs (2.0 kgs)
- HP Long-Life Rechargeable battery, with HP Fast Charge Technology recharges 50% in 30 minutes[2]
- Supports wireless LAN options for connectivity on the go
- Up to 512 GB Solid State Drives and 1 TB Hard Drive
- Up to 32 GB total system memory
- 720p HD webcam, IR camera for face authentication with Windows Hello
- Spill-resistant and optional backlit Keyboard, and Clickpad with multi-touch gestures enabled, taps enabled as default.
- Enjoy the rich conferencing experience of the Skype for Business™ Certified HP ProBook 450

1. MIL STD 810G testing is pending and 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. Recharges the battery up to 50% within 30 minutes when the system is off or in standby mode when used with the power adapter provided with the notebook. After charging has reached 50% capacity, charging speed will return to normal. Charging time may vary +/-10% due to System tolerance.

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

Technical Specifications

PRODUCT NAMES

HP ProBook 450 G6 Notebook PC

OPERATING SYSTEMS

Preinstalled	Windows 10 Pro 64[1] Windows 10 Pro 64 (National Academic only)[2] Windows 10 Home 64[1] Windows 10 Home Single Language 64[1] Windows 10 Government Edition V0 China Only FreeDOS 3.0

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™ i7-8565U processor with Intel® UHD Graphics 620 (1.8 GHz base frequency, up to 4.6 GHz with Intel® Turbo Boost Technology, 8 MB L3 cache, 4 cores)3,4,5,6
Intel® Core™ i5-8265U with Intel® UHD Graphics 620 Graphics (1.6 GHz base frequency, up to 3.9 GHz with Intel® Turbo Boost Technology, 6 MB L3 cache, 4 cores) 3,4,5,6
Intel® Core™ i3-8145U with Intel® UHD Graphics 620 Graphics (2.1 GHz base frequency, up to 3.9 GHz with Intel® Turbo Boost Technology, 4 MB L3 cache, 2 cores) 3,4,5,6
Intel® Core™ i7+ 8565U processor (Core™ i7 and 16 GB Intel® Optane™ memory) with Intel® UHD Graphics 620 (1.8 GHz base frequency, up to 4.6 GHz with Intel® Turbo Boost Technology, 8 MB L3 cache, 4 cores)3,4,5,6,7
Intel® Core™ i5+ 8265U processor (Core™ i5 and 16 GB Intel® Optane™ memory) with Intel® UHD Graphics 620 (1.6 GHz base frequency, up to 3.9 GHz with Intel® Turbo Boost Technology, 6 MB L3 cache, 4 cores) 3,4,5,6,7
Intel® Celeron® 4205U processor with Intel® HD Graphics 610 (1.8 GHz base frequency, 2 MB L3 cache, 2 cores)3,4,5,6
Intel® Pentium® 5405U processor with Intel® HD Graphics 610 (2.3 GHz base frequency, 2 MB L3 cache, 2 cores)3,4,5,6

Processors Family
8th Generation Intel® Core™ i7 processor (i7-8565U) 6
8th Generation Intel® Core™ i5 processor (i5-8265U) 6
8th Generation Intel® Core™ i3 processor (i3-8145U)6
Intel® Pentium® processor (5405U)6
Intel® Celeron® processor (4205U)6

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. Intel® Turbo Boost performance varies depending on hardware, software and overall system configuration. See http://www.intel.com/technology/turboboost for more information.

Technical Specifications

6. NOTE: 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.
7. Intel® Optane™ memory system acceleration does not replace or increase the DRAM in your system and requires configuration with an optional Intel® Core™ i(5 or 7)+ processor.

CHIPSET

Integrated with processor

GRAPHICS

Integrated
Intel® UHD graphics 620[8]
Discrete
NVIDIA® GeForce® MX130 (2 GB DDR5 dedicated)[9]

Supports
Support HD decode, DX12, HDMI 1.4b up to 4K 30Hz
Support CUDA, Optimus, PhysX, GPU Boost 2.0

8. HD content required to view HD images.
9. Integrated graphics depends on processor. NVIDIA® Optimus™ technology requires an Intel processor, plus an NVIDIA® GeForce® discrete graphics configuration and is available on Windows 10 Pro OS. With NVIDIA® Optimus™ 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).

DISPLAYS

Internal
Non-Touch
39.6 cm (15.6") diagonal HD SVA eDP anti-glare LED-backlit slim, 220 cd/m², 67% sRGB for two WLAN antennas (1366 x 768)[8,10]
39.6 cm (15.6") diagonal HD SVA eDP anti-glare LED-backlit slim, 220 cd/m², 67% sRGB for HD camera and one WLAN antenna (1366 x 768)[8,10]
39.6 cm (15.6") diagonal HD SVA eDP anti-glare LED-backlit slim, 220 cd/m², 67% sRGB for HD camera and two WLAN antennas (1366 x 768)[8,10]
39.6 cm (15.6") diagonal HD SVA eDP anti-glare LED-backlit slim, 220 cd/m², 67% sRGB for HD+IR camera and two WLAN antennas (1366 x 768)[8,10]
39.6 cm (15.6") diagonal FHD UWVA eDP anti-glare LED-backlit slim, 220 cd/m², 67% sRGB for two WLAN antennas (1920 x 1080)[8,10]
39.6 cm (15.6") diagonal FHD UWVA eDP anti-glare LED-backlit slim, 220 cd/m², 67% sRGB for HD camera and one WLAN antenna (1920 x 1080)[8,10]
39.6 cm (15.6") diagonal FHD UWVA eDP anti-glare LED-backlit slim, 220 cd/m², 67% sRGB for HD camera and two WLAN antennas (1920 x 1080)[8,10]
39.6 cm (15.6") diagonal FHD UWVA eDP anti-glare LED-backlit slim, 220 cd/m², 67% sRGB for HD+IR camera and two WLAN antennas (1920 x 1080)[8,10]

Touch

Technical Specifications

39.6 cm (15.6") diagonal HD SVA eDP LED-backlit slim touch screen, 220 cd/m², 67% sRGB for HD camera and two WLAN antennas (1366 x 768)[8,10,11]

HDMI
Supports resolutions up to 4K 30Hz

8. HD content required to view HD images.
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 Connect3ors	Technical limitations
HP Thunderbolt Dock 120W G2	3	Dual 4k @60Hz	2xDP, 1xVGA, 1xTB,1xUSB-C alt-mode	Dual 4k only with one display in to DP and + TB port or USB-C alt mode + TB port
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

STORAGE AND DRIVES

Primary Storage
500 GB 7200 rpm SATA12
1 TB 5400 rpm SATA12

Primary M.2 Storage
128 GB M.2 SATA TLC Solid State Drive12
256 GB PCIe® NVMe™ M.2 Value Solid State Drive12
512 GB PCIe® NVMe™ M.2 TLC Solid State Drive12
512 GB PCIe® NVMe™ M.2 Value Solid State Drive12

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.

Note: PCIe SSD not available for Celeron

Technical Specifications

MEMORY

Maximum Memory
32 GB DDR4-2400 SDRAM[13]

Memory
32 GB DDR4-2400 SDRAM (2 X 16 GB)[13]
16 GB DDR4- 2400 SDRAM (1 X 16 GB)
16 GB DDR4- 2400 SDRAM (2 X 8 GB)[13]
12 GB DDR4- 2400 SDRAM (4 GB and 8 GB (1 x 8 GB)[13]
8 GB DDR4- 2400 SDRAM (1 x 8 GB)
8 GB DDR4- 2400 SDRAM (2 x 4 GB)[13]
4 GB DDR4- 2400 SDRAM (1 x 4 GB)

Memory Slots
2 SODIMM
Both slots are customer accessible / upgradeable
DDR4 PC4 SODIMMS, system runs at 2400
Supports Dual Channel Memory

13. 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.

NETWORKING/COMMUNICATIONS

WLAN
Intel® Dual Band Wireless-AC 9560 802.11ac (2x2) WLAN and Bluetooth® 5 Combo, non-vPro™[14]
Realtek RTL8821CE 802.11ac (1x1) WLAN + Bluetooth®4.2 Combo[14]
Realtek RTL8822BE 802.11ac (2x2) WLAN + Bluetooth®4.2 Combo[14]

Ethernet
Realtek RTL8111HSH-CG 10/100/1000 GbE NIC[16]

14. 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. 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.

AUDIO/MULTIMEDIA

Audio
Integrated microphone (Mono or Dual Array)
2 Integrated stereo speakers

Technical Specifications

Speaker Power
2W/4ohm per Speaker

Camera
720p HD camera[8]
720p HD camera+IR Camera[8,17]

8. HD content required to view HD images.
17. Sold separately or as an optional feature.

KEYBOARDS/POINTING DEICES/BUTTONS & FUNCTION KEYS

Keyboard
HP Premium Keyboard, spill resistant with optional backlit function

Pointing Device
Clickpad with multi-touch gesture support

Function Keys
F1 - Display Switching
F2 - Blank
F3 - Brightness Down
F4 - Brightness Up
F5 - Audio Mute
F6 - Volume Down
F7 - Volume Up
F8 - Mic Mute
F9 - Blank or Backlit Toggle
F10 - Blank
F11 - Wireless
F12 - Sleep

Hidden Functions
Fn+R - Break
Fn+S - Sys Rq
Fn+C - Scroll Lock

SOFTWARE AND SECURITY

BIOS

HP BIOSphere Gen4[18]

HP DriveLock & Automatic DriveLock

BIOS Update via Network

Secure Erase[19]

Absolute Persistence Module[20]

Pre-boot Authentication

HP Wireless Wakeup

Technical Specifications

Software
HP Native Miracast Support[21]
HP LAN-Wireless Protection
HP Connection Optimizer
HP 3D DriveGuard
HP Hotkey Support - CMIT
HP Jumpstart
HP Support Assistant[22]
HP Noise Cancellation Software
HP Host Based MAC Address Manager
Buy Office (sold separately)

Manageability Features
HP Driver Packs[24]
HP System Software Manager (SSM)
HP BIOS Config Utility (BCU)
HP Client Catalog
HP Manageability Integration Kit Gen2[25]
Ivanti Management Suite[26]
HP Cloud Recovery[27]

Client Security Software
- HP Client Security Suite Gen4[28] **including:**
- HP Security Manager[29] **(including Credential Manager, HP Password Manager, HP Spare Key)**
- HP Fingerprint Sensor[30]
- HP Device Access Manager[31]
- HP Power On Authentication
Windows Defender[32]

Security Management
Secure Erase[19]
TPM 2.0 Embedded Security Chip shipped with Windows 10 (Common Criteria EAL4+ Certified)[32]
SATA 0,1 port disablement (viaBIOS)
RAID configurations[34]
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[35]

Technical Specifications

18. HP BIOSphere Gen4 requires Intel(R) or AMD 8th Gen processors. Features may vary depending on the platform and configurations.
19. For the methods outlined in the National Institute of Standards and Technology Special Publication 800-88 "Clear" sanitation method.
20. 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.
21. Miracast is a wireless technology your PC can use to project your screen to TVs, projectors, and streaming
22. HP Support Assistant requires Windows and Internet access.
23. .
24. HP Driver Packs not preinstalled, however available for download at http://www.hp.com/go/clientmanagement.
25. HP Manageability Integration Kit can be downloaded from http://www8.hp.com/us/en/ads/clientmanagement/overview.html.
26. Ivanti Management Suite subscription required.
27. HP Cloud Recovery is available for HP Elite and Pro desktops and laptops PCs with Intel® or AMD processors and requires an open, wired network connection. Note: You must back up important files, data, photos, videos, etc. before use to avoid loss of data. Detail please refer to: https://support.hp.com/us-en/document/c05115630
28. HP Client Security Suite Gen 4 requires Windows and Intel® or AMD 8th generation processors.
29. 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.
30. HP Fingerprint Sensor sold separately or as an optional feature.
31. HP Device Access Manager requires HP Client Security Suite Gen4.
32. Windows Defender Opt in and internet connection required for updates.
33. Firmware TPM is version 2.0. Hardware TPM is v1.2, which is a subset of the TPM 2.0 specification version v0.89 as implemented by Intel Platform Trust Technology (PTT).
34. RAID configuration is optional and does require a second hard drive.
35. HP Sure Click is available on most HP PCs and supports Microsoft® Internet Explorer and Chromium™. Supported attachments include Microsoft Office (Word, Excel, PowerPoint) and PDF files in read only mode when Microsoft Office or Adobe Acrobat are installed.

POWER

Power Supply

HP Smart 65 W External AC power adapter[36]
HP Smart 65 W EM External AC power adapter[36]
HP Smart 65 W USB Type-C™ adapter[36]
HP Smart 45 W External AC power adapter[36]
HP Smart 45 W USB Type-C™ adapter[36]

Primary Battery

3-cell, 45 Wh Long Life Li-ion[37]

Technical Specifications

Battery Life
TBD [38]

Power Cord
3-wire plug - 1m[35]
3-wire plug - 1.8m[35]
2-wire plug - 1m[35]
Duckhead power cord- 1.0m[35]
Duckhead power cord- 1.8m[35]

Battery Weight
0.49 lb
0.22 kg

36. Availability may vary by country.
37. Battery is internal and not replaceable by customer. Serviceable by warranty.
38. 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 www.bapco.com for additional details.

WEIGHTS & DIMENSIONS

Weight
Starting at 4.41 lbs[38]
Starting at 2.0 kgs[38]

Dimensions (w x d x h)
14.37 x 10.11 x 0.75 in
36.49 x 25.69 x 1.9 cm

39. Weight will vary by configuration.

PORTS/SLOTS

Ports
1 USB 3.1 Type-C™ Gen 1 (Power delivery, DisplayPort™)
1 USB 2.0 (Powered port)
2 USB 3.1
1 HDMI 1.4b[39]
1 RJ-45
1 AC power
1 Headphone/microphone combo jack

Expansion Slots
1 SD
Supports SD, SDHC, SDXC

39. HDMI cable sold separately.

Technical Specifications

SERVICE AND SUPPORT

HP Services offers 3-year and 1-year limited warranties and 90 day software limited warranty options depending on country. Batteries have a default one year limited warranty except for Long Life Batteries which will have 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. [40]

40. 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.

ENVIRONMENTAL & INDUSTRY

HP Probook 450 G6 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® Gold registered in the United States. See http://www.epeat.net for registration status in your country. •TCO or TCO Certified Edge		
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)	5.97 W	5.86 W	5.96 W
Normal Operation (Long idle)	2.96 W	3.14 W	3.00 W
Sleep	0.79 W	0.81 W	0.79 W
Off	0.39 W	0.42 W	0.39 W
	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)	20 BTU/hr	20 BTU/hr	18 BTU/hr
Normal Operation (Long idle)	10 BTU/hr	11 BTU/hr	10 BTU/hr
Sleep	3 BTU/hr	3 BTU/hr	3 BTU/hr
Off	1 BTU/hr	1 BTU/hr	1 BTU/hr

Technical Specifications

	Heat dissipation is calculated based on the measured watts, assuming the service level is attained for one hour.	
Declared Noise Emissions	**Sound Power** **(L_{WAd}, bels)**	**Sound Pressure** **(L_{pAm}, decibels)**

(in accordance with ISO 7779 and ISO 9296)		
Typically Configured – Idle	3	26.6
Fixed Disk – Random writes	3	26.7
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: • 3 USB ports • 1 PC card slot (type I/II) • 1 ExpressCard/54 slot • 1 IEEE 1394 Port • 2 SODIMM memory slots • Optional expansion base docking station • 1 multi-bay II storage port • Interchangeable HDD 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/manganese dioxide	
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 (EPEAT) standard at the Gold level, see www.epeat.net • Plastics parts weighing over 25 grams used in the product are marked per ISO11469 and ISO1043. • This product contains 12.7% post-consumer recycled plastic (by wt.) • This product is 96.2% recycle-able when properly disposed of at end of life.	

Packaging Materials	External:	PAPER/Corrugated	295 g
	Internal:	PLASTIC/Polyethylene Expanded - EPE	68 g
		PLASTIC/Polyethylene low density – LDPE	10 g

Technical Specifications

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. • 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	HP follows these guidelines to decrease the environmental impact of product packaging: • Eliminate the use of heavy metals such as lead, chromium, mercury and cadmium in packaging materials. • Eliminate the use of ozone-depleting substances (ODS) in packaging materials. • Design packaging materials for ease of disassembly. • Maximize the use of post-consumer recycled content materials in packaging materials. • Use readily recyclable packaging materials such as paper and corrugated materials. • Reduce size and weight of packages to improve transportation fuel efficiency. • Plastic packaging materials are marked according to ISO 11469 and DIN 6120 standards.
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.

Technical Specifications

HP Inc. Corporate Environmental Information	**For more information about HP's commitment to the environment:** **Global Citizenship Report** **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**

Technical Specifications

SYSTEM UNIT

Stand-Alone Power Requirements (AC Power)	
Nominal Operating Voltage	19V
Average Operating Power	Win 10
Integrated graphics	5.71W
Discrete Graphics	6.78W
Max Operating Power	Discrete < 65W UMA < 45W
Temperature	
Operating	32° to 95° F (0° to 35° C)
Non-operating	-4° to 140° F (-20° to 60° C)
Relative Humidity	
Operating	10% to 90%, non-condensing
Non-operating	5% to 95%, 101.6° F (38.7° C) maximum wet bulb temperature
Shock	
Operating	40 G, 2 ms, half-sine
Non-operating	200 G, 2 ms, half-sine
Random Vibration	
Operating	0.75 grms
Non-operating	1.50 grms
Altitude (unpressurized)	
Operating	-50 to 10,000 ft (-15.24 to 3,048 m)
Non-operating	-50 to 40,000 ft (-15.24 to 12,192 m)
Planned Industry Standard Certifications	
UL	Yes
CSA	Yes
FCC Compliance	Yes
Energy Star®	Selected models [41]
EPEAT	Registered Gold in United States[42]
ICES	Yes
Australia /	Yes
NZ A-Tick Compliance	Yes
CCC	Yes
Japan VCCI Compliance	Yes
KC	Yes
BSMI	Yes
CE Marking Compliance	Yes
BNCI or BELUS	Yes
CIT	Yes
GOST	Yes
Saudi Arabian Compliance (ICCP)	Yes

Technical Specifications

SABS	Yes
UKRSERTCOMPUTER	Yes

41. Configurations of the HP ProBook 450 G6 that are ENERGY STAR® certified[2] are identified as HP ProBook 450 G6 ENERGY STAR on HP websites and on http://www.energystar.gov.

42. EPEAT® registered where applicable. EPEAT registration varies by country. 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.

DISPLAYS

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

Panel LCD 15.6 inch diagonal FHD (1920x1080) Anti-Glare WLED UWVA 45% cg 220nits eDP slim NB non-touch	Outline Dimensions (W x H x D)	350.96 x 216.75 (max.)
	Active Area	344.16 x 193.59 (typ.)
	Weight	<370g max.
	Diagonal Size	15.6"
	Thickness	3.2mm max.
	Interface	eDP 1.2
	Surface Treatment	Anti-glare
	Touch Enabled	No
	Contrast Ratio	600:1 (typ) - AG
	Refresh Rate	60Hz
	Brightness	220 nits typical (Panel Only)
	Pixel Resolution	1920 x 1080 (FHD)
	Format	RGB
	Backlight	LED
	Color Gamut Coverage	45%
	Color Depth	6 bits + Hi FRC
	Viewing Angle	UWVA 85/85/85/85

Panel LCD 15.6 inch diagonal HD (1366x768) Anti-Glare WLED SVA 45% cg 220nits eDP 1.2 w/o PSR slim NB non-touch	Outline Dimensions (W x H x D)	350.96 x 216.75 (max.)
	Active Area	344.16 x 193.59 (typ.)
	Weight	<370g max.
	Diagonal Size	15.6"
	Thickness	3.2mm max.
	Interface	eDP 1.2
	Surface Treatment	Anti-glare

Technical Specifications

	Touch Enabled	No
	Contrast Ratio	300:1 (typ)
	Refresh Rate	60Hz
	Brightness	220 nits typical (Panel Only)
	Pixel Resolution	1366 x 768 (HD)
	Format	RGB
	Backlight	LED
	Color Gamut Coverage	45%
	Color Depth	6 bits + Hi FRC
	Viewing Angle	SVA 40/40/15/30

Panel LCD 15.6 inch diagonal HD (1366x768) WLED SVA 45% cg 220nits eDP 1.2 w/o PSR slim NB touch	Outline Dimensions (W x H x D)	350.96 x 216.75 (max.)
	Active Area	344.16 x 193.59 (typ.)
	Weight	<568g max.
	Diagonal Size	15.6"
	Thickness	3.4mm max.
	Interface	eDP 1.2
	Surface Treatment	BrightView Glass
	Touch Enabled	Yes
	Contrast Ratio	300:1 (typ)
	Refresh Rate	60Hz
	Brightness	220 nits typical (Panel Only)
	Pixel Resolution	1366 x 768 (HD)
	Format	RGB
	Backlight	LED
	Color Gamut Coverage	45%
	Color Depth	6 bits + Hi FRC
	Viewing Angle	SVA 40/40/15/30

STORAGE AND DRIVES

Hard Drives

500 GB 7200 rpm SATA Hard Drive	Drive Weight	0.20 lbs (92 g) ~ 0.21 lbs (95 g)
	Rotation speed	7200 rpm
	Cache Buffer	Up to 32 MB
	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;

Technical Specifications

		Maximum: 18 ~ 22 ms
	Logical Blocks	976,773,168
	Operating Temperature	32° to 140° F (0° to 60° C) [top cover temp]
	Security Features	ATA Security
	Features	S.M.A.R.T., NCQ, Ultra DMA
1 TB 5400 rpm SATA Hard Drive	Drive Weight	0.21 lbs (94 g)
	Rotation speed	5400 rpm
	Cache Buffer	Up to 32 MB
	Height	0.28 in (7.2 mm)
	Width	2.75 in (69.85 mm)
	Interface	ATA-8, SATA 3.0
	Transfer Rate	600 MB/s
	Seek Time	Single Track2 ms Average12 ~ 13 ms Maximum18 ~ 22 ms
	Logical Blocks	1,953,525,168
	Operating Temperature	32° to 140° F (0° to 60° C) [top cover temp]
	Security Features	ATA Security
	Features	S.M.A.R.T., NCQ, Ultra DMA
SSD 128 GB 2280 M2 SATA-3 TLC	Form Factor	M.2 2280
	Capacity	128GB
	NAND Type	TLC
	Height	0.09 in (2.3 mm)
	Width	0.87 in (22 mm)
	Weight	0.02 lb (10 g)
	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
256 GB 2280 PCIe NVMe Value Solid State Drive	Form Factor	M.2 2280
	Capacity	256 GB
	NAND Type	TLC
	Height	0.09 in (2.3 mm)
	Width	0.87 in (22 mm)
	Interface	PCIe NVMe Gen3
	Maximum Sequential Read	Up To 1700 MB/s

	Maximum Sequential Write	**Up To 1300 MB/s**
	Logical Blocks	**500,118,192**
	Operating Temperature	**32° to 158°F (0° to 70°C) [ambient temp]**
	Features	**TRIM; L1.2**

512 GB 2280 M2 PCIe NVMe TLC Solid State Drive	**Form Factor**	**M.2 2280**
	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**

16 GB 2280 PCIe-3x2 NVMe 3D Xpoint Solid State Drive	**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**

512 GB 2280 PCIe NVMe Value Solid State Drive	**Form Factor**	**M.2 2280**
	Capacity	**512 GB**
	NAND Type	**Value**
	Height	**0.09 in (2.3 mm)**
	Width	**0.87 in (22 mm)**
	Interface	**0.02 lb (10 g)**
	Maximum Sequential Read	**Up To 1500 ~ 1700 MB/s**
	Maximum Sequential Write	**Up To 860 ~ 1500MB/s**
	Logical Blocks	**1,000,215,216**
	Operating Temperature	**32° to 158°F (0° to 70°C) [ambient temp]**
	Features	**ATA Security, TRIM; L1.2**

Technical Specifications

Technical Specifications

NETWORKING/COMMUNICATIONS

WLAN

Intel® 9560 802.11a/b/g/n/ac (2x2) WLAN and Bluetooth® 5.0 Combo[1] non-vPro	**Wireless LAN Standards**	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n IEEE 802.11ac IEEE 802.11d IEEE 802.11e IEEE 802.11h IEEE 802.11i IEEE 802.11k IEEE 802.11r IEEE 802.11v
	Interoperability	Wi-Fi® certified
	Frequency Band	802.11b/g/n • 2.402 – 2.482 GHz 802.11a/n/ac • 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[3]	• 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

Technical Specifications

	• 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/Modern 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 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 with CNVi Interface
Dimensions	1. Type 2230: 2.3 x 22.0 x 30.0 mm 2. Type 1216: 1.67 x 12.0 x 16.0 mm
Weight	1. Type 2230: 2.8g 2. Type 126: 1.3g
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

1. Check latest software/driver release for updates on supported security features.
2. Maximum output power may vary by country according to local regulations.
3. 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)
Signaling Data Rate	Legacy: 3 Mbps signaling data rate[1]

Technical Specifications

		BLE: 1 Mbps signaling data rate[1] 1. Actual throughput may vary.
		Legacy: Synchronous Connection Oriented links up to 3, 64 kbps, voice channels
		Legacy: Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric (3-DH5) or 864 kbps symmetric (3-EV5)
	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
	Bluetooth Software Supported	Microsoft Windows Bluetooth Software
	Link Topology	
	Power Management	Microsoft Windows ACPI, and USB Bus Support
	Certifications	FCC (47 CFR) Part 15C, Section 15.247 & 15.249
	Power Management Certifications	ETS 300 328, ETS 300 826 Low Voltage Directive IEC950UL, 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 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)

Realtek 802.11a/b/g/n/ac (2x2) WLAN and Bluetooth® 4.1 Combo[1]	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/ac • 4.9 – 4.95 GHz (Japan) • 5.15 – 5.25 GHz • 5.25 – 5.35 GHz • 5.47 – 5.725 GHz

Technical Specifications

	• 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)
Modulation	Direct Sequence Spread Spectrum BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM
Security[3]	• 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: +14dBm minimum • 802.11g: +12dBm minimum • 802.11a: +12dBm minimum • 802.11n HT20(2.4GHz): +12dBm minimum • 802.11n HT40(2.4GHz): +12dBm minimum • 802.11n HT20(5GHz): +10dBm minimum • 802.11n HT40(5GHz): +10dBm minimum • 802.11ac VHT80(5GHz): +10dBm 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 10 mW 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 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	

1. Check latest software/driver release for updates on supported security features.
2. Maximum output power may vary by country according to local regulations.
3. 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 Wireless Technology

Bluetooth Specification	4.0/4.1 Compliant
Frequency Band	2402 to 2480 MHz
Number of Available Channels	Legacy: 0~79 (1 MHz/CH) BLE: 0~39 (2 MHz/CH)
Signaling Data Rate	Legacy: 3 Mbps signaling data rate[1] BLE: 1 Mbps signaling data rate[1] 1. Actual throughput may vary. Legacy: Synchronous Connection Oriented links up to 3, 64 kbps, voice channels Legacy: Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric (3-DH5) or 864 kbps symmetric (3-EV5)
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
Electrical Interface	USB 2.0 compliant
Bluetooth Software Supported	Microsoft Windows Bluetooth Software
Link Topology	
Power Management	Microsoft Windows ACPI, and USB Bus Support
Certifications	FCC (47 CFR) Part 15C, Section 15.247 & 15.249
Power Management Certifications	ETS 300 328, ETS 300 826 Low Voltage Directive IEC950UL, 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

		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)

Realtek 802.11a/b/g/n/ac (1x1) WLAN and Bluetooth® 4.2 Combo[1]	**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, and 80MHz)
	Modulation	Direct Sequence Spread Spectrum BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM
	Security[3]	• 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: +14dBm minimum • 802.11g: +12dBm minimum • 802.11a: +12dBm minimum • 802.11n HT20(2.4GHz): +12dBm minimum

	• 802.11n HT40(2.4GHz): +12dBm minimum • 802.11n HT20(5GHz): +10dBm minimum • 802.11n HT40(5GHz): +10dBm minimum • 802.11ac VHT80(5GHz): +10dBm 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 10 mW 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 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

1. Check latest software/driver release for updates on supported security features.
2. Maximum output power may vary by country according to local regulations.
3. 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 Wireless Technology

Bluetooth Specification	4.0/4.1/4.2 Compliant
Frequency Band	2402 to 2480 MHz
Number of Available Channels	Legacy: 0~79 (1 MHz/CH) BLE: 0~39 (2 MHz/CH)
Signaling Data Rate	Legacy: 3 Mbps signaling data rate[1] BLE: 1 Mbps signaling data rate[1]

1. Actual throughput may vary.

Technical Specifications

	Legacy: Synchronous Connection Oriented links up to 3, 64 kbps, voice channels Legacy: Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric (3-DH5) or 864 kbps symmetric (3-EV5)
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
Electrical Interface	USB 2.0 compliant
Bluetooth Software Supported	Microsoft Windows Bluetooth Software
Link Topology	
Power Management	Microsoft Windows ACPI, and USB Bus Support
Certifications	FCC (47 CFR) Part 15C, Section 15.247 & 15.249
Power Management Certifications	ETS 300 328, ETS 300 826 Low Voltage Directive IEC950UL, 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 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)

POWER

HP 45W Smart AC adapter	Dimensions (H x W x D)	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

Technical Specifications

		Output current limit	<8.0A
	Connector	4.5mm Barrel Type, 3 pin/grounded, mates with interchangeable cords	
	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 5,000 m)
		Humidity	20% to 95%
		Storage Humidity	10% 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 200,000 hours at 25°C ambient condition.	

HP 65W Smart AC adapter	Dimensions	90x51x28.5mm	
	Weight	unit: 220g +/- 10g	
	Input	Input Efficiency	88% min at 115 VAC and 89% min at 230 VAC
		Input frequency range	47 to 63 Hz
		Input AC current	1.7 A at 90 VAC
	Output	Output power	65W
		DC output	19.5V
		Hold-up time	5 msec at 115 VAC input
		Output current limit	<11.0A
	Connector	4.5mm Barrel Type, 3 pin/grounded, mates with interchangeable cords	
	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%
	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 200,000 hours at 25°C ambient condition.	

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**
		DC output	**65W(19.5V/3.33A)**
		Hold-up time	**5 msec 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%**
	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 200,000 hours at 25°C ambient condition.**	

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 to 63 Hz**
		Input AC current	**1.7 A at 90 VAC and maximum load**
		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	**Type C**	
	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%**
	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 200,000 hours at 25°C ambient condition.**	

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 to 63 Hz**
		Input AC current	**Max. 1.4 A at 90 Vac**
		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	**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%**
	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 200,000 hours at 25°C ambient condition.**	

	Dimensions (H x W x L)	**6.0. x184.7x88.9 mm**
	Weight	**0.22 kg (0.48lb)**

Technical Specifications

3 Cell WHr 45 Long Life - Polymer HP Fast Charge Technology[1]	**Cells/Type**	**3cell Lithium-Ion**
	Voltage	**11.55V**
	Amp-hour capacity	**3.900Ah**
	Watt-hour capacity	**45Wh**
	Operating (Charging)	**32° to 113° F (0° to 45° C)**
	Operating (Discharging)	**14° to 122° F (-10° to 60° C)**

1. **Recharges the battery up to 50% within 30 minutes when the system is off or in standby mode when used with the power adapter provided with the notebook. After charging has reached 50% capacity, charging speed will return to normal. Charging time may vary +/- 10% due to System tolerance.**

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

Type	Description	Part Number
Cases	HP Essential Top Load Case	H2W17AA
	HP Essential Backpack	H1D24AA
	HP Essential Messenger Case	H1D25AA
Dockings	HP USB-C Mini Dock	1PM64AA
	HP USB-C Universal Dock	1MK33AA
	HP USB-C Dock G4	3FF69AA
Input/Output	HP USB Essential Keyboard and Mouse	H6L29AA
	HP Ultra Mobile Wireless Mouse	H6F25AA
	HP Comfort Grip Wireless Mouse	H2L63AA
	HP 3-Button USB Laser Mouse	H4B81AA
	HP USB Travel Mouse	G1K28AA
	HP HDMI to DVI Adapter	F5A28AA
Memory	4GB 2666MHz DDR4	4VN05AA
	8GB 2666MHz DDR4	4VN06AA
	16GB 2666 MHz DDR4	4VN07AA
Power	HP 45W Smart AC Adapter 4.5mm	H6Y88AA
	HP 65W Slim AC Adapter	H6Y82AA
	HP 65W USB-C Power Adapter	3PN48AA
	HP 45W USB-C Power Adapter	1HE17AA
	HP 65W USB-C Power Adapter	1HE08AA
	HP Power Bank	N9F71AA
	HP USB-C Power Bank	2NA10AA
	HP 45W LC USB-C Power Adapter	1MZ01AA#ABA
Storage	HP External USB Optical Drive	F2B56AA
	HP 500GB 7200rpm HDD	F3B97AA
Security	HP Combination Lock	T0Y15AA
	HP Essential Keyed Cable lock 12.3mm	T0Y14AA
	HP Keyed Cable Lock 10mm	T1A62AA
	HP UltraSlim Keyed Cable Lock	T1A62AA
UCC	HP Conferencing Keyboard	K8P74AA
	HP Speaker Phone	K7V16AA
	HP Wired Headset	K7V17AA
Displays	HP ProDisplay P223 21.5-inch Monitor	X7R61AA
	HP ProDisplay P232 23-inch Monitor	K7X31AA
	HP ProDisplay P240va 23.8-inch Monitor	X3B48AA
	HP EliteDisplay E243 23.8-inch Monitor	1FH47AA
	HP EliteDisplay E243m 23.8-inch Collaboration Monitor	1FH48AA
	HP EliteDisplay E273 27-inch Monitor	1FH50AA

Summary of Changes

Date of change:	Version History:		Description of change:
	V1 to V2		