QuickSpecs
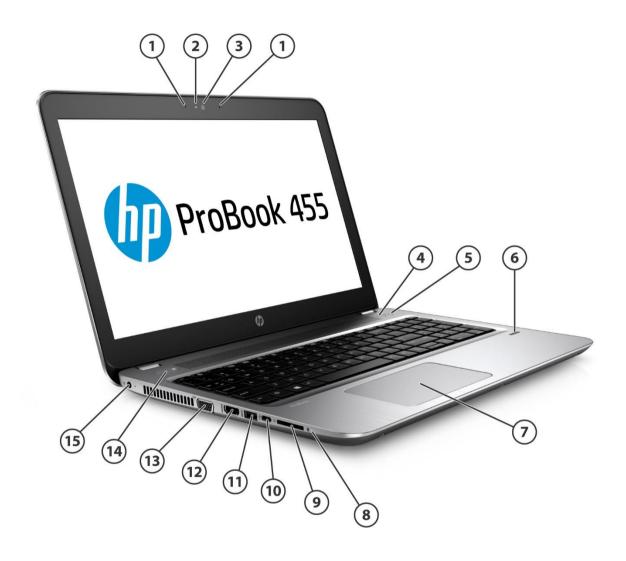
Overview

ProBook 455 G4 Notebook PC

Front

1. Microphones (2)
2. Webcam light
3. Webcam
4. Wireless on/off button
5. Speaker mute button
6. Fingerprint Reader
7. Touchpad
8. Hard Drive LED

9. SD Card reader
10. USB Type-C™ (1)
11. USB 3.0 port
12. HDMI port
13. External VGA monitor port
14. Power button
15. Power connector

QuickSpecs

Overview

Rear/Left

1. Optical drive eject button (select models only)
2. Headphone/Microphone combo jack
3. USB 2.0 ports (2)

4. Ethernet port (RJ-45)
5. Security lock slot

Not all configuration components are available in all regions/countries.
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QuickSpecs

Overview

At A Glance

- Windows 10 Home 64, Windows 10 Pro MSNA 64, FreeDOS 2.0
- Durable multi-layer soft touch painted LCD cover and brushed aluminum keyboard deck that keeps system looking good longer
- Full-sized spill-resistant keyboard with a thin layer of Mylar film to prevent minor spills; full separate numeric keypad
- Large Clickpad with gestures support
- Enhanced security features including HP Client Security Manager and optional HP Fingerprint Reader and TPM 2.0
- HP 3D DriveGuard helps protect critical information while you're on the move.
- HDMI port for connecting to high-resolution displays
- USB Type-C™, and USB 3.0 ports
- HP Audio optimized for high fidelity audio
- Widescreen LED-backlit HD display with 16:9 aspect ratio with available 15.6-inch diagonal HD
- Accelerated Processing Unit and graphics from AMD
- Wireless on/off and speaker mute button to conveniently manage the connectivity and speaker.
- Passed MIL-STD testing[1]
- Flexible wireless connectivity options controlled by HP Connection Manager:
  - Integrated 802.11 b/g/n (1x1) with Bluetooth® 4.0 combo card
  - Integrated 802.11 a/b/g/n/ac (2x2) with Bluetooth 4.2 High Speed combo card

1. MIL STD 810G testing was 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.

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

Features

PRODUCT NAME

HP ProBook 455 G4 Notebook PC

OPERATING SYSTEM

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

Web-only Support
Windows 10 Pro 64[1]
Windows 10 Home 64[1]
Windows 10 Enterprise 64[1]

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.microsoft.com.

NOTE: Your product does not support Windows 8 or Windows 7

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

ACCELERATED PROCESSING UNIT

AMD A10-9600P APU with Radeon™ R6 Graphics (1.8 GHz, 2 MB cache, 4 cores)[1,2]
AMD A9-9410 APU with Radeon™ R4 Graphics (1.8 GHz, 1 MB cache) [1,2]
AMD A6-9210 APU with Radeon™ R4 Graphics (1.8 GHz, 1 MB cache) [1,2]

1. Processor speed denotes maximum performance mode; processors will run at lower speeds in battery optimization mode.

2. 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. AMD's numbering is not a measurement of clock speed.

CHIPSET

Integrated with processor

Not all configuration components are available in all regions/countries.
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Features

GRAPHICS

Integrated graphics[1]
AMD A10-9600P APU with Radeon™ R5 Graphics
AMD A9 9410 APU with Radeon™ R5 Graphics
AMD A6-9210 APU with Radeon™ R4 Graphics

1. Minimum DDR4-1866 required. Dual graphics may be enabled by single channel memory configurations but is not recommended as some memory sensitive applications might have lower dual graphics performance.

DISPLAY

Internal
(39.62 cm) 15.6" diagonal HD SVA eDP LED-backlit HD anti-glare 1 WLAN Antenna (1366 x 768) [1]
(39.62 cm) 15.6" diagonal HD SVA eDP LED-backlit HD anti-glare 2 WLAN Antennas (1366 x 768) [1]

(39.62 cm) 15.6" diagonal HD SVA eDP LED-backlit HD anti-glare 1 camera WLAN Antenna (1366 x 768) [1]
(39.62 cm) 15.6" diagonal HD SVA eDP LED-backlit HD anti-glare 2 camera WLAN Antennas (1366 x 768) [1]

(39.62 cm) 15.6" diagonal FHD SVA eDP LED-backlit HD anti-glare with camera 1 WLAN Antenna (1920 x 1080)[1]
(39.62 cm) 15.6" diagonal FHD SVA eDP LED-backlit HD anti-glare with camera 2 WLAN Antennas (1920 x 1080) [1]

External
Up to 32-bit per pixel color depth
VGA
Port supports resolutions up to 2048 x 1536 external resolution @60 Hz
HDMI
Supports direct connection to high-definition displays with up to 4096 x 2160 @24 Hz resolution and 7-channel audio with one convenient cable (not included)

1. HD content required to view HD images.
NOTE: Resolutions are dependent upon monitor capability, and resolution and color depth settings.

STORAGE AND DRIVES

Primary Storage Bay
Hard Drives
500 GB/ 1TB/ 2TB 5400 rpm SMART SATA HDD
500 GB 7200 rpm SMART SATA HDD

Solid State Drive (by 2.5" converter)
M.2 2280 128 GB SSD SATA

HP 3D DriveGuard (Windows only)
The hard drive is mounted directly to the notebook frame, reducing the transmission of shock to the hard drive

Features

NOTE: For hard drives, GB = 1 billion bytes. Actual formatted capacity is less. Up to 36 GB (for Windows 10) of system disk is reserved for the system recovery software.

OPTICAL DRIVES

Fixed 9.0 mm (0.35 in) SATA Optical Drive
DVD+/-RW SuperMulti DL Drive[1]
DVD-ROM Drive[2]
No optical drive option

1. Sold separately as an optional feature. Double Layer discs can store more data than single layer discs. However, double-layer discs burned with this drive may not be compatible with many existing single-layer DVD drives and players. Don't copy copyright protected materials.

2. Sold separately as an optional feature.

MEMORY

Standard
DDR4 PC4 -1866 (Transfer rates up to 1866 MT/s)
Two SODIMM slots supporting single-channel memory
4 GB, 8 GB, 12 GB, and 16 GB SODIMMs
Maximum
Upgradeable to 16384 MB with optional 8192 MB SODIMMs in slots 1 and 2

NOTE: 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

Wireless
Support for a broad range of secure, integrated wireless LAN featuring support for the latest industry standards. Integrated Bluetooth is also available (factory configurable only) and can be combined with any of the supported wireless LAN options.

Wireless LAN (WLAN)[1]

Realtek 802.11b/g/n (1x1) and Bluetooth® 4.0 Combo

Intel® Dual Band Wireless-AC 7265 802.11a/b/g/n/ac (2x2) WiFi and Bluetooth® 4.2 Combo (non-vPro)

Communications
Realtek 10/100/1000 Ethernet Controller[2]

1. Sold separately as an optional feature. Requires wireless access point and Internet access. Availability of public wireless access points limited.
2. 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
HP Audio
Integrated stereo speakers
Integrated digital microphone (dual-microphone array when equipped with optional webcam)
Function keys for microphone mute, volume up, volume down
Headphone/Microphone combo jack

Webcam
Optional 720p HD webcam [1,2]

- HD format (widescreen)
- Supports videoconferencing and still image capture
- High quality fixed focus lens
- Video capture at various resolutions up to 1280x720 resolution (720p) and up to 30fps
- M-JPEG compression supports higher frame rates for video capture and videoconferencing
- Improved low light sensitivity
- Improved dynamic range
- Skype-ready[3,4]

1. Available on select models.
2. HD content required to view HD images.
3. Internet access required.
4. Not available in China.

KEYBOARDS/POINTING DEVICES/BUTTONS & FUNCTION KEYS

Keyboard
The HP spill-resistant keyboard is designed using a thin layer of Mylar film under the keyboard. The 101/102-key compatible keyboard features a full-pitch key layout with desktop keyboard features, such as editing keys, both left and right control and alt keys, and function keys. US and International key layouts are available. Includes a separate numeric keypad. Backlit keyboard available as an option.
Pointing Devices
Touchpad with gestures support, on/off button with LED indicator, two-way scroll, two pick buttons
Buttons and Function Keys
Separate launch buttons provide easy access to wireless on/off and speaker mute. Function keys provide control of features including: standby mode, display brightness, external display, microphone mute, volume down, volume up and keyboard backlight on/off (select models only).

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

Features

F12 – Blank

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

Gestures
(Windows 10)
Disabled by default
3 Finger Flick
2 Finger Rotate
Momentum Motion
1 Finger Vertical Scroll

Windows 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

Software Included

BIOS

HP BIOSphere[1]
HP DriveLock | HP Automatic DriveLock
HP BIOS Protection[2]
BIOS Update via Network
Master Boot Record Security
Power On Authentication
Pre-Boot Security
Secure Erase[3]
HP Spare Key[10]
Hybrid Boot
Measure Boot
Secure Boot
Absolute Persistence Module[4]

Multi Media

Cyberlink Power Media Player[12]
Native Miracast Support[5]

Communication

HP Mobile Connect[6,11]

HP Value Add Software

HP ePrint Driver[7]

Features

HP Recovery Manager
HP Support Assistant
HP Jumpstart

Microsoft Products

Buy Office
Bing Search
Skype for Business Certified[8]

Manageability

HP Driver Packs[9]
HP SoftPaq Download Manager (SDM)
HP System Software Manager (SSM)[9]
HP BIOS Config Utility (BCU)[9]
HP Client Catalog[9]
HP CIK for Microsoft SCCM[9]
LANDESK Management
HP Image Assistant[9]

For more information on HP Client Management Solutions refer to: http://www.hp.com/go/clientmanagement.

Client Security Software

HP Security Manager (including Credential Manager and Password Manager)
HP Drive Lock
HP Password Manager
Absolute Persistence Module
Power On Authentication
Microsoft Defender[11]

Standard

TPM 2.0 (1.2 optional)
HP Fingerprint reader
Security lock slot

For more information on HP Client Security Software Suite, refer to http://www.hp.com/go/clientsecurity.

1 Available only on business PCs with HP BIOS. HP BIOSphere features may vary depending on the PC platform & configuration.
2 May require a manual recovery step if all copies of BIOS are compromised or deleted. BIOS adheres to NIST SP800-147.
3 For the methods outlined in the National Institute of Standards and Technology Special Publication 800-88.
4 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.
5 Miracast is a wireless technology your PC can use to project your screen to TVs, projectors, and streaming media players that also support Miracast. You can use Miracast to share what you're doing on your PC and present a slide show. For more information: http://windows.microsoft.com/en-us/windows-8/project-wireless-screen-miracast
6 HP Mobile Connect is only available on preconfigured devices with WWAN. For geographic availability refer to http://www.hp.com/go/mobileconnect
7 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 http://www.hp.com/go/eprintcenter). Requires optional

Features

broadband module. Broadband use requires separately purchased service contract. Check with service provider for coverage and availability in your area. Separately purchased data plans or usage fees may apply. Print times and connection speeds may vary.
8 Skype is not offered in China.
9 Not preinstalled, however available on manageability website.
10 Requires initial user set up.
11 Microsoft Defender (Windows 10 only)
12 Only available with optical drive.

POWER

Power Supply

45W Smart 4.5mm AC Adapter	Not available for ASIA, PRC, INDIA, JPN2, JPN/ENG
45W Smart 4.5mm AC Adapter 2-prong (Japan only)	Only available with JPN2, JPN/ENG
65W Smart 4.5mm AC Adapter - EM	Available for ASIA, PRC, INDIA

Power cord included is 1.8 m (+/- 0.1 m) or 1.0 m (+/- 0.1 m).

Primary Battery
HP 3-cell (48 WHr) Lithium-Ion Battery

Battery Life[1]

Platform	Other HW Details	Battery	SSD	HDD
HP Probook 455 G4	AMD A10-9600P APU, Optimal SKU	3 cell (48Whr)	Up to 8 hrs and 45 mins	Up to 8 hrs
HP Probook 455 G4	AMD A9-9410 APU, AMD A6-9210 APU, Optimal SKU	3 cell (48Whr)	Up to 10 hrs and 15 mins	Up to 9 hrs

1. 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

System Standby Time*
TBD

* Standby life will vary depending on various factors including battery, Memory, CPU, EC and LAN chip. The maximum capacity of the battery will naturally decrease with time and usage.

Power Conservation

WEIGHTS & DIMENSIONS

Weight
Lightest possible configuration across battery and panel options (HD Panel, No-ODD, 3-cell (48Whr) Battery, HDD)
Starting at at 4.58 lb/ 2.08 kg
Lightest Weight Configurations (across panel, battery and ODD options, if applicable)

	3-cell (48Whr)
No-ODD	4.58 lb / 2.08 kg
ODD	4.82 lb / 2.19 kg

Features

Dimensions (w x d x h)
38.2 x 26.3 x 2.44 cm (15.04 x 10.35 x 0.96 in)

PORTS/SLOTS

Ports
(1) USB 3.0
(1) USB Type-C™
(2) USB 2.0
(1) HDMI 1.4
(1) VGA
(1) Headphone/Microphone Combo Jack
(1) Power connector – One
(1) RJ-45

Digital Media Slots
Multi Media Reader Slot supporting SD, SDHC, SDXC (Up to 2TB)

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.

NOTE: Certain restrictions and exclusions apply. Consult the HP Customer Support Center for details.
http://h20000.www2.hp.com/bizsupport/TechSupport/ProductRoot.jsp

Technical Specifications

SYSTEM UNIT

Stand-Alone Power Requirements (AC Power)	**Nominal Operating Voltage**	19V
	Average Operating Power	5.7W
	Max Operating Power	< 45W
Temperature	**Operating**	32° to 95° F (0° to 35° C) (not writing optical) 41° to 95° F (5° to 35° C) (writing optical)
	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®	Select models*
	EPEAT®	Registered Gold in United States**
	ICES	Yes
	Australia / 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
	SABS	Yes
	UKRSERTCOMPUTER	Yes

* Configurations of the HP ProBook 455 G4 that are ENERGY STAR qualified are identified as HP ProBook 455 G4 ENERGY STAR on HP websites and on http://www.energystar.gov.
** EPEAT registration varies by country. See http://www.epeat.net for registration status by country.
EPEAT status listed above applies to U.S.

For accessibility information on HP products, please visit: http://www.hp.com/accessibility.

Technical Specifications

DISPLAYS

Panel LCD 15.6 FHD AG WLED SVA 45%cg 220nits eDP Slim		
	Active Area (W x H)	344.2 x 193.5 (mm)
	Dimensions (W x H)	360 x 224.3 (mm) max
	Diagonal Size	15.6 (inch)
	Thickness	3.2 (mm) max
	Weight	370 g max
	Interface	eDP 1.2
	Surface Treatment	Anti-Glare (AG)
	Contrast Ratio	300:1 (typical)
	Refresh Rate	60 Hz
	Brightness	220 nits
	Pixel Resolution - Format	1920 x 1080 (FHD)
	Pixel Resolution - Configuration	RGB
	Backlight	LED
	Color Gamut Coverage	45%
	Color Depth	6 bits + Hi FRC
	Viewing Angle	SVA 45/45/25/35
	Touch Point Supported	N/A
	Other Features	N/A
	Pen Enabled	No

Panel LCD 15.6 HD AG WLED SVA 45%cg 220nits eDP Slim		
	Active Area (W x H)	344.2 x 193.5 (mm)
	Dimensions (W x H)	360 x 224.3 (mm) max
	Diagonal Size	15.6 (inch)
	Thickness	3.2 (mm) max
	Weight	370 g max
	Interface	eDP 1.2
	Surface Treatment	Anti-Glare (AG)
	Contrast Ratio	300:1 (typical)
	Refresh Rate	60 Hz
	Brightness	220 nits
	Pixel Resolution - Format	1366 x 768 (HD)

QuickSpecs

HP ProBook 455 G4 Notebook PC

Technical Specifications

Pixel Resolution - Configuration	RGB
Backlight	LED
Color Gamut Coverage	45%
Color Depth	6 bits + Hi FRC
Viewing Angle	SVA 45/45/25/35
Touch Point Supported	10-point multi-touch
Other Features	AS
Pen Enabled	No

STORAGE AND DRIVES

HARD DRIVES

Internal Storage

500 GB* 5400 rpm SATA Hard Drive	Capacity	500 GB	
	Drive Weight	0.20 lbs (92 g) ~ 0.21 lbs (95 g)	
	Rotation Speed	5400 rpm	
	Cache Buffer	Up to 16 MB	
	NAND Type/Size	N/A	
	Height	0.28 in (7 mm)	
	Width	2.75 in (69.85 mm)	
	Interface	ATA-8, SATA 3.0	
	Interface Transfer Rate	600 MB/s	
	Seek Time	**Single Track**	1.5 ~ 2 ms
		Average	13 ~ 16 ms
		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	
	Other Features	S.M.A.R.T., NCQ, Ultra DMA	

500 GB* 7200 rpm SATA Hard Drive	Capacity	500 GB
	Drive Weight	0.20 lbs (92 g) ~ 0.21 lbs (95 g)
	Rotation Speed	7200 rpm
	Cache Buffer	Up to 32 MB
	NAND Type/Size	N/A

Not all configuration components are available in all regions/countries.
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Technical Specifications

Height	0.28 in (7 mm)		
Width	2.75 in (69.85 mm)		
Interface	ATA-8, SATA 3.0		
Interface 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) [top cover temp]		
Security Features	ATA Security		
Other Features	S.M.A.R.T., NCQ, Ultra DMA		

1TB* 5400 rpm SATA Hard Drive			
Capacity	1 TB		
Drive Weight	0.25 lbs (115 g) ~ 0.22 lbs (102 g)		
Rotation Speed	5400 rpm		
Cache Buffer	8 MB		
NAND Type/Size	N/A		
Height	0.37 in (9.5 mm)		
Width	2.75 in (69.85 mm)		
Interface	ATA-8, SATA 3.0		
Interface Transfer Rate	600 MB/s		
Seek Time	**Single Track**	2 ms	
	Average	13 ms	
	Maximum	15 ~ 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		
Other Features	S.M.A.R.T., NCQ, Ultra DMA		

2TB* 5400 rpm SATA Hard Drive			
Capacity	2 TB		
Drive Weight	0.29lbs (130 g)		
Rotation Speed	5400 rpm		
Cache Buffer	32 MB		
NAND Type/Size	N/A		
Height	0.37 in (9.5 mm)		
Width	2.75 in (69.85 mm)		
Interface	ATA-8, SATA 3.0		

Technical Specifications

Interface Transfer Rate	600 MB/s		
Seek Time	**Single Track**	2 ms	
	Average	12 ms	
	Maximum	22 ms	
Logical Blocks	3,907,029,168		
Operating Temperature	32° to 140° F (0° to 60° C) [top cover temp]		
Security Features	ATA Security		
Other Features	S.M.A.R.T., NCQ, Ultra DMA		

SOLID STATE DRIVE

SSD 128GB 2280 M2 SATA-3 Value	**Capacity**	128 GB	
	Form-Factor (I/O)	M.2 2280	
	NAND Type	TLC	
	Drive Weight	0.01 lb (6 g) ~ 0.02 lb (10 g)	
	Height	0.09 in (2.3 mm)	
	Width	0.87 in (22 mm)	
	Interface	ATA-8, SATA 3.0	
	Performance	**Maximum Sequential Read**	**Maximum Sequential Write**
		530 ~ 535 MB/s	185 ~ 515 MB/s
	Logical Blocks	250,069,680	
	Operating Temperature	32° to 158°F (0° to 70°C) [case temp]	
	Features	ATA Security; DIPM; TRIM; DEVSLP	

* For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 30GB for Windows 10 of system disk is reserved for system recovery software.

OPTICAL DRIVES

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	
		8X DVD+R	
		8X DVD+RW	
		8X DVD-R	
		6X DVD-RW	
		6X - DVD+R Dual Layer	

Not all configuration components are available in all regions/countries.

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Technical Specifications

		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	

DVD-ROM Drive	**Access Times**	**Random**	< 140ms CD (typical)
			< 160ms DVD (typical)
	Max Data Transfer Rate	24X CD-ROM	
		8X-DVD	
	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)	None	
	Max Media Capacity (read)	8.5GB	
	Transport	Tray Loading	

SECURITY

HP Fingerprint Reader (optional)	**Mobile Voltage Operation**	3.0V-3.6V Single Supply
	Operating Temperature	32° – 158°F (0° – 70°C)
	Current Consumption @ 3.3V	Less than 70 mA peak imaging and scrolling Less than 25 mA hardware finger detection Advanced Power Management
	High-Rate Image Capture	Up to 240 image frames /sec
	ESD Resistance	IEC 61000-4-2 Level 4 (±15KV)
	Detection Matrix	192 x 16 Pixels 9.7 mm x 0.81 mm 500 ppi High-Resolution Images

Not all configuration components are available in all regions/countries.

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Technical Specifications

NETWORKING/COMMUNICATIONS

Integrated Realtek 10/100/1000 NIC	Ethernet Features	10 Mbit/s operation (10BASE-T; IEEE 802.3i; IEEE 802.3 clauses 13-14) 100 Mbit/s operation (100BASE-TX; IEEE 802.3u; IEEE 802.3 clauses 21-30) 1000 Mbit/s operation (1000BASE-T; IEEE 802.3ab; IEEE 8023 clauses 40) Auto-Negotiation (Automatic Speed Selection) Full Duplex Operation at all Speeds, Half Duplex operation at 10 and 100 Mbit/s IEEE 802.1p QoS (Quality of Service) Support IEEE 802.1q VLAN support IEEE 802.3x Flow Control (IEEE 802.3 clauses 31-32; configurable) IEEE 802.3az EEE (Energy Efficient Ethernet) Jumbo Frame 9K Auto MDI/MDIX Crossover cable detection
	Power Management	ACPI compliant - multiple power modes Situation-sensitive features reduce power consumption Advanced link down power saving for reducing link down power consumption
	Performance Features	TCP/IP/UDP Checksum Offload (configurable) Protocol Offload (ARP & NS) Large send offload and Giant send offload Receiving Side Scaling
	Manageability	Wake-on-LAN from standby and hibernation (Magic Packet and Microsoft Wake-Up Frame); Wake-on-LAN from off (Magic Packet only) PXE 2.1 Remote Boot Statistics Gathering (SNMP MIB II, Ethernet-like MIB, Ethernet MIB (802.3x, clause 30)) Comprehensive diagnostic and configuration software suite Virtual Cable Doctor for Ethernet cable status
	Interface	PCI Express 1.1 x1 to fully support ASPM L0s/L1 and CLKREQ
	NIC Device Driver Name	Realtek PCIe GBE Ethernet Family Controller

*Wireless access point and internet service required. Availability of public wireless access points limited.

Realtek 802.11 b/g/n (1x1) with Bluetooth® v4.0 combo *	Wireless LAN Standards	IEEE 802.11b IEEE 802.11g IEEE 802.11n
	Interoperability	Wi-Fi certified
	Frequency Band	2.402 – 2.482 GHz
	Data Rates	802.11b: 1, 2, 5.5, 11 Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11n: card will support rates for NSS=1 for RX and TX for 20 MHz channels. Short and long guard interval will be supported.
	Modulation	Direct Sequence Spread Spectrum BPSK, QPSK, CCK, 16-QAM, 64-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 types WPA, WPA2:

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	802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES. WPA2 certification IEEE 802.11i Cisco Certified Extensions, all versions through V5 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]	13.5 dBm, nominal	
Power Consumption	Transmit: 2.0 W (max) Receive: 1.6 W (max) Associated to Access Point, Idle: 250 mW nominal Wireless Button Off: 100 mW nominal Radio disabled: 75 mW nominal	
Power Management	ACPI compliant power management 802.11 compliant power saving mode	
Receiver Sensitivity[3]	802.11b:-95 dBm (1 Mbps), -93 dBm (2 Mbps), -91 dBm (5.5 Mbps), -88 dBm (11 Mbps) 802.11g:-90 dBm (6 Mbps), -89 dBm (9 Mbps), -87 dBm (12 Mbps), -85 dBm (18 Mbps), -82 dBm (24 Mbps), -79 dBm (36 Mbps), -76 dBm (48 Mbps), -74 dBm (54 Mbps) 802.11n:-70dBm (72.2 Mbps)	
Antenna type	High efficiency antenna with spatial diversity, mounted in the display enclosure	
Form Factor	PCI-Express Half-MiniCard	
Weight	0.013 lb (6 g)	
Dimensions	0.19 x 1.06 x 1.18 in (4.75 x 26.8 x 30 mm)	
Operating Voltage	3.3v +/- 9%	
Temperature	**Operating** **Non-operating**	14° to 158° F (−10° to 70° C) −40° to 176° F (−40° to 80° C)
Humidity	**Operating** **Non-operating**	10% to 90% (non-condensing) 5% to 95% (non-condensing)
Altitude	**Operating** **Non-operating**	0 to 10,000 ft (3,048 m) 0 to 50,000 ft (15,240 m)
LED Activity	**Amber** – Radio OFF; **White** – Radio ON	
Notes	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).	

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Bluetooth 4.0 Wireless Technology

Bluetooth Specification	2.1+EDR, 3.0, 4.0 Compliant
Dimensions	1.18 x 0.26 x 0.13 in (30 x 6.5 x 3.25 mm)
Frequency Band	2402 to 2480 MHz
Number of Available Channels	79 (1 MHz) available channels
Data Rates and Throughput	3 Mbps data rate; throughput up to 2.17 Mbps
	Synchronous Connection Oriented links up to 3, 64 kbps, voice channels
	Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric or 1306.9 kbps symmetric
Transmit Power	Max 4 dBm (Bluetooth Class II)
Receiver Sensitivity	Better than -80 dBM at 0.1 % raw bit error rate
Power Consumption	Average 230mW
	Sleep <1 mW
Antenna	Internally integrated within module
Range	Up 33 ft (10 m)
Electrical Interface	USB 2.0 compliant
	Microsoft Windows Plug and Play compliant
Bluetooth Software Supported	Broadcom Bluetooth for Windows
	Microsoft Windows Bluetooth Software
Link Topology	Point to Point, Multipoint Pico Nets up to 7 slaves
Security	Full support of Bluetooth Security Provisions
Power Management	Microsoft Windows ACPI, and USB Bus Support
	Self configurable to optimize power conservation in all operating modes, including Standby, Hold, Park, and Sniff
Certifications	All necessary regulatory approvals for supported countries, including:
	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

Temperature	**Operating**	−4° to 158° F (−20° to 70° C)
	Non-operating	−40° to 176° F (−40° to 80° C)
Humidity	**Operating**	10% to 90%
	Non-operating	5% to 95%
Altitude	**Operating**	15,000 ft (4,572 m)
	Non-operating	40,000 ft (12,192 m)

Not all configuration components are available in all regions/countries.
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Bluetooth Profiles Supported	Serial Port Profile (SPP)[1]
	Service Discovery Application Profile (SDAP)
	Dial-Up Networking (DUN)[1,2]
	Generic Object Exchange Profile (GOEP)[1,2]
	Object Push Profile (OPP)[1,2]
	File Transfer Profile (FTP)
	Synchronization Profile (SYNC)
	Hard Copy Cable Replacement (HCRP)[1,2]
	Personal Area Networking Profile (PAN)[1,2,]
	Human Interface Device Profile (HID)[1,2,3]
	FAX Profile (FAX)
	Basic Imaging Profile (BIP)[2]
	Headset Profile (HSP)
	Hands Free Profile (HFP)
	Advanced Audio Distribution Profile (A2DP)

[1] indicates the profile is supported by Microsoft Windows XP SP2
[2] indicates the profile is part of Windows Vista

*Wireless access point and internet service required. Availability of public wireless access points limited.

Intel® 802.11 a/b/g/n/ac (2x2) +Bluetooth® 4.2 Combo*	**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
		Note:
		The FCC has declared as of January 1, 2015 products that utilize passive scanning on channel 12/13 and are capable of transmitting must fully comply with requirements of 15.247 or otherwise disable those channels.
		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
		Note: Indonesia no support this band
	Data Rates	• 802.11b: 1, 2, 5.5, 11 Mbps
		• 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps

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- 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[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 : +16dBm minimum 802.11g : +14dBm minimum 802.11a : +14dBm minimum 802.11n HT20(2.4GHz) : +14dBm minimum 802.11n HT40(2.4GHz) : +12dBm minimum 802.11n HT20(5GHz) : +14dBm minimum 802.11n HT40(5GHz) : +12dBm minimum
Power Consumption	Transmit: 2.0 W (max) Receive: 1.6 W (max) Idle mode (PSP): 180 mW (WLAN Associated) Idle mode: 50 mW (WLAN unassociated) Connect Standby: 10 mW (WLAN+BT) Radio disabled: 5 mW
Power Management	ACPI and PCI Express compliant power management 802.11 compliant power saving mode
Receiver Sensitivity[3]	802.11b, 1Mbps : -94dBm maximum 802.11b, 11Mbps : -86dBm maximum 802.11g, 6Mbps : -88dBm maximum 802.11g, 54Mbps : -74dBm maximum 802.11a, 6Mbps : -88dBm maximum 802.11a, 54Mbps : -74dBm maximum 802.11n, MCS07 : -69dBm maximum 802.11n, MCS15 : -66dBm maximum 802.11ac, 1SS, MCS-0 : -86dBm maximum 802.11ac, 1SS, MCS-9 : -61dBm maximum 802.11ac, 2SS, MCS-0 : -83dBm maximum 802.11ac, 2SS, MCS-9 : -58dBm 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

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Form Factor	PCI-Express M.2 MiniCard
Dimensions	Type 2230: 2.3 x 22.0 x 30.0 mm Or Type 1630: 2.3 x 16.0 x 30.0 mm
Weight	Type 2230: 2.8g Or Type 1630: 2g
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).

* Wireless access point and internet service required. 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.

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)
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
	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.

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AUDIO/MULTIMEDIA

Hardware	**Implementation**	Conexant
	Function Key Volume Controls	Volume up, volume down, and mute
	Full Duplex	Yes
	Microphone In	Stereo
	Headphone/Line Out	Stereo
	Integrated Microphone	Yes, dual digital microphone array
Audio Output Quality	**Frequency Response**	20Hz – 20kHz
	Signal to Noise Ratio	106 dB (DAC), 102dB (ADC)
	Total Harmonic Distortion	91dB THD+n on Line Out/HP (0.003%)
	Noise Floor	Up to 192kHz
	Play/Record Sampling Rate(s)	Up to 96Khz
	DAC	16, 20 or 24-bit
	ADC	16, 20 or 24-bit
Integrated Stereo Speakers	**Power Rating**	2 Watts
	Impedance	4 Ohms

POWER

HP 65W Smart AC Adapter 3-prong (EM Model)	**Dimensions**	4.96 x 1.96 x 1.18 in (12.6cmx5.0cmx3.0cm)	
	Weight	1.65 lb (275g) max	
	Input	**Input Voltage**	90V to 264V
		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**	65W(19.5V/3.33A) ; 7.5W(5V/1.5A)
		DC output	19.5V
		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%

Not all configuration components are available in all regions/countries.

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	Safety Certifications	CE Mark - 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; Reliability - failure rate of less than 0.1% annually within the first three years of operation.	
HP 45W Smart AC Adapter	**Dimensions**	3.78 x 1.95 x 0.88 in (9.6 x 4.95 x 2.24 cm)	
	Input	90 to 265 VAC	
		Input Efficiency	87% min at 115 VAC
		Input frequency range	47 to 63 Hz
		Input AC current	1.4 A at 90 VAC and maximum load
	Output	**Output power**	45W
		DC output	19.5V
		Hold-up time	5 msec at 115 VAC input
		Output current limit	<8A, Over voltage protection- 29V max automatic shutdown
	Connector	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 121° F (-20° to 85° C)
		Altitude	0 to 16,405 ft (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; Reliability - failure rate of less than 0.1% annually within the first three years of operation.	
3-Cell (48 WHr) Long Life Lithium-Ion battery	**Dimensions** (H x W x L)	7.0. x180.48x88.95 mm (0.273 x 7.09 x 3.49 inch)	
	Weight (max)		
	Weight	0.22 kg (0.48lb)	
	Cells/Type	3cell Lithium-Ion	
	Energy	**Voltage**	11.4V/ 10.95V
		Amp-hour capacity	4.212Ah /4.385Ah
		Watt-hour capacity	48Wh
	Temperature Temperature	**Operating (Charging)**	*32˚ to 113˚ F (0˚ to 45˚ C)*
		Operating (Discharging)	*14˚ to 122˚ F(-10˚ to 60˚ C)*
		Non-operating	*-4˚ to 122˚ F (-20˚ to 60˚ C)*
	Battery Re-Charge Time Battery Re-Charge Time	**System in OFF or Standby Mode**	<3 hours
	Fuel Gauge LED	No	

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Warranty	3 year
Optional Travel Battery Available	No

ENVIRONMENTAL

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.

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)	8.83 W	9.15 W	8.83 W
Normal Operation (Long idle)	4.70 W	4.81 W	4.69 W
Sleep	0.41 W	0.43 W	0.41 W
Off	0.29 W	0.32 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.

Not all configuration components are available in all regions/countries.
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COUNTRY OF ORIGIN

China

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

Type	Description	Part #
Docking	HP 3001pr USB 3 Port Replicator	F3S42AA
	HP 3005pr USB 3.0 Port Replicator	H1L08AA#xxx
	HP Display and Notebook Stand	E8G00AA#xxx
Input/Output	HP Stylish Wireless Keyboard and Mouse	H4B79AA#xxx
	HP USB Essential Keyboard and Mouse	H6L29AA
	HP 2.4 GHz Keyboard and Mouse	G1K29AA#xxx
	HP Ultra Mobile Wireless Mouse	H6F25AA#xxx
	HP Comfort Grip Wireless Mouse	H2L63AA
	HP 3-Button USB Laser Mouse	H4B81AA
	HP USB Travel Mouse	G1K28AA
	HP Ultrathin Wireless Mouse SE	L9V77AA
	HP Ultrathin Wireless Mouse	L9V78AA
	HP HDMI to DVI Adapter	F5A28AA
	HP Wireless Display Adapter	J1V25AA#xxx
	HP Stereo USB Headset	T1A67AA
	HP Stereo 3.5mm Headset	T1A66AA
Power	HP 45W Smart AC Adapter 4.5mm	H6Y88AA#XXX
	HP 65W Smart AC Adapter	H6Y89AA#xxx
	HP 65W Slim AC Adapter	H6Y82AA#xxx
	HP 90W Slim Combo AC Adapter w/ USB	H6Y84AA#xxx
	HP Power Bank	N9F71AA#xxx
Storage	HP External USB Optical Drive	F2B56AA
Security	HP UltraSlim Keyed Cable Lock	H4D73AA
	HP USB Smart Card Reader	F6V67AA
	15.6" Privacy Filter	V8Z58AA
	HP Essential Combination Lock	T0Y16AA
	HP Combination Lock	T0Y15AA
	HP Keyed Cable lock	T0Y14AA
	HP Keyed Cable Lock 10mm	T1A62AA
	HP Dual Head Keyed Cable Lock	T1A64AA
UCC	HP Conferencing Keyboard	K8P74AA#xxx
	HP Speaker Phone	K7V16AA
	HP Wired Headset	K7V17AA

Summary of Changes

Date of change:	Version History:		Description of change:
	Version 1 to 2		

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