

Overview

HP ZBook 15v G5 Mobile Workstation



- 1. Clickpad
- 2. HD Camera
- 3. IR Camera

- 4. Microphone
- 5. Fingerprint sensor

HP ZBook 15v G5 Mobile Workstation

Overview



LEFT VIEW

1. (2) USB-A 3.0
2. SD Card reader
3. Security cable slot
4. Storage Usage Indicator LED

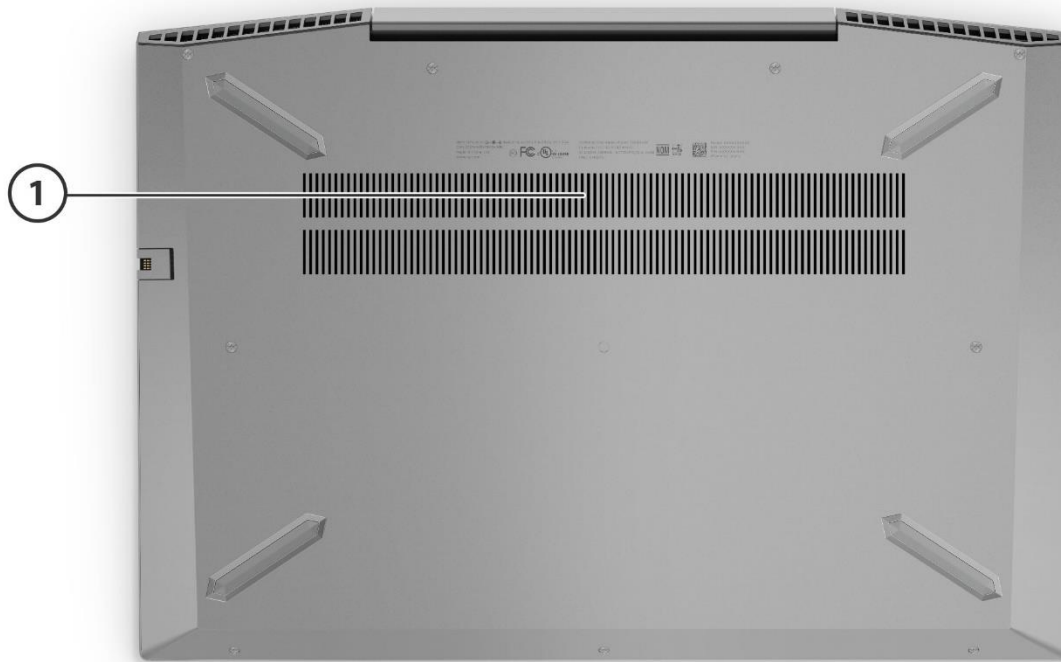
HP ZBook 15v G5 Mobile Workstation



RIGHT VIEW

1. power connector
2. USB Type-C™ (Thunderbolt™ 3, DisplayPort™ 1.2, USB 3.1)
3. HDMI 2.0
4. headphone/microphone combo
5. USB 3.0 Charging
6. Ethernet port (RJ-45)
7. Power LED

Overview



BOTTOM VIEW

1. Fan Venting

Overview

At A Glance

- Eye-catching industrial design, Aluminum Keyboard deck with HP's turbo silver color provides optimal durability with minimal weight.
- Featuring HP Spill Resistant Keyboard with Clickpad to manage most commonly used functions with a single keystroke..
- ISV certified to provide fast and reliable performance with workstation applications, including manipulation of 3D textures
- HP Performance Advisor for optimal configuration, compatibility and performance
- Optional Workstation-caliber graphics:
 - NVIDIA® Quadro® discrete graphics featuring NVIDIA® Optimus technology:
 - NVIDIA® Quadro® P600 (4GB GDDR5)
- Intel® Integrated graphics: Intel® UHD Graphics 630 integrated on Core™ i5 and i7. Intel® UHD Graphics P630 integrated on Xeon® processors. Intel® Xeon® processor configurations require the NVIDIA® Quadro® P600 (4GB GDDR5) graphics card.
- Choice of 8th or 9th generation Intel® Core™ i5 quad-core and Intel® Core™ i7 hexa-core or Intel® Xeon® hexa-core processors with optional Intel® vPro™ technology.
- Populate up to two SODIMM slots supporting up to 32 GB DDR4-2667MHz dual-channel memory. Up to 32GB ECC DDR4-2667MHz dual-channel memory available with Intel® Xeon® processors.
- Supports multi-display, including up to three (3) displays without a docking solution, with hybrid graphics enabled. Supports up to five (5) displays, with hybrid graphics enabled.
- Choice of 15.6-inch diagonal LED-backlit displays:
 - FHD IPS anti-glare, 220nits, 67% sRGB (1920 x 1080);
 - FHD IPS touch screen with Corning® Gorilla® Glass 4, 250 nits, 67% sRGB (1920 x 1080);
 - UHD IPS anti-glare, 340nits, 100% sRGB (3840 x 2160)
- One (1) Thunderbolt™ 3 port (supporting DP 1.2, USB 3.1, PCIe Gen 3 devices) on the new USB-C™ connector, for high speed data/video/audio transfer support.
- Flexible wireless connectivity options:
 - Intel® Dual Band Wireless-AC 9560 802.11 AC/a/b/g/n (2x2) WiFi and Bluetooth 5.0 combo adaptor (non-vPro™) or Intel® Dual Band Wireless-AC 9560 802.11 AC/a/b/g/n (2x2) WiFi and Bluetooth 5.0 combo adaptor (vPro™)
- Optimize your audio experience for conference calls and remote collaboration with optional HD webcam, dual-array microphones, and premium speakers. Custom-tuned by HP and Bang & Olufsen optimized for high fidelity audio with immersive surround sound with deep, rich bass and crystal-clear dialog without distortion at high volume.
- HP Long life battery solution: 4-cell (70 WHr) or 3-cell (52.5 WHr) supporting HP Fast Charge capability
- Two dedicated drive slots. (1) M.2 slots and (1) 2.5" drive bays supporting up to 4TB of data.
- Security features including TPM 2.0 and HP Fingerprint Sensor

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

Features

OPERATING SYSTEM

Preinstalled	Windows 10 Pro 64 – HP recommends Windows 10 Pro* Windows 10 Home 64 Plus* Windows 10 Pro 64 Workstation Plus*
	FreeDOS 2.0
Supported	Windows 10 Enterprise 64*

*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>

PROCESSOR*

9th Generation Intel® Core™ i9-9880H vPro™ processor with Intel® UHD Graphics 630 (2.3 GHz base frequency, up to 4.8 GHz with Intel® Turbo Boost Technology, 16 MB cache, 8 cores)

9th Generation Intel® Core™ i7- 9750H with Intel® UHD Graphics 630 (2.6 GHz base frequency, up to 4.5 GHz with Intel® Turbo Boost Technology, 12 MB cache, 6 cores)

9th Generation Intel® Core™ i5 -9300H with Intel® UHD Graphics 630 (2.4 GHz base frequency, up to 4.1 GHz with Intel® Turbo Boost Technology, 8 MB cache, 4 cores)

8th Generation Intel® Core™ i7-8850H vPro™ processor with Intel® UHD Graphics 630 (2.6 GHz base frequency, up to 4.3 GHz with Intel® Turbo Boost Technology, 9 MB cache, 6 cores)

8th Generation Intel® Core™ i7-8750H with Intel® UHD Graphics 630 (2.2 GHz base frequency, up to 4.1 GHz with Intel® Turbo Boost Technology, 9 MB cache, 6 cores)

8th Generation Intel® Core™ i5-8400H vPro™ processor with Intel® UHD Graphics 630 (2.5 GHz base frequency, up to 4.2 GHz with Intel® Turbo Boost Technology, 8 MB cache, 4 cores)

8th Generation Intel® Core™ i5-8300H with Intel® UHD Graphics 630 (2.3 GHz base frequency, up to 4.0 GHz with Intel® Turbo Boost Technology, 8 MB cache, 4 cores)

Intel® Xeon® E-2176M vPro™ processor with Intel® UHD Graphics P630 (2.7 GHz base frequency, up to 4.4 GHz with Intel® Turbo Boost Technology, 12 MB cache, 6 cores)

*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.

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>

CHIPSET

Mobile Intel® CM246

Features

INTEL® CORE™ I5 WITH VPRO/CORE™ I7 WITH VPRO/XEON® WITH VPRO TECHNOLOGY CAPABLE

Intel® Core™ i5 with vPro™, Core™ i7 with vPro™ and Xeon® with vPro™ technology is a selectable feature that is available on units configured with select processors, a qualified Intel® WLAN module and a preinstalled Windows® operating system. It provides advances in remote manageability, security, energy efficient performance, and wireless connectivity. Intel® Active Management Technology (iAMT) offers built-in manageability and proactive security for networked mobile workstations, even when they are powered off* or when the operating system is inoperable. It can help identify threats before they reach the network, isolate infected systems, and update regardless of their power state.

* Requires a Windows operating system, network hardware and software, connection with a power source, and a direct (non-VPN) corporate network connection which is either cable or wireless LAN.

NOTE: Some functionality of Intel® Core™ i5 with vPro™/Core™ i7 with vPro™/Core™ i9 with vPro™/Xeon® with vPro™ technology, such as Intel® Active Management technology and Intel® Virtualization technology, requires additional third-party software in order to run. Availability of future "virtual appliances" applications for Intel® Core™ i5 with vPro™/Core™ i7 with vPro™/Core™ i9 with vPro™/XEON® with vPro™ technology is dependent on third-party software providers. Compatibility with future "virtual appliances" is yet to be determined.

GRAPHICS

Integrated

Intel® UHD Graphics 630^{1,2}

Intel® UHD Graphics P630^{1,2}

Discrete

NVIDIA® Quadro® P600 (4 GB GDDR5 dedicated)

NOTE 1: UHD content required to view UHD images

NOTE 2: Intel® UHD graphics 630 is configurable as a standalone graphics option; Intel® UHD graphics P630 only used when NVIDIA® Optimus™ Technology is enabled.

NOTE 3: Intel® Xeon® processor configurations require the NVIDIA® Quadro® P600 (4GB GDDR5) graphics card.

Multi-Display Support

Without HP Thunderbolt™ Dock G2:

HP ZBook 15v with hybrid graphics and without the use of the dock supports up to a maximum of 3 independent displays. These three displays are the internal panel plus two external displays connected to the two following ports: HDMI 2.0, Thunderbolt™ 3.

With HP Thunderbolt™ Dock G2¹:

HP Thunderbolt™ Dock when used together with the HP ZBook 15v configuration with hybrid graphics, supports a maximum of 5 independent displays provided DisplayPort™ is connected. These five displays are internal panel, one external display connected to the system's HDMI port and 3 external displays connected to the dock's Type-C, or VGA, and two DisplayPort™ ports. If Thunderbolt™ only port on the dock is connected, then the 3 external displays will not function.

¹HP ZBook 15v G5 Mobile Workstation does not support 2 4K monitors with HP Thunderbolt Dock G2

Features

DISPLAY

- 15.6" diagonal FHD IPS anti-glare eDP LED-backlit 220nits at 67% sRGB (1920 x 1080);
- 15.6" diagonal FHD IPS anti-glare eDP LED-backlit touch screen with Corning® Gorilla® Glass 4, 250 nits at 67% sRGB (1920 x 1080);
- 15.6" diagonal 4K IPS anti-glare eDP LED-backlit 340nits at 100% sRGB (3840 x 2160)

STORAGE AND DRIVES*

(2) M.2

- SATA SED Solid State Drive
- 256GB M.2 SATA-3 Self-Encrypting Drive (SED) Solid State Drive

PCIe NVMe Solid State Drive

- 16 GB Intel® Optane™ memory**,***
- 256GB M.2 PCIe NVMe™ TLC Solid State Drive
- 512GB M.2 PCIe NVMe™ TLC Solid State Drive
- 1TB M.2 PCIe® NVMe™ TLC Solid State Drive
- 2TB M.2 PCIe® NVMe™ TLC Solid State Drive
- 256GB M.2 PCIe® NVMe™ TLC Self-Encrypting Drive (SED) Solid State Drive
- 512GB M.2 PCIe® NVMe™ TLC Self-Encrypting Drive (SED) Solid State Drive

(1) 2.5" Storage Bay Drives*

- 2TB SATA (5400 rpm) Hard Disk Drive
- 500GB SATA (7200 rpm) Hard Disk Drive
- 1TB SATA (7200 rpm) Hard Disk Drive
- 500GB SATA Self-Encrypting Drive (SED) (7200 rpm) Hard Disk Drive
- 500GB SATA SSHD (Hybrid Drive) (8 GB cache)
- 1TB SATA SSHD (Hybrid Drive) (8 GB cache)
- 2TB SATA SSHD (Hybrid Drive) (8 GB cache)

HP 3D DriveGuard (Windows only)

The hard drive is mounted directly to the notebook frame, reducing the transmission of shock to the hard drive. Uses three-axis digital motion detection with intelligent sensitivity to help protect the hard drive during normal use from shock and vibration. The digital accelerometer temporarily halts all data transfer and parks the hard drive when abrupt motion is detected.

*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.

**Must be configured with either a Hard Disk Drive or a Hybrid Drive. Cannot be configured with an additional M.2 SSD.

***Intel® Optane™ memory system acceleration does not replace or increase the DRAM in your system.

Features

DRIVE CONTROLLERS

2.5" Storage Bay and M.2 Storage Bay (SATA):	SATA-3 or SATA-2 for HDD and SATA-3 for SSD
RAID:	Not supported

MEMORY

32 GB DDR4-2667 ECC or non-ECC SDRAM
Two SODIMM slots supporting dual-channel memory

4 GB, 8GB and 16 GB SODIMMs (for Intel® Core™ Processors)
8GB and 16 GB ECC SODIMMs (for Intel® XEON® Processors)

Maximum

Upgradable to 64GB with optional 32GB SODIMMs in 2 slots

Dual-channel

Maximized dual-channel performance requires SODIMMs of the same size and speed in both memory channels.

NOTE: Transfer rates up to 2667 MT/s for systems with less than 32 GB. ECC memory only available with Intel® Xeon® processors.

NETWORKING/COMMUNICATIONS

LAN*

Integrated Intel® I219-LM Gigabit Network Connection

Wireless

Support for a broad range of secure, integrated wireless LAN options 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.

802.11 Wireless LAN options**

Intel® Dual Band Wireless-AC 9560 802.11ac (2x2) Wi-Fi and Bluetooth® 5.0 Combo
Intel® Dual Band Wireless-AC 9560 802.11ac (2x2) Wi-Fi® and Bluetooth® 5.0 Combo, non-vPro™

*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.

**Wireless cards are optional or add-on features and requires separately purchased wireless access point and internet service. 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.

Features

AUDIO/MULTIMEDIA

Audio

HP tuned Bang & Olufsen HD audio. Integrated stereo speakers and microphone (dual-microphone array when equipped with optional webcam and optional world facing microphone). Functions keys for volume mute, up and down. Combo microphone-in/stereo headphone-out jack.

Webcam*

Optional (720p HD webcam)

- 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

Optional IR camera (1080p FHD) for face authentication with Windows Hello

- FHD format
- Supports videoconferencing and still image capture
- High quality fixed focus lens
- Video capture at various resolutions up to 1920x1280 resolution (1080p) and up to 30fps
- M-JPEG compression supports higher frame rates for video capture and videoconferencing

*HD content required to view HD images

**Optional or add-on feature

KEYBOARDS/POINTING DEVICES/BUTTONS & FUNCTION KEYS

Keyboard

HP Backlit Keyboard* with function key control and numeric keypad

* the Spill resistance is IPX1 standard 1mm/min for 10mins not traditional Commercial spill Keyboard

Pointing Devices

Clickpad with multi-touch gesture support

Buttons and Function Keys

Discrete buttons provide easy access to the following features:

- F1 – Open App
- F2 – Brightness Down
- F3 – Brightness Up
- F4 – Display Switching
- F5 – Keyboard backlight
- F6 – Speaker mute
- F7 – Volume down
- F8 – Volume up
- F9 – Plays previous track

Features

- F10 – Pause / Play
 - F11 – Plays next track
 - F12 – Wireless on/off
-

Features

SOFTWARE AND SECURITY

Preinstalled Software with Windows® Operating System

Bing search for IE11; Buy Office (sold separately); HP ePrint Driver + JetAdvantage; HP Hotkey Support; HP Noise Cancellation Software; HP Performance Advisor; HP Recovery Manager; HP Remote Graphics Software; HP Support Assistant; HP Velocity; HP WorkWise (requires Bluetooth); Skype for Business Certified; HP LAN-WLAN Protection; HP JumpStart ^{1,2,3}

Security Management

Absolute persistence module; Common Criteria EAL4+ Augmented Certified Discrete TPM 2.0 Embedded Security Chip; HP 3D Drive Guard; HP FingerPrint Sensor; One-step log-on; Optional USB port disable at factory (user configurable via BIOS); Power-on password (via BIOS); Removable media write/boot control; SATA port disablement (via BIOS); Security lock slot; Serial enable/disable (via BIOS); Setup password (via BIOS); Support for Intel® Anti-Theft Technology; IR camera with Windows Hello ^{4,5,6,7,8,9}

TPM

Model: Infineon SLB9670

Version: 7.63.3353.0

Revision: TPM 2.0

FIPS 140-2 Compliant: TBD

Fingerprint Sensor (Optional)

Voltage: 3.0-3.6V

Operating temperature: -20° - 85°C

Imaging current: 31mA

Wake on finger current: 40 uA

Capture rate: 30ms/frame

ESD Resistance: IEC 6100-4-2 4B (+/-15KV)

Detection Matrix: 363 dpi, sensing area 8x8 mm

HP Remote Graphics Software

The remote desktop solution for serious workstation users and their most demanding applications.

Download at: <http://www.hp.com/go/RGS>

HP Performance Advisor

HP Performance Advisor enables optimal configuration of HP Mobile Workstations delivering stability and best performance. HP Performance Advisor will guide your system setup allowing a "custom" configuration that best matches the workstation to user requirements.

Download at: <http://www.hp.com/go/performanceadvisor>

1. HP Remote Graphics Software requires a Windows, Linux®, or Mac® OS X 10.10 and newer operating system and network access.
2. HP Workwise smartphone app is available as a free download on the App Store and Google Play. See requirements at www.hp.com/go/workwise.
3. BIOS Absolute Persistence module is shipped turned off, and will be activated when customers purchase and activate a subscription. Service may be limited. Check with Absolute for availability outside the U.S. The optional
4. subscription service of Absolute Recovery Guarantee is a limited warranty. Certain conditions apply. For full details visit: <http://www.absolute.com/company/legal/agreements/computrace-agreement>.
5. Finger Sensor is optional
6. HP Manageability Integration Kit can be downloaded from <http://www.hp.com/go/clientmanagement>.
7. HP Password manager requires Windows.

Features

POWER

Power Supply

120 W Smart AC adapter (external)*

150 W Smart AC adapter (external)

Battery

HP Long Life 3-cell Polymer 52.5Whr (optional)

HP Long Life 4-cell Polymer 70Whr

Battery Life

Battery life up to 12.25 hours **

NOTE: Battery is internal and not replaceable by the customer

*120 W Slim Smart AC adapter (external) for UMA Configurations Only

** Battery life will vary depending on the 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 MobileMark14 battery benchmark <https://bapco.com/products/mobilemark-2014/> for additional details.

ENVIRONMENTAL

US ENERGY STAR®

IT ECO declaration

EPEAT® registered*

Low Halogen**

* EPEAT® registered where applicable. EPEAT registration varies by country. See www.epeat.net for registration status by country. See HP's 3rd party option store for solar energy accessory www.hp.com/go/options.

**External power supplies, power cords, cables and peripherals are not low halogen. Service parts obtained after purchase may not be low halogen.

WEIGHTS & DIMENSIONS

Weight

Starting at 4.77 lb (2.165kg)

Dimensions (w x d x h)

10.1 x 14.37 x 1 in

256.5 x 365 x 25.4 mm

Features

PORTS/SLOTS

Ports

Left side:

(2) USB 3.0

Right side:

(1) HDMI 2.0

(1) USB Type-C™ (Thunderbolt™ 3, DisplayPort™ 1.3, USB 3.1)

(1) USB 3.0 Port Charging

(1) Headphone/Microphone Combo

(1) RJ-45 / Ethernet

(1) Power connector

Digital Media Slots

(1) SD UHS-II Flash Media slot – Supports next generation SD (Secure Digital), backward compatible to SDHC, SDXC

SERVICE AND SUPPORT

Limited 3-year or 1-year limited warranty options available, 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. Optional* HP Care Pack Services are extended service contracts which go beyond your 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>.

1. HP Care Services are sold separately or as an optional feature. 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. 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. Consult your local HP Customer Support Center for details.
-

Technical Specifications – System Unit

SYSTEM UNIT

Stand-Alone Power Requirements (AC Power)	Nominal Operating Voltage	19.5 V	
	Average Operating Power	System in idle mode + max panel brightness	UMA 10.58W DIS 9.21W
		Adapter Safety test condition	UMA 116.6W DIS 144.7W
	Max Operating Power	UMA < 120W DIS < 150W	
Temperature	Operating	41°F to 95°F 5°C to 35°C	
	Non-operating	-4°F to 140°F -20°C to 60°C	
Relative Humidity	Operating	10% to 90%	
	Non-operating	5% to 95%	
Shock	Operating	SVTP test condition: 40G, 2ms, half-sine	
	Non-operating	SVTP test condition: 240G, 2ms, half-sine	
Random Vibration	Operating	SVTP test condition: 1.043 grms	
	Non-operating	SVTP test condition: 3.50 grms	
Maximum Altitude (unpressurized)	Operating	-50 ft to 10,000 ft (-15 m to 3,048 m)	
	Non-operating	-50 ft to 40,000 ft (15 m to 12,192 m)	
Industry Standard Certifications	UL	Yes	
	CSA	NA	
	FCC Compliance	Yes	
	ENERGY STAR®	Yes, 6.1 & 7.0	
	EPEAT	Yes, Silver	
	ICES	Yes	
	Australia / NZ A-Tick Compliance	Yes	
	CCC	Yes	
	Japan VCCI Compliance	Yes	
	KC	Yes	
	BSMI	Yes	
	CE Marking Compliance	Yes	
	MIL STD 810G	Temperature, Relative Humidity, Shock, Random Vibration and Altitude	

Technical Specifications - Displays

DISPLAYS

15.6" diagonal LED-backlit FHD IPS AG (1920 x 1080) 67% sRGB (220 nits)

Active Area (W x H)	13.54 x 7.59 in (34.4 x 19.4 cm)	
Dimensions (W x H)	15.6 in (39.6 cm)	
Weight	360 g (max)	
Surface Treatment	Anti-glare	
Contrast Ratio	600:1 (typical)	
Refresh Rate	60 Hz	
Brightness*	220nits (typical)	
Pixel Resolution	Format	1920 x 1080 (FHD)
	Configuration	RGB Stripe
Backlight	LED	
PPI	141	
Viewing Angle	85/85/85/85 (Left/Right/Down/Up) (typical)	

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

15.6" diagonal LED FHD IPS Touch 67% sRGB (1920 x 1080) (250 nits)

Active Area (W x H)	13.54 x 7.59 in (34.4 x 19.4 cm)	
Dimensions (W x H)	15.6 in (39.6 cm)	
Weight	380 g (max)	
Surface Treatment	Touch with Gorilla® Glass 4	
Contrast Ratio	400:1 (typical)	
Refresh Rate	60 Hz	
Brightness*	250 nits (typical)	
Pixel Resolution	Format	1920 X 1800 (FHD)
	Configuration	RGB Stripe
Backlight	LED	
PPI	141	
Viewing Angle	45/45/35/25 (Left/Right/Down/Up) (typical)	

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

15.6" diagonal UHD IPS LED AG (3840x2160) 100% sRGB (340 nits)

Dimensions (W x H)	13.62 x 7.59 in (3.6 x 19.4 cm)	
Diagonal Size	15.6 in (39.6 cm)	
Weight	345 g (max)	
Surface Treatment	Anti-glare	
Contrast Ratio	1000:1 (min)	
Refresh Rate	60 Hz	
Brightness*	340 nits (typical)	
Pixel Resolution	Pitch	0.090 x 0.090 mm
	Format	3840x2160
	Configuration	RGB Stripe
Interface	eDP	

Technical Specifications - Displays

Backlight	LED
PPI	282
Viewing Angle	85/85/85/85 (Left/Right/Down/Up) (typical)

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

Technical Specifications - Storage and Drives

STORAGE AND DRIVES

Internal Storage

Intel® Optane™ Memory (SSD 16 GB 2280 PCI3-3x2 NVMe 3D Xpoint)	Form Factor	M.2 2280
	Capacity	16 GB
	NAND Type	3D Xpoint
	Height	0.09 in (2.3 mm)
	Width	0.87 in (22 mm)
	Interface	PCIe NVMe Gen3X2
	Maximum Sequential Read	900 MB/s
	Maximum Sequential Write	145 MB/s
	Logical Blocks	28,181,188
	Operating Temperature	32° to 158°F (0° to 70°C) [ambient temp]
	Features	L1.2

Must be configured with either a standard Hard Disk Drive or Solid-State Hybrid Drive. Cannot be configured with an additional M.2

2 TB 5400 rpm SATA Hard Disk Drive	Drive Weight	0.21 lbs (95 g)
	Capacity	2 TB
	Height	0.28 in (7 mm)
	Width	2.75 in (69.85 mm)
	Interface	ATA-8, SATA 3.0
	Transfer Rate	Synchronous (maximum) 600 MB/s
	Seek Time (typical reads, including settling)	Single Track 2 ms Average 12 ms-13 ms Maximum 18 ms-22 ms
	Cache	128 MB
	Rotational Speed	5400 rpm
	Logical Blocks	3,907,029,168
	Operating Temperature	32° to 140° F (0° to 60° C) [case temp]
	Features	ATA Security, S.M.A.R.T., NCQ, Ultra DMA

500 GB 7200 rpm SATA Disk Hard Drive	Drive Weight	0.20 lbs (92 g) ~ 0.25 lbs (115 g)
	Capacity	500 GB
	Height	0.28 in (7 mm)
	Width	2.75 in (69.85mm)
	Interface	ATA-8, SATA 3.0
	Transfer Rate	Synchronous (maximum) 600 MB/s (Drive Capability)
	Seek Time (typical reads, including settling)	Single Track 1.5 ms ~ 2 ms Average 11 ms ~ 13 ms Maximum 18 ms ~ 22 ms
	Cache	Up To 32 MB

Technical Specifications - Storage and Drives

Rotational Speed	7200 rpm
Logical Blocks	976,773,168
Operating Temperature	32° to 140° F (0° to 60° C) [top cover temp]
Features	ATA Security, S.M.A.R.T., NCQ, Ultra DMA

Technical Specifications - Storage and Drives

1 TB 7200 rpm SATA Hard Disk Drive	Drive Weight	0.21 lbs (95 g)	
	Capacity	1 TB	
	Height	0.28 in (7 mm)	
	Width	2.75 in (69.85mm)	
	Interface	ATA-8, SATA 3.0	
	Transfer Rate	Synchronous (maximum) 600 MB/s (Drive Capability)	
	Seek Time (typical reads, including settling)	Single Track	1.5 ms
		Average	13 ms
		Maximum	32 ms
	Cache	128 MB	
	Rotational Speed	7200 rpm	
	Logical Blocks	1,953,525,168	
	Operating Temperature	32° to 140° F (0° to 60° C) [top cover temp]	
Features	ATA Security, S.M.A.R.T., NCQ, Ultra DMA		

500 GB Hybrid Drive, 8 GB cache	Drive Weight	0.198 lbs (90 g) ~ 0.20 lbs (92 g)	
	Capacity	500 GB	
	Height	0.28 in (7 mm)	
	Width	2.75 in (69.85 mm)	
	Interface	ATA-8, SATA 3.0	
	Transfer Rate	Synchronous (maximum) 600 MB/s	
	Seek Time (typical reads, including settling)	Single Track	1.5 ms ~ 2 ms
		Average	12 ms ~13 ms
		Maximum	22 ms ~ 32 ms
	Cache	Up to 128MB	
	Rotational Speed	5400 rpm	
	Logical Blocks	976,773,168	
	Operating Temperature	32° to 140° F (0° to 60° C) [case temp]	
Features	ATA Security, S.M.A.R.T., NCQ, Ultra DMA		

1 TB Hybrid Drive, 8 GB cache	Drive Weight	90g	
	Capacity	1 TB	
	Height	0.28 in (7 mm)	
	Width	2.75 in (69.85 mm)	
	Interface	ATA-8, SATA 3.0	
	Transfer Rate	Synchronous (maximum) 600 MB/s (Drive Capability)	
	Seek Time (typical reads, including settling)	Single Track	600 MB/s
		Average	1.5 ms
		Maximum	13 ms
	Cache	Up to 128MB	
	Rotational Speed	5400 rpm	
	Logical Blocks	1,953,525,168	
	Operating Temperature	32° to 140° F (0° to 60° C) [case temp]	

Technical Specifications - Storage and Drives

	Features	ATA Security, S.M.A.R.T., NCQ, Ultra DMA		
2 TB Hybrid Drive, 8 GB cache	Drive Weight	90g		
	Capacity	2 TB		
	Height	0.28 in (7 mm)		
	Width	2.75 in (69.85 mm)		
	Interface	ATA-8, SATA 3.0		
	Transfer Rate	Synchronous (maximum)	600 MB/s	
	Seek Time (typical reads, including settling)	Single Track	1.5 ms	
		Average	13 ms	
		Maximum	32 ms	
	Cache	Up to 128MB		
	Rotational Speed	5400 rpm		
	Logical Blocks	3,907,029,168		
	Operating Temperature	32° to 140° F (0° to 60° C) [case temp]		
Features	ATA Security, S.M.A.R.T., NCQ, Ultra DMA			
500 GB 7200 rpm SATA SED Hard Disk Drive	Drive Weight	0.21 lbs (95g)		
	Capacity	500 GB		
	Height	0.28 in (7 mm)		
	Width	2.75 in (69.85 mm)		
	Interface	ATA-8, SATA 3.0		
	Transfer Rate	Synchronous (maximum)	600 MB/s (Drive Capability)	
	Seek Time (typical reads, including settling)	Single Track	2 ms	
		Average	12 ms	
		Maximum	18-22 ms	
	Cache	32 MB		
	Rotational Speed	7200 rpm		
	Logical Blocks	976,773,168		
	Operating Temperature	32° to 140° F (0° to 60° C) [case temp]		
Features	ATA Security, TCG Opal v1.00, S.M.A.R.T., NCQ, Ultra DMA			
256 GB SATA TLC Solid State Drive (2.5")	Drive Weight	0.17 lb (78 g)		
	Capacity	256 GB		
	Height	0.28 in (7 mm)		
	Width	2.75 in (69.85 mm)		
	Interface	ATA-8, SATA 3.0		
	NAND	TLC		
	Form Factor (I/O)	2.5 inch		
	Performance	Maximum Sequential Read	530 MB/s ~ 560 MB/s	
		Maximum Sequential Write	500 MB/s ~ 525 MB/s	
	Logical Blocks	500,118,192		

Technical Specifications - Storage and Drives

Operating Temperature	32° to 158°F (0° to 70°C) [ambient temp]
Features	ATA Security; DIPM; TRIM; DEVSLP

1 TB SATA TLC Solid State Drive (2.5")	Drive Weight	0.17 lb (78 g)	
	Capacity	1 TB	
	Height	0.28 in (7 mm)	
	Width	2.75 in (69.85 mm)	
	Interface	ATA-8, SATA 3.0	
	NAND	TLC	
	Form Factor (I/O)	2.5 inch	
	Performance	Maximum Sequential Read	Maximum Sequential Write
		530 MB/s ~ 560 MB/s	500 MB/s ~ 530 MB/s
	Logical Blocks	2,000,409,264	
Operating Temperature	32° to 158°F (0° to 70°C) [ambient temp]		
Features	ATA Security; DIPM; TRIM; DEVSLP		

256 GB M2 SED TLC Solid State Drive	Drive Weight	0.02 lb (<10 g)	
	Capacity	256 GB	
	Height	0.14 in (3.58 mm)- 0.09 in (2.23 mm)	
	Width	0.87 in (22 mm)	
	Interface	ATA-8, SATA 3.0	
	Generation	??	
	NAND	TLC	
	Form Factor (I/O)	M.2 2280	
	Performance	Maximum Sequential Read	Maximum Sequential Write
		Up to 530 MB/s	UP to 515 MB/s
Logical Blocks	500,118,192		
Operating Temperature	32° to 158°F (0° to 70°C) [ambient temp]		
Features	ATA Security; TCG Opal 2.0, DIPM; TRIM; DEVSLP		

256 GB M.2 NVMe TLC Solid State Drive	Drive Weight	0.02 lb (<10 g)	
	Capacity	256 GB	
	Height	0.09 in (2.3 mm)	
	Width	0.87 in (22 mm)	
	Generation	Samsung PM961/ Toshiba XG5	
	NAND Type	TLC	
	Form-Factor (I/O)	M.2 2280	
	Interface	PCIe NVMe Gen3X4	
	Performance	Maximum Sequential Read	Maximum Sequential Write
		2580 MB/s ~ 2600 MB/s	1000 MB/s ~ 1100 MB/s
Logical Blocks	500,118,192		

Technical Specifications - Storage and Drives

Operating Temperature	32° to 158°F (0° to 70°C) [ambient temp]
Features	ATA Security (Option), TRIM; L1.2

256 GB M.2 NVMe TLC SED Solid State Drive	Drive Weight	0.02 lb (<10 g)		
	Capacity	256 GB		
	Height	0.09 in (2.3 mm)		
	Width	0.87 in (22 mm)		
	Generation	Samsung PM961 SED Opal2/ Toshiba XG5 SED Opal2		
	NAND Type	TLC		
	Form-Factor (I/O)	M.2 2280		
	Interface	PCIe NVMe Gen3X4		
	Performance	Maximum Sequential Read	Maximum Sequential Write	
		2580 MB/s ~ 2600 MB/s	Up to 1000 MB/s	
	Logical Blocks	500,118,192		
	Operating Temperature	32° to 158°F (0° to 70°C) [ambient temp]		
	Features	ATA Security (Option); TCG Opal 2.0; TRIM; L1.2		

512 GB M.2 NVMe TLC Solid State Drive	Drive Weight	0.02 lb (<10 g)		
	Capacity	512 GB		
	Height	0.09 in (2.3 mm)		
	Width	0.87 in (22 mm)		
	Generation	Samsung PM981 / Toshiba XG5		
	NAND Type	TLC		
	Form-Factor (I/O)	M.2 2280		
	Interface	PCIe NVMe Gen3X4		
	Performance	Maximum Sequential Read	Maximum Sequential Write	
		2800 MB/s ~ 2900 MB/s	1000 MB/s ~ 1800 MB/s	
	Logical Blocks	1,000,215,215		
	Operating Temperature	32° to 158°F (0° to 70°C) [ambient temp]		
	Features	ATA Security, TRIM; L1.2		

512 GB M.2 NVMe TLC SED Solid State Drive	Drive Weight	0.02 lb (<10 g)		
	Capacity	512 GB		
	Height	0.09 in (2.3 mm)		
	Width	0.87 in (22 mm)		
	Generation	Samsung PM981 SED Opal2/ Toshiba XG5 SED Opal2		
	NAND Type	TLC		
	Form-Factor (I/O)	M.2 2280		
	Interface	PCIe NVMe Gen3X4		
	Performance	Maximum Sequential Read	Maximum Sequential Write	

Technical Specifications - Storage and Drives

	2800 MB/s ~ 2900 MB/s	1000 MB/s ~ 1800 MB/s
Logical Blocks	1,000,215,215	
Operating Temperature	32° to 158°F (0° to 70°C) [ambient temp]	
Features	ATA Security (Option); TCG Opal 2.0 ; TRIM; L1.2	

1 TB, M.2 NVMe TLC Solid State Drive	Drive Weight	0.02 lb (<10 g)	
	Capacity	1 TB	
	Height	0.09 in (2.3 mm)	
	Width	0.87 in (22 mm)	
	Generation	Samsung PM981 / Toshiba XG5	
	NAND Type	TLC	
	Form-Factor (I/O)	M.2 2280	
	Interface	PCIe NVMe Gen3X4	
	Performance	Maximum Sequential Read	Maximum Sequential Write
		2900 MB/s ~ 3000 MB/s	Up to 2000MB/s
Logical Blocks	2,000,409,264		
Operating Temperature	32° to 158°F (0° to 70°C) [ambient temp]		
Features	ATA Security, TRIM; L1.2		

2 TB, M.2 NVMe TLC Solid State Drive	Drive Weight	0.02 lb (<10 g)	
	Capacity	2 TB	
	Height	0.09 in (2.3 mm)	
	Width	0.87 in (22 mm)	
	Generation	Toshiba XG5P	
	NAND Type	TLC	
	Form-Factor (I/O)	M.2 2280	
	Interface	PCIe NVMe Gen3X4	
	Performance	Maximum Sequential Read	Maximum Sequential Write
		Up to 2900MB/s	Up to 2100 MB/s
Logical Blocks	3,907,029,168		
Operating Temperature	32° to 158°F (0° to 70°C) [ambient temp]		
Features	ATA Security, TRIM; L1.2		

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

Technical Specifications - Security

SECURITY

HP Fingerprint Sensor	Mobile Voltage Operation	3.0V-3.6V Single Supply
	Operating Temperature	14° - 167°F (-10° - 75°C)
	Current consumption image	36mA
	Low latency wait for finger	950 uA
	Capture rate	3000 lines/sec
	ESD Resistance	IEC 6100-4-2 4B (+/-15KV)
	Detection Matrix	200*1 (plus another secondary line); 508 dpi, sensor area 12*3 mm

Technical Specifications – Networking

NETWORKING/COMMUNICATION

Intel® I219-LM Gigabit Network Connection

Ethernet Features

10 Mbit/s operation (10BASE-T; IEEE 802.3i; IEEE 802.3 clauses 13-14)
 100 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 802.3. 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
 Energy Detect Low Power Mode(Green Ethernet)

Performance Features

TCP/IP/UDP Checksum Offload (configurable)
 Protocol Offload(ARP & NS)
 Large send offload and Giant send offload
 Receiving Side Scaling
 MACSec Offload (802.3ae)

Manageability

Intel® vPro
 iSCSI Boot
 RSS is kernel based support (e.g. in Win Server 2013)
 Ultra Low Power at cable disconnect (<1mW) enables platform support for connected standby.
 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.
NOTE: Intel® I219-LM Gigabit interface is not PCIe compliant. It operates at half of PCIe specification V1.1 (2.5GT/S) speed.

NIC Device Driver Name

Intel® Ethernet Network Connection I219-LM

Technical Specifications – Networking

Intel® Dual Band Wireless-AC 9560AC 802.11 a/b/g/n (2x2) WiFi + Bluetooth 5.0 Combo Adaptor*	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 802.11a/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 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 only supports 5.725 - 5.825 GHz (CH149 - CH161)
	Data Rates	802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11b: 1, 2, 5.5, 11 Mbps 802.11g: 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 CCK, BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM
	Security¹	<ul style="list-style-type: none"> • 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 band Access Points
	Output Power²	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 Management	ACPI and PCI Express compliant power management 802.11 compliant power saving mode
	Receiver Sensitivity³	802.11b, 1Mbps : -94dBm maximum 802.11b, 11Mbps : -86dBm maximum

Technical Specifications – Networking

	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 : -61 dBm 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
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.

HP Integrated Module with Bluetooth 4.2 Wireless Technology

Bluetooth Specification	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.

Technical Specifications – Networking

Receiver Sensitivity

Modulation	0.01% BER	0.001% BER
GFSK	-80 dBm	-70 dBm
$\pi/4$ -DQPSK	-80 dBm	-70 dBm
8DPSK	-80 dBm	-70 dBm

Power Consumption

Peak (Tx) 330 mW
 Peak (Rx) 230 mW
 Selective Suspend 17 mW

Range

Legacy Up to 33 ft (10 m)
 BLE Up to 99 ft (30 m)

Electrical Interface

USB 2.0 compliant

Bluetooth Software Supported

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

Bluetooth Profiles Supported

Serial Port Profile (SPP)
 Service Discovery Application Profile (SDAP)
 Dial-Up Networking (DUN)
 Generic Object Exchange Profile (GOEP)
 Object Push Profile (OPP)
 Hard Copy Cable Replacement (HCRP)
 Personal Area Networking Profile (PAN)
 Human Interface Device Profile (HID)
 Hands Free Profile (HFP)
 Advanced Audio Distribution Profile (A2DP)
 Audio Video Remote Control Profile (AVRCP)

AUDIO/MULTIMEDIA – BANG & OLUFSEN

Hardware

Implementation	Realtek ALC3258
Function Key Volume Controls	Volume up, volume down, and Mute
Full Duplex	Yes
Microphone In	Mono, (combo jack)
Headphone/Line Out	Stereo
Integrated Microphone	Yes, Digital Microphone Array

Audio Output Quality

Frequency Response	20 Hz ~ 20kHz
Signal to Noise Ratio	100dBFS
Total Harmonic Distortion	<-45 dBFS / Headphone Out @32ohms

Technical Specifications – Networking

Noise Floor	< -80 dB
Play Sampling Rate(s)	48kHz
Record Sampling Rate(s)	Up to 192kHz
DAC	16 or 24-Bit
ADC	16, 20 or 24-Bit

Internal Stereo Speaker	Power Rating	2 Watts
	Impedance	4 ohms

Technical Specifications - Power

POWER

HP 150W Smart AC Adapter

Dimensions	6.02 x 2.60 x .87 in (153 x 66 x 22 mm)
Weight	325 g
Input	100 to 240 VAC
Input Efficiency	88% min at 115 VAC 89% min at 230VAC
Input frequency range	47 to 63 Hz
Input AC current	2.7 A at 90 VAC
Output	Output power 150W
	DC output 19.5V
	Hold-up time 5 msec at 115 VAC input
	Output current limit <15A, 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 185° F (-20° to 85° C)
	Altitude 0 to 16,400 ft (0 to 5,000 m)
	Humidity 5% to 95%
	Storage Humidity 5% to 95%
EMI and Safety Certifications	CE Mark- full compliance with LVD and EMC directives; Worldwide safety standards- IEC60950, EN60950, UL60950, Class1, SELV; Agency approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CISPR22 Class B, CCC, NOM-1 NYCE; MTBF - over 100,000 hours at 25°C ambient condition.

HP 120W Smart AC Adapter

Dimensions	148 x 75.5 x 25.4mm
Weight	485 g
Input	100 to 240 VAC
Input Efficiency	88% min at 115 VAC 89% min at 230VAC
Input frequency range	47 to 63 Hz
Input AC current	2.2 A at 90 VAC
Output	Output power 120W
	DC output 19.5V
	Hold-up time 5 msec at 115 VAC input
	Output current limit <16A, 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 185° F (-20° to 85° C)
	Altitude 0 to 16,400 ft (0 to 5,000 m)
	Humidity 5% to 95%

Technical Specifications - Power

EMI and Safety Certifications	Storage Humidity	5% to 95%
	CE Mark- full compliance with LVD and EMC directives; Worldwide safety standards- IEC60950, EN60950, UL60950, Class1, SELV; Agency approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CISPR22 Class B, CCC, NOM-1 NYCE; MTBF - over 100,000 hours at 25°C ambient condition.	

HP Long Life 4-cell Polymer Battery (70 WHr)	Dimensions (H x W x L)	0.31 x 3.66 x 9.56 in (0.79 x 9.29 x 24.3 cm)		
	Weight (max)	0.61lb (275g)		
	Cells/Type	4-cell; Polymer		
	Energy	Voltage	15.4V	
		Amp-hour capacity	4.55Ah	
		Watt-hour capacity	70Wh	
	Temperature	Operating (Charging)	32° to 113° F (0° to 45° C)	
		Operating (Discharging)	14° to 140° F (-10° to 60° C)	
		Non-operating	-4° to 140° F (-20° to 60° C)	
	Battery Re-Charge Time	System in OFF or Standby Mode	3 hours	
		System ON	3 to 5 hours	
	Charge Rate	0.7C; HP Fast Charge 90% in 90 minutes		
	Fuel Gauge LED	No		
Warranty*	3 year			
Compatible with optional Travel Battery	N/A			

* 3-year platform warranty is required for a 3-year Long Life Battery warranty.

HP Long Life 3-cell Polymer Battery (52.5 WHr)	Dimensions (H x W x L)	0.31 x 3.66 x 9.56 in (0.79 x 9.29 x 24.3 cm)		
	Weight (max)	0.49 lb (220g)		
	Cells/Type	3-cell; Polymer		
	Energy	Voltage	11.55V	
		Amp-hour capacity	4.55Ah	
		Watt-hour capacity	52.5Wh	
	Temperature	Operating (Charging)	32° to 113° F (0° to 45° C)	
		Operating (Discharging)	14° to 140° F (-10° to 60° C)	
		Non-operating	-4° to 140° F (-20° to 60° C)	
	Battery Re-Charge Time	System in OFF or Standby Mode	3 hours	
		System ON	3 to 5 hours	
	Charge Rate	0.7C; HP Fast Charge 90% in 90 minutes		
	Fuel Gauge LED	No		
Warranty*	3 year			
Compatible with optional Travel Battery	N/A			

* 3-year platform warranty is required for a 3-year Long Life Battery warranty.

Technical Specifications - Environmental Data

ENVIRONMENTAL DATA

Eco-Label Certifications & declarations

This product has received or is in the process of being certified to the following approvals and may be labeled with one or more of these marks:

- IT ECO declaration
- US ENERGY STAR®
- EPEAT® Silver registered in the United States. 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, 50Hz
Normal Operation (Sort idle)	8.490	8.560	8.540
Normal Operation (Long idle)	5.550	5.629	5.585
Sleep	0.707	0.935	0.736
Off	0.270	0.344	0.281

Note:

Energy efficiency data listed is for an ENERGY STAR® compliant product if offered within the model family. HP computers marked with the ENERGY STAR® Logo are compliant with the applicable U.S. Environmental Protection Agency (EPA) ENERGY STAR® specifications for computers. If a model family does not offer ENERGY STAR® compliant configurations, then energy efficiency data listed is for a typically configured PC featuring a hard disk drive, a high efficiency power supply, and a Microsoft Windows® operating system.

Heat Dissipation*

	115VAC, 60Hz	230VAC, 50Hz	100VAC, 50Hz
Normal Operation (Short idle)	29 BTU/hr	29 BTU/hr	30 BTU/hr
Normal Operation (Long idle)	23 BTU/hr	21 BTU/hr	22 BTU/hr
Sleep	2 BTU/hr	2 BTU/hr	2 BTU/hr
Off	1 BTU/hr	1 BTU/hr	1 BTU/hr

*NOTE: Heat dissipation is calculated based on the measured watts, assuming the service level is attained for one hour.

Declared Noise Emissions (in accordance with ISO 7779 and ISO 9296)

	Sound Power (L _{WAd} , bels)	Sound Pressure (L _{pAm} , decibels)
Typically Configured – Idle	3.3B	24.5dB
Fixed Disk – Random writes	3.3B	25.2dB

Batteries

This battery(s) in this product comply with EU Directive 2006/66/EC

Batteries used in the product do not contain:
Mercury greater the 1ppm by weight
Cadmium greater than 20ppm by weight

Battery type: Lithium

Battery size: 4-cell high capacity Lithium-Ion battery (optional 3 cell available)

Technical Specifications - Environmental Data

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 Silver level, see www.epeat.net
 - Plastics parts weighing over 25 grams used in the product are marked per ISO11469 and ISO1043.
 - This product contains 0.0% post-consumer recycled plastic (by wt.)
- This product is 95.2% recycle-able when properly disposed of at end of life.

Packaging Materials

External:	PAPER/Corrugated	445 g
Internal:	PLASTIC/Polyethylene low density - LDPE	19 g
	PLASTIC/Polyethylene Expanded - EPE	90 g
	PLASTIC/Polypropylene - PP	7 g

The plastic packaging material contains at least 81.5% recycled content.

The corrugated paper packaging materials contains at least 80.0% recycled content.

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, 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.

Technical Specifications - Environmental Data

- 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 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 HP 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.

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://h20195.www2.hp.com/V2/GetDocument.aspx?docname=c04755842>

and

<http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/cert.pdf>

COUNTRY OF ORIGIN

China

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

Type	Description	Part #
Display	HP DreamColor Z31x Studio Display	Z4Y82A8
Memory	HP 8GB DDR4-2666 SODIMM	TBD
	HP 16GB DDR4-2666 SODIMM	TBD
	HP 32GB DDR4-2666 SODIMM	TBD
	HP 8GB DDR4-2666 ECC SODIMM	TBD
	HP 16GB DDR4-2666 ECC SODIMM	TBD
Cases	HP 15.6 Business Top Load– Refresh	Z5C66AA
	HP Exec Black Leather 15.6 Top Load	1LG83AA
	HP Slim Ultrabook Messenger (up to 15.6" x .88"/22/5mm)	F3W14AA
	HP Slim Ultrabook Backpack (up to 15.6" x .88"/22/5mm)	F3W16AA
	HP Essential Backpack (up to 15.6")	H1D24AA
Docking	HP USB-C Universal Dock	1MK33AA
	HP USB-C Mini Dock	1PM64AA
	HP Thunderbolt™ Dock 230W G2	2UK38AA
	HP Thunderbolt Dock Audio	3AQ21AA
	HP USB-C Dock G4	3FF69AA#xxx
	HP TB Dock G2 w/Combo Cable	3TR87AA#xxx
	HP Travel Hub	T0K30AA
	HP 3005pr USB 3.0 Port Replicator w/ USB-C™ Adapter	Y4H06AA
Input/Output - Mice	HP Wireless Premium Mouse	1JR31AA
	HP USB Premium Mouse	1JR32AA
	HP Slim Bluetooth Mouse	F3J92AA#xxx
	HP USB Travel Mouse	G1K28AA#xxx
	HP Comfort Grip Mouse	H2L63AA
	HP X4000 Bluetooth Mouse	H3T50AA#xxx
	HP 3-Button Laser Mouse	H4B81AA#xxx
	HP Ultra Mobile Wireless Mouse	H6F25AA#xxx
	HP Slim Wireless Keyboard and Mouse	T6L04AA
	HP Slim USB Keyboard and Mouse	T6T83AA
	HP Wireless (Link-5) Keyboard	T6U20AA
Power Adapters	HP 150W Slim A/C Adapter	45C18UT#xxx
Adapters	HP HDMI to DVI adapter	F5A28AA
	HDMI to VGA Adapter	H4F02AA
	USB 3.0 to RJ45	N7P47AA
	HP USB-C™ to VGA Adapter	N9K76AA
	USB-C to RJ45	V7W66AA
	HP USB-C™ to USB Hub	Z6A00AA

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

Collaboration	HP Elite Presenter Mouse	2CE30AA#xxx
	HP UC Conferencing Keyboard	K8P74AA#xxx
	HP Stereo 3.5mm Headset	T1A66AA
	HP Stereo USB Headset	T1A67AA
	HP USB Collaboration Keyboard	Z9N38AA
	HP Wireless Collaboration Keyboard	Z9N39AA#xxx
	HP Wireless Premium Keyboard	Z9N41AA#xxx
Storage - External Storage	HP 256GB M2 NVME PCIe SSD (2280)	V3K66AA
	HP 512GB M2 NVME PCIe SSD (2280)	V3K67AA
	HP 256GB TLC PCI-e 3x4 NVMe M.2 SSD	1FU87AA
	HP 512GB TLC PCI-e 3x4 NVMe M.2 SSD	1FU88AA
	HP USB External DVDRW Drive	F2B56AA
Security	HP Nano Keyed Cable Lock	1AJ39AA
	HP Nano Dual Head Keyed Cable Lock	1AJ41AA
	HP 3 year Next business day onsite Hardware Support w/Accidental Damage Protection-G2 for Notebooks	UF631E

Summary of Changes

Date of change:	Version History:		Description of change:
June 11, 2018	From v1 to v2	Changed	Networking, Environmental, Display, Audio, Storage
June 26, 2018	From v2 to v3	Changed	Processors, Storage and Drives, Software and Security sections and format changes
August 27, 2018	From v3 to v4	Changed	Format
October 17, 2018	From v4 to v5	Changed	Format
March 19, 2019	From v5 to v6	Changed	Battery life
August 9, 2019	From v6 to v7	Added	9th Generation Intel Core Processors
October 28, 2019	From v7 to v8	Changed	Options and Accessories section
January 17, 2020	From v8 to v9	Changed	Multi-Display Support section
June 9, 2020	From v9 to v10	Changed	Memory section

Copyright © 2020 HP Development Company, L.P.

The information contained herein is subject to change without notice. The only warranties for HP products are set forth in the express limited warranty statements accompanying such products. Nothing herein should be construed as constituting an additional warranty. HP shall not be liable for technical or editorial errors or omissions contained herein.

Intel, Core, vPro, Xeon, and Thunderbolt™ are registered trademarks or trademarks of Intel Corporation in the U.S. and/or other countries. Bluetooth is a registered trademark of its proprietor, used by HP Inc. under license. Adobe is a trademark of Adobe Systems Incorporated. Qualcomm and Snapdragon are trademarks of Qualcomm, Inc. ENERGY STAR is a registered trademark mark of the U.S. Environmental Protection Agency. Microsoft and Windows are registered trademarks of Microsoft Corporation in the United States and/or other countries. AMD, Enduro and FirePro are trademarks of Advanced Micro Devices, Inc. NVIDIA, the NVIDIA logo, Optimus and Quadro are trademarks and/or registered trademarks of NVIDIA Corporation in the U.S. and other countries. SD, SDHC, and SDXC are trademarks or registered trademarks of SD-3C in the United States, other countries or both. USB Type-C and USB-C are trademarks of USB Implementers Forum. DisplayPort™ and the DisplayPort™ logo are trademarks owned by the Video Electronics Standards Association (VESA®) in the United States and other countries.