

### Overview

#### HP ZHAN 99 Mobile Workstation



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

- 4. Microphone
- 5. Fingerprint sensor

### Overview

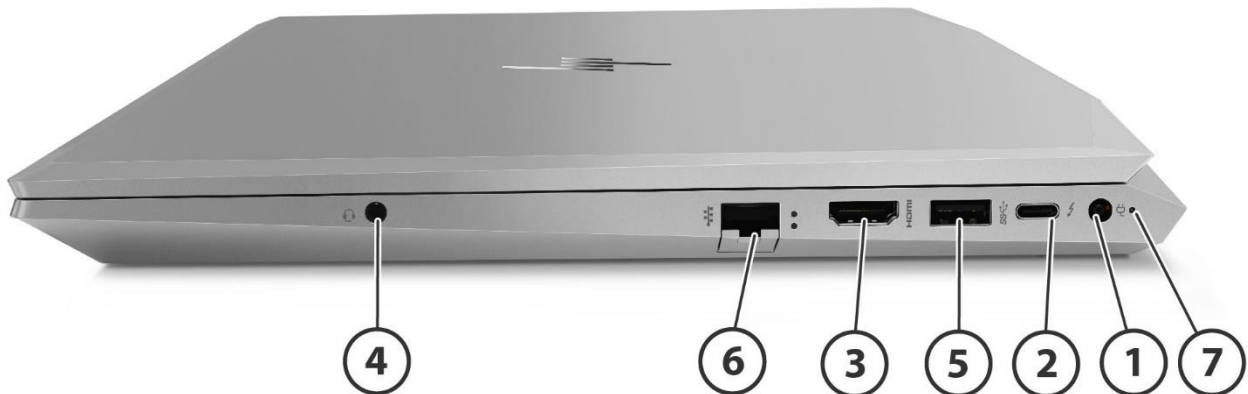
#### HP ZHAN 99 Mobile Workstation



#### LEFT VIEW

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

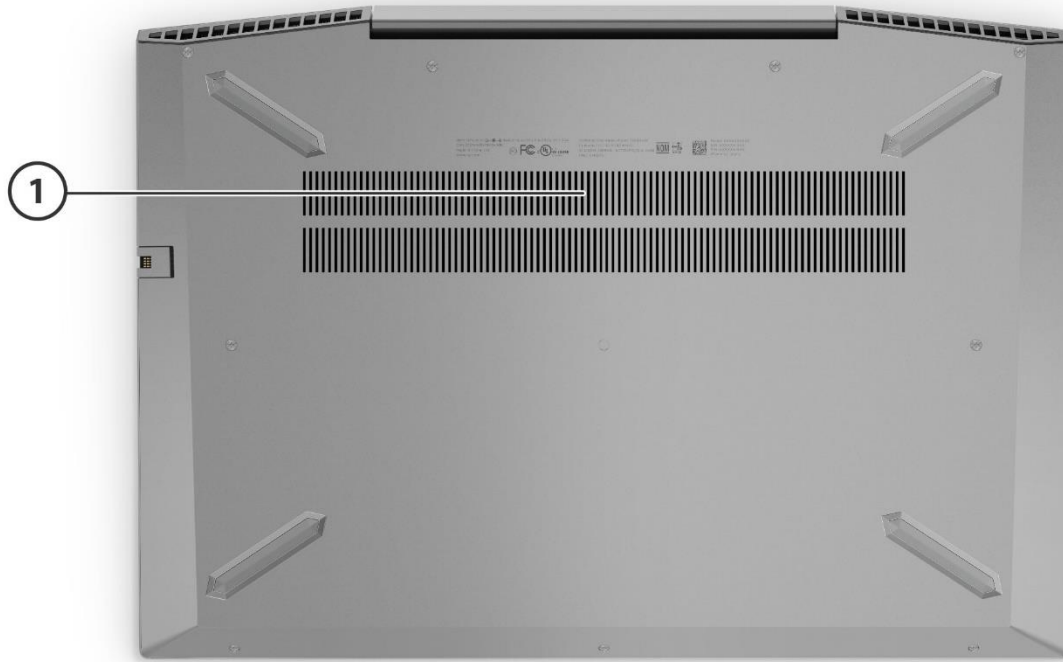
#### HP ZHAN 99 Mobile Workstation



#### 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 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 or (2) 4K displays with HP Thunderbolt™ Dock G2 (sold separately), 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

<b>Preinstalled</b>	Windows 10 Pro 64 – HP recommends Windows 10 Pro* Windows 10 Home 64 Plus* Windows 10 Pro 64 Workstation Plus*
	FreeDOS 2.0
<b>Supported</b>	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\*

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™/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™/XEON® with vPro™ technology is dependent on third-party software providers. Compatibility with future "virtual appliances" is yet to be determined.

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### **GRAPHICS**

#### **Integrated**

Intel® UHD Graphics 630<sup>1,2</sup>

Intel® UHD Graphics P630<sup>1,2,3</sup>

#### **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.

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### **Multi-Display Support**

#### **Without HP Thunderbolt™ Dock G2:**

HP ZHAN 99 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 G2:**

HP Thunderbolt™ Dock when used together with the HP ZHAN 99 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.

### Features

#### DISPLAY

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

Upgradeable to 32 GB with optional 16 GB 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

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

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#### 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

### Features

- F9 – Plays previous track
  - F10 – Pause / Play
  - F11 – Plays next track
  - F12 – Wireless on/off
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### 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 <sup>1,2,3</sup>

##### 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 <sup>4,5,6,7,8,9</sup>

##### 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](http://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

**NOTE:** Battery is internal and not replaceable by the customer

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

#### ENVIRONMENTAL

US ENERGY STAR®

IT ECO declaration

EPEAT® registered\*

Low Halogen\*\*

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

#### 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

### Features

(1) Power connector

#### **Digital Media Slots**

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

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### **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.
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### Technical Specifications – System Unit

#### SYSTEM UNIT

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

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

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

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

### Technical Specifications - Displays

<b>Backlight</b>	LED
<b>PPI</b>	282
<b>Viewing Angle</b>	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."

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### Technical Specifications - Storage and Drives

#### STORAGE AND DRIVES

##### Internal Storage

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

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

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

### Technical Specifications - Storage and Drives

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

### Technical Specifications - Storage and Drives

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

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

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

### Technical Specifications - Storage and Drives

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

### Technical Specifications - Storage and Drives

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

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

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

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

### Technical Specifications - Storage and Drives

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

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

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

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

### Technical Specifications - Storage and Drives

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

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

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

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

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### 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

<b>Intel® Dual Band Wireless-AC 9560AC 802.11 a/b/g/n (2x2) WiFi + Bluetooth 5.0 Combo Adaptor*</b>	<b>Wireless LAN Standards</b>	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n IEEE 802.11ac
	<b>Interoperability</b>	Wi-Fi certified
	<b>Frequency Band</b>	802.11b/g/n  802.11a/n
		2.402 - 2.482 GHz <b>Note:</b> 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 <b>Note:</b> Indonesia only supports 5.725 - 5.825 GHz (CH149 - CH161)
	<b>Data Rates</b>	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)
	<b>Modulation</b>	Direct Sequence Spread Spectrum CCK, BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM
	<b>Security<sup>1</sup></b>	<ul style="list-style-type: none"> <li>• IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only</li> <li>• AES-CCMP: 128 bit in hardware</li> <li>• 802.1x authentication</li> <li>• WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES.</li> <li>• WPA2 certification</li> <li>• IEEE 802.11i</li> <li>• Cisco Certified Extensions, all versions through CCX4 and CCX Lite</li> <li>• WAPI</li> </ul>
	<b>Network Architecture Models</b>	Ad-hoc (Peer to Peer) Infrastructure (Access Point Required)
	<b>Roaming</b>	IEEE 802.11 compliant roaming between band Access Points
	<b>Output Power<sup>2</sup></b>	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
	<b>Power Management</b>	ACPI and PCI Express compliant power management 802.11 compliant power saving mode
	<b>Receiver Sensitivity<sup>3</sup></b>	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 : -61dBm maximum
	802.11ac, 2SS, MCS-0 : -83dBm maximum
	802.11ac, 2SS, MCS-9 : -58dBm maximum
<b>Antenna Type</b>	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
<b>Form Factor</b>	PCI-Express M.2 MiniCard
<b>Dimensions</b>	Type 2230 : 2.3 x 22.0 x 30.0 mm Or Type 1630 : 2.3 x 16.0 x 30.0 mm
<b>Weight</b>	Type 2230 : 2.8g Or Type 1630 : 2g
<b>Operating Voltage</b>	3.3v +/- 9%
<b>Temperature</b>	Operating 14° to 158° F (-10° to 70° C) Non-operating -40° to 176° F (-40° to 80° C)
<b>Humidity</b>	Operating 10% to 90% (non-condensing) Non-operating 5% to 95% (non-condensing)
<b>Altitude</b>	Operating 0 to 10,000 ft (3,048 m) Non-operating 0 to 50,000 ft (15,240 m)
<b>LED Activity</b>	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

<b>Bluetooth Specification</b>	4.2 Compliant
<b>Frequency Band</b>	2402 to 2480 MHz
<b>Number of Available Channels</b>	Legacy : 0~79 (1 MHz/CH) BLE : 0~39 (2 MHz/CH)
<b>Data Rates and Throughput</b>	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)
<b>Transmit Power</b>	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

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

#### Audio Output Quality

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

### Technical Specifications – Networking

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

<b>Internal Stereo Speaker</b>	<b>Power Rating</b>	2 Watts
	<b>Impedance</b>	4 ohms

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### Technical Specifications - Power

#### POWER

##### HP 150W Smart AC Adapter

<b>Dimensions</b>	6.02 x 2.60 x .87 in (153 x 66 x 22 mm)
<b>Weight</b>	325 g
<b>Input</b>	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
<b>Output</b>	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
<b>Connector</b>	3 pin/grounded, mates with interchangeable cords
<b>Environmental Design</b>	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%
<b>EMI and Safety Certifications</b>	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

<b>Dimensions</b>	148 x 75.5 x 25.4mm
<b>Weight</b>	485 g
<b>Input</b>	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
<b>Output</b>	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
<b>Connector</b>	3 pin/grounded, mates with interchangeable cords
<b>Environmental Design</b>	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

<b>EMI and Safety Certifications</b>	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.	

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

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

<b>HP Long Life 3-cell Polymer Battery (52.5 WHr)</b>	<b>Dimensions (H x W x L)</b>	0.31 x 3.66 x 9.56 in (0.79 x 9.29 x 24.3 cm)		
	<b>Weight (max)</b>	0.49 lb (220g)		
	<b>Cells/Type</b>	3-cell; Polymer		
	<b>Energy</b>	Voltage	11.55V	
		Amp-hour capacity	4.55Ah	
		Watt-hour capacity	52.5Wh	
	<b>Temperature</b>	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)	
	<b>Battery Re-Charge Time</b>	System in OFF or Standby Mode	3 hours	
		System ON	3 to 5 hours	
	<b>Charge Rate</b>	0.7C; HP Fast Charge 90% in 90 minutes		
	<b>Fuel Gauge LED</b>	No		
<b>Warranty*</b>	3 year			
<b>Compatible with optional Travel Battery</b>	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 <sub>WAd</sub> , bels)	Sound Pressure (L <sub>pAm</sub> , 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](http://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

<b>External:</b>	PAPER/Corrugated	445 g
<b>Internal:</b>	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>

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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 #
<b>Display</b>	HP DreamColor Z31x Studio Display	Z4Y82A8
<b>Memory</b>	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
<b>Cases</b>	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
<b>Docking</b>	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
<b>Input/Output - Mice</b>	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
<b>Power Adapters</b>	HP 150W Slim A/C Adapter	45C18UT#xxx
<b>Adapters</b>	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

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

<b>Collaboration</b>	HP USB-C™ to USB Hub	Z6A00AA
	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
<b>Storage - External Storage</b>	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
<b>Security</b>	HP Nano Keyed Cable Lock	1AJ39AA
	HP Nano Dual Head Keyed Cable Lock	1AJ41AA
	HP Docking Station Cable Lock	AU656AA#XXX
	HP Keyed Cable Lock	T0Y14AA
	HP Combination Lock	T0Y15AA
	HP Essential Combination Lock	T0Y16AA
	HP Keyed Cable Lock 10mm	T1A62AA
	HP Dual Head Cable Lock (Non-Master key)	T1A64AA
	HP Dual Head Cable Lock (Master Key)	T1A65AA
	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:
	From v1 to v2		

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