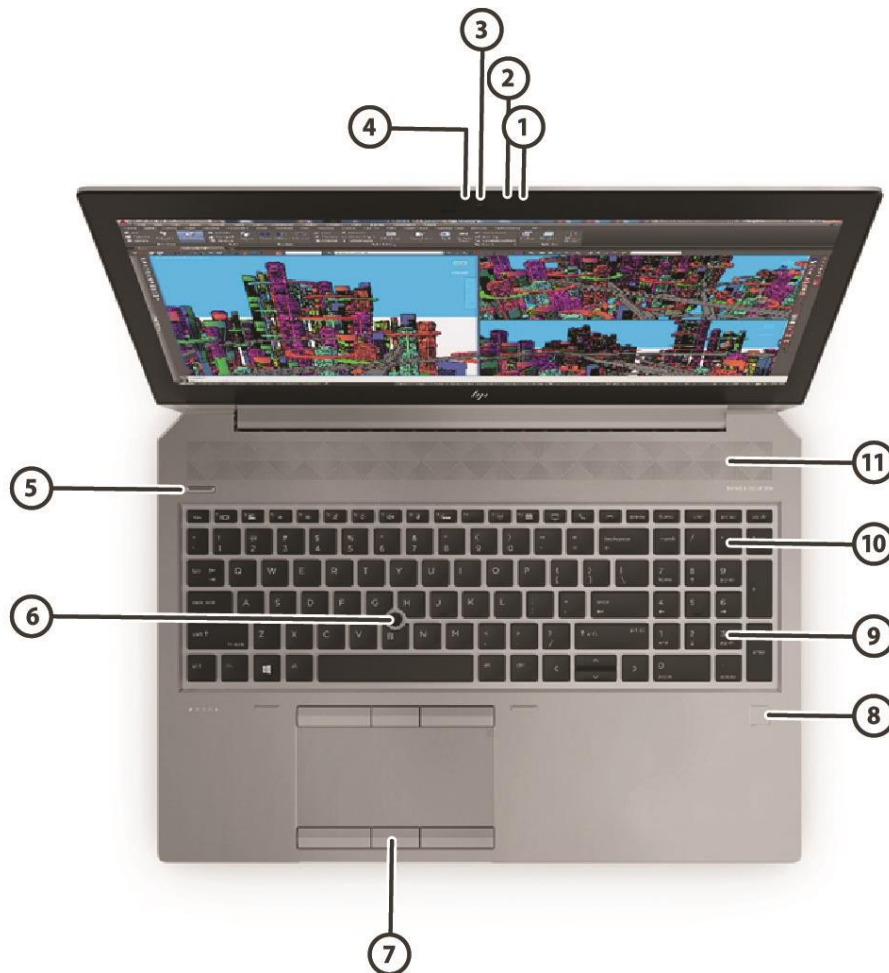


Overview

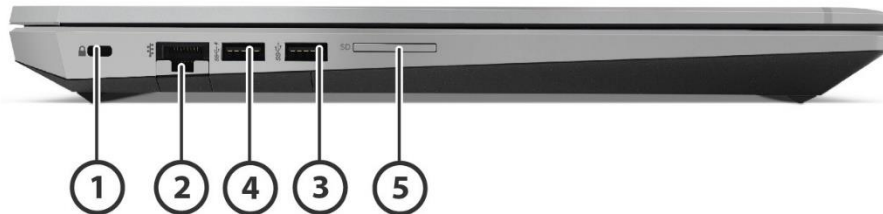
HP ZBook 15 G5 Mobile Workstation



Integrated Color Calibration Sensorz

- | | |
|------------------------------|------------------------|
| 1. Microphone | 7. 3-button touchpad |
| 2. IR camera | 8. Fingerprint sensor |
| 3. Camera | 9. Numeric Keypad |
| 4. HP Privacy Camera shutter | 10. Collaboration Keys |
| 5. Power button | 11. Speakers |
| 6. Pointstick | |

Overview



LEFT VIEW

- | | | | |
|----|---------------------|----|-----------------------|
| 1. | Security cable slot | 4. | USB 3.0 charging port |
| 2. | RJ-45/Ethernet | 5. | SD Card reader |
| 3. | USB 3.0 | | |



RIGHT VIEW

- | | | | |
|----|---|----|--------------------------|
| 1. | Smart Card Reader | 4. | USB 3.0 |
| 2. | Stereo microphone in / headphone-out combo jack | 5. | (2) Thunderbolt™ 3 ports |
| 3. | HDMI 2.0 | 6. | Power connector |
| | | 7. | Power LED |

Overview



BOTTOM VIEW

- | | |
|---------------------|--------------------------|
| 1. Fan Venting | 3. Keyboard liquid drain |
| 2. Tool less access | |

Overview

At A Glance

- Eye-catching industrial design, aluminum and magnesium-reinforced chassis with HP's turbo silver color provides optimal durability with minimal weight.
- Featuring HP Collaboration Keyboard with Clickpad to manage most commonly used conferencing functions with a single keystroke. HP Spill Resistant Keyboard with Durakeys to help protect keys from fading.
- 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
- Designed to pass MIL-STD-810G testing*.
- Optional Workstation-caliber graphics:
 - NVIDIA® Quadro® discrete graphics featuring NVIDIA® Optimus technology:
 - NVIDIA® Quadro® P1000 (4GB GDDR5)
 - NVIDIA® Quadro® P2000 (4GB GDDR5)
 - AMD RadeonPro™ WX 4150 (4GB GDDR5) featuring AMD Enduro™ technology
- Intel® Integrated graphics: Intel® UHD Graphics 630 integrated on Core™ i7. Intel® UHD Graphics P630 integrated on Xeon® processors.
- Choice of 8th generation Intel® Core™ i5 quad-core and Intel® Core™ i7 hexa-core or Intel® Xeon® hexa-core processors with option Intel® vPro™ technology.
- Populate up to four SODIMM slots supporting up to 64 GB DDR4-2667MHz dual-channel memory. Up to 64GB ECC DDR4-2667MHz dual-channel memory available with Intel® Xeon® processors.
- Supports multi-display, including up to four (4) displays without a docking solution, with hybrid graphics enabled. Supports up to six (6) 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 eDP anti-glare, 220 nits (1920x1080)
 - FHD IPS eDP + PSR anti-glare, 400 nits with ambient light sensor (1920x1080)
 - HP Sure View FHD IPS eDP+PSR Touch-screen with Corning Gorilla Glass 4 650 nits (1920x1080)
 - UHD IPS eDP + PSR anti-glare, 400 nits with ambient light sensor (3840x2160)
 - UHD IPS eDP + PSR Touch-screen with Corning Gorilla Glass 4 400 nits with ambient light sensor (3840x2160)
 - HP DreamColor Technology, UHD IPS eDP + PSR anti-glare, 600 nits, 100% AdobeRGB with 10-bit color (3840x2160)
- Two (2) Thunderbolt™ 3 ports (supporting DP 1.3, 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™)
 - Optional integrated wireless 4G (LTE) mobile broadband module support
- Optimize your audio experience for conference calls and remote collaboration with optional HD webcam, dual-array microphones, premium speakers, HP Noise Cancellation Software, HP Audio Boost, and audio. 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, and new discrete amp.
- HP Long life battery solution: 4-cell (90 WHr) supporting HP Fast Charge capability
- Three (3) dedicated drive slots, two (2) M.2 slots, and one (1) 2.5" drive bays supporting up to 6TB of data.
- Enterprise grade security features including HP Client Security Manager, HP SureClick, HP WorkWise, HP SureView, and HP SureStart self healing BIOS. Low halogen HP BIOS technology, including HP Sure Start to identify and recover from unknown BIOS attacks. TPM 2.0, encrypted storage drives, fingerprint sensor, IR camera for Windows Hello, Integrated Smart Card Reader, BIOS Preboot power on, and Drive Encryption preboot option

*MIL STD 810G testing is pending and is not intended to demonstrate fitness for U.S. Department of Defense contract requirements or for military use. Test results are not a guarantee of future performance under these test conditions. Accidental damage requires an optional HP Accidental Damage Protection Care Pack.

Overview

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

Features

OPERATING SYSTEM

| | |
|---------------------|---|
| Preinstalled | Windows® 10 Pro 641 Windows 10 Pro for Workstations 641 Windows® 10 Home 641 Windows® 10 Home 64 Advanced^1 FreeDOS 2.0 |
| Supported | Windows® 10 Enterprise 64 ¹ Red Hat® Enterprise Linux® (REHL)7 Ubuntu Linux 16.04 |

For additional Linux OS information, please reference our Linux Hardware Matrix:
<http://h10032.www1.hp.com/ctg/Manual/c00060684.pdf>

¹Not 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

Intel® Core™ i7+ 8750H processor (Core i7 and 16GB Intel® Optane™ memory) 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)

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)

Intel® Xeon® E-2176M vPro™ processor with Intel® UHD Graphics P630 (2.7 GHz (up to 4.4 GHz)/2667 MHz/12 MB L3 cache/45W)

Intel® Xeon® E-2186M vPro™ processor with Intel® UHD Graphics P630 (2.9 GHz (up to 4.6 GHz)/2667 MHz/12 MB L3 cache/45W)

*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.

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

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

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.

GRAPHICS

Intel® Integrated

Intel® UHD graphics 630^{1,2};

Intel® UHD graphics P630^{1,2};

Discrete³

AMD RadeonPro™ WX 4150 with 4 GB dedicated GDDR5 video memory
Microsoft DirectX 12 (Shader Model 5.0) and OpenGL 4.4 capable

NVIDIA® Quadro® P1000 with 4 GB dedicated GDDR5 video memory
Microsoft DirectX 12 (Shader Model 5.0) and OpenGL 4.4 capable

NVIDIA® Quadro® P2000 with 4 GB dedicated GDDR5 video memory
Microsoft DirectX 12 (Shader Model 5.0) and OpenGL 4.4 capable

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: NVIDIA® Quadro® mobile professional graphics support up to four independent displays when using a HP ZBook Dock with Thunderbolt™ 3 (sold separately) or DP 1.2 hubs with MST. AMD RadeonPro™ professional graphics support up to six independent displays when using an HP ZBook Dock with Thunderbolt™ 3 (sold separately) or DP 1.2 hubs with MST.

NOTE: Intel® HD Graphics 630 integrated on Core™ i7 and Core™ i5 processors. Intel® HD Graphics P630 integrated on Xeon® processors.

DisplayPort™ 1.3 protocol features supported on Thunderbolt™ 3 ports:

- Legacy displays (HDMI, DVI, VGA) may be attached to Thunderbolt™ port with the use of a certified dongle.

Features

- DisplayPort™ monitors capable of supporting DisplayPort™ 1.3 may be directly attached to the Thunderbolt™ port to achieve HBR2 with the use a dongle.
- DisplayPort™ monitors capable of supporting DP 1.3 may be directly attached to the Thunderbolt™ port to achieve HBR2 with the use a dongle.
- Thunderbolt™ 3 enabled monitors may be directly attached to the Thunderbolt™ port to achieve HBR2 and MST.
- DisplayPort™ 1.3 MST feature ("daisy-chain" feature) is supported through Thunderbolt™ 3 port on Thunderbolt™ 3 enabled devices or DisplayPort™ 1.3 monitors (requires monitor with DisplayPort™ 1.3 MST capability) with the use of a dongle.
- Up to 2 streams (eight lanes) of DisplayPort™ 1.3 are supported over a single Thunderbolt™ 3 port. Up to (2) 4K displays 24/30-bit color depth at 60 Hz or (1) 5K display supported over a single Thunderbolt™ 3 port. (Requires Intel® certified Thunderbolt™ cable).
- DisplayPort™ 1.3 w/MST (Multi-stream Transport): Supports resolutions up to Full 4K, 24/30-bit color depth at 60 Hz, and WUXGA (1920 x1200) monitors, 24/30-bit color depth at 120 Hz.

*Thunderbolt™ 3 is superset port supporting DisplayPort™ 1.3, USB 3.1 Gen 2, and PCIe Gen 3 devices over the new USB-C™ connector. Install all the latest drivers for your Thunderbolt™ device before connecting the device to the Thunderbolt™ port. Thunderbolt™ cable and Thunderbolt™ device (sold separately) must be compatible with Windows. To determine whether your device is Thunderbolt™ Certified for Windows, see <https://Thunderbolttechnology.net/products>.

Multi-Display Support

Without HP Thunderbolt Dock G2:

HP ZBook 15 with hybrid graphics and without the use of the ZBook dock supports up to a maximum of four independent displays. These four displays are the internal panel plus three external displays connected to the three following ports: HDMI 2.0, Thunderbolt™ 3, Thunderbolt™ 3. HP ZBook 15 configuration with Intel® integrated graphics and without the use of the ZBook dock supports up to a maximum of three independent displays. Any three-display combination of the system panel: HDMI, Thunderbolt™ 3, Thunderbolt™ 3.

With HP Thunderbolt Dock G2:

The HP Thunderbolt Dock G2 has Thunderbolt™ 3 port, VGA, two DisplayPort™ 1.3, and a USB-C port. When used together with the HP ZBook 15 configuration with hybrid graphics, a maximum of 6 independent displays are supported. These six displays are internal panel, one external display connected to the system's HDMI port and four external displays connected to the ZBook dock's Thunderbolt™ 3, VGA, and two DisplayPort™ ports. When used together with the HP ZBook 15 configuration with Intel® integrated graphics, a maximum of 3 independent displays are supported. Any three display combination of the system panel, system ports and ZBook Dock ports.

Features

DISPLAY

Internal

- 15.6" diagonal FHD IPS eDP anti-glare LED-backlit, 220 nits (1920x1080)
- 15.6" diagonal FHD IPS eDP + PSR anti-glare LED-backlit, 400 nits with ambient light sensor (1920x1080)
- HP Sure View Display 15.6" diagonal FHD IPS eDP+PSR LED-backlit Touch-screen with Corning Gorilla Glass 4, 650 nits (1920x1080)
- 15.6" diagonal UHD IPS eDP + PSR anti-glare LED-backlit, 400 nits with ambient light sensor (3840x2160)
- 15.6" diagonal UHD IPS eDP + PSR LED-backlit Touch-screen with Corning Gorilla Glass 4 400 nits with ambient light sensor (3840x2160)
- HP DreamColor Display, 15.6" diagonal UHD IPS eDP + PSR anti-glare, RG phosphors - LED-backlit, 600 nits, 100% AdobeRGB with 10-bit color (3840x2160) featuring Integrated Color Calibration Sensor on ClickPad to ensure color accuracy.

NOTE: Resolutions are dependent upon monitor capability, and resolution and color depth settings.

STORAGE AND DRIVES

(2) M.2

SATA SED Solid State Drives*

256 GB SATA Self Encrypting Drive (SED) Solid State Drive
512 GB SATA FIPS 140-2 SED Drive
16GB Intel® Optane Cache (Must be configured with HDD)

HP Z Turbo Drives (NVMe PCIe SSD)

256GB PCIe (NVMe) TLC Solid State Drive
512GB PCIe (NVMe) TLC Solid State Drive
1 TB PCIe (NVMe) TLC Solid State Drive
2 TB PCIe (NVMe) TLC Solid State Drive
256GB PCIe (NVMe) TLC Opal 2 Solide State Drive
512GB PCIe (NVMe) TLC Opal 2 Solide State Drive

(1) 2.5" Storage Bay Drives*

2 TB 5400 rpm SATA
2 TB SATA SSHD (Hybrid Drive) (8 GB cache)
1 TB SATA SSHD (Hybrid Drive) (8 GB cache)
1 TB 7200 rpm SATA
500 GB 7200 rpm SATA
500 GB SATA SSHD (Hybrid Drive) (8 GB cache)
500 GB 7200 rpm SATA SED (Self Encrypting Drive)
500 GB 5400 rpm SATA FIPS 140-2 SED Drive
256GB SATA SSD
1 TB SATA SSD

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

Features

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.

Features

DRIVE CONTROLLERS

| | |
|---|---|
| 2.5" Storage Bays and M.2 Storage Bay (SATA): | SATA-3 or SATA-2 for HDD and SATA-3 for SSD |
| HP Z Turbo Drive: | PCIe NVMe SSD |
| RAID: | 0, 1 supported* |

NOTE: Raid 0, 1 supported only on SATA drives.

MEMORY

Standard

64 GB DDR4 ECC or Non-ECC SDRAM (With transfer rates up to 2667MT/s¹)
Four SODIMM slots supporting dual-channel memory; two SODIMMS slots are customer accessible or upgradeable
4 GB, 8GB and 16 GB SODIMMs (for Intel® Core™ Processors)
8GB and 16 GB ECC SODIMMs (for Intel® XEON® Processors)

Maximum

Upgradeable to 64 GB with optional 16 GB SODIMMs in all 4 slots

Dual-channel

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

NOTE 1: Only 2 DIMM configurations run at 2400 MHz . 4 DIMM configurations run at 2133 MHz.

NOTE: Maximum memory capacities assume Windows 64-bit operating systems. With Windows 32-bit operating systems, memory above 3 GB may not all be available due to system resource requirements.

NETWORKING/COMMUNICATIONS

Communications*

Intel® I219-LM Gigabit* Network Connection (vPro configurations)

Wireless

Support for a broad range of secure, integrated wireless LAN and wireless WAN options featuring support for the latest industry standards. Optional Broadband Wireless (WWAN) requires a Windows® operating system and is available in select countries as a standard, factory configurable feature only. Integrated Bluetooth® is also available (factory configurable only) and can be combined with any of the supported wireless LAN and wireless WAN 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™

Wireless WAN - Mobile Broadband options***

Intel® XMM™ 7360 LTE-Advanced
HP It4132 LTE/HSPA+ 4G Mobile Broadband Module

Features

Near Field Communication¹

NFC Mirage WNC XRAV-1 (NXP NPC300 I2C 10mmx17mm)

*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.

***WWAN is an optional feature. WWAN use requires separately purchased service contract. Check with service provider for coverage and availability in your area. Connection speeds will vary due to location, environment, network conditions, and other factors. 4G LTE not available on all products, and in all regions.

¹Sold separately or as an optional feature.

Features

AUDIO/MULTIMEDIA

Audio¹

Audio custom-tuned by HP and Bang & Olufsen, dual stereo speakers
Dual array digital microphone
Optional World Facing microphone
Functions keys for volume up and down
Combo microphone/headphone jack
HD audio; featuring HP Noise Cancellation Software, HP Clear Sound Amp and Skype for Business Certification

Webcam^{*,**}

Optional HP Privacy Camera (720p HD webcam)

Optional HP Privacy Camera (720p HD webcam) IR camera for face authentication with Windows Hello

- Privacy Camera features sliding camera shutter (non-touch only)
- 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

* HD content required to view HD images.

**Optional or add-on feature.

Note 1: Dual-microphone array when equipped with optional webcam and optional world facing microphone

KEYBOARDS/POINTING DEVICES/BUTTONS & FUNCTION KEYS

Keyboard

Full-size, spill-resistant backlit HP Premium Collaboration Keyboard to manage most commonly used conferencing functions with a single keystroke with Durakeys to help protect keys from fading, featuring function key control and numeric keypad

Pointing Devices

Touchpad with On/Off button, two-way scroll, gestures, three pick buttons
Pointstick with three additional pointstick buttons
Image sensor touchpad for enhanced performance and improved precision on scroll and gesture

Buttons and Function Keys

Discrete buttons provide easy access to the following features:

- F1 – Display Switching
- F2 – HP Sure View (if configured)
- F3 - Brightness Down
- F4 – Brightness Up
- F5 – Speaker mute
- F6 – Volume down
- F7 – Volume up
- F8 – Microphone mute
- F9 – Keyboard backlight

Features

- F10 – NumLock
 - F11 – Wireless on/off
 - F12 – Calendar
 - F13 – Share screen
 - F14 – Call
 - F15 – End Call
-

Features

SOFTWARE AND SECURITY

Preinstalled Software with Windows® Operating System

BIOS

HP BIOSphere Gen4¹
HP Sure Start Gen4²
HP DriveLock | HP Automatic DriveLock
BIOS Update via Network
Master Boot Record Security
Power On Authentication
Secure Erase³
Absolute Persistence Module⁴
Pre-boot Authentication
HP LAN-WLAN Protection

Multi Media

Cyberlink Power MediaPlayer CMIT

Communication / Connectivity

HP Mobile Connect Pro⁵
Native Miracast Support⁶
HP MAC Address Manager (select models only)
HP Host Based Mac Address
HP Wireless Wakeup (select models only)
HP SureConnect

HP Value Add Software

HP 3D DriveGuard 6
HP ePrint Driver + JetAdvantage⁷
HP Hotkey Support
HP Recovery Manager
HP Jumpstart
HP Support Assistant¹²
HP Noise Cancellation Software
HP Performance Advisor
HP Remote Graphics Software
HP Velocity

Microsoft Products

Buy Office
Bing Search
Skype⁸

Manageability

HP Driver Packs⁹
HP SoftPaq Download Manager (SDM)
HP System Software Manager (SSM)⁹
HP BIOS Config Utility (BCU)⁹
HP Client Catalog⁹
HP Manageability Integration Kit for Microsoft SCCM¹⁰
HP Image Assistant
LANDESK Management¹¹

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

Client Security Software

Features

- HP Client Security Suite Gen3¹³
- HP Security Manager (including Credential Manager and Password Manager¹⁶)
- HP Fingerprint Sensor
- IR Camera with Windows Hello
- Device Access Manager
- Microsoft Defender¹⁴
- HP WorkWise¹⁵

Standard

For Windows 10, Trusted Platform Module (TPM) 2.0 (Infineon SLB9670). Common Criteria EAL4+ Certified. For more information on HP Client Security Software Suite, refer to <http://www.hp.com/go/clientsecurity>.

1. HP BIOSphere Gen4 requires Intel® or AMD 8th generation processors.
2. HP Sure Start Gen4 is available on HP Z Workstations products equipped with 8th generation Intel® or AMD processors.
3. HP Secure Disk Erase is for the methods outlined in the National Institute of Standards and Technology Special Publication 800-88.
4. 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 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>. If Data Delete is utilized, the Recovery Guarantee payment is null and void. In order to use the Data Delete service, customers must first sign a Pre-Authorization Agreement and either create a PIN or purchase one or more RSA SecurID tokens from Absolute Software.
5. HP Mobile Connect Pro is only available on preconfigured devices with WWAN. For geographic availability refer to <http://www.hp.com/go/mobileconnect>
6. Miracast is a wireless technology your PC can use to project your screen to TVs, projectors, and streaming media players that also support Miracast. You can use Miracast to share what you're doing on your PC and present a slide show. For more information: <http://windows.microsoft.com/en-us/windows-8/project-wireless-screen-miracast>
7. Requires an Internet connection to HP web-enabled printer and HP ePrint account registration (for a list of eligible printers, supported documents and image types and other HP ePrint details, see <http://www.hp.com/go/eprintcenter>). Requires optional broadband module. Broadband use requires separately purchased service contract. Check with service provider for coverage and availability in your area. Separately purchased data plans or usage fees may apply. Print times and connection speeds may vary.
8. Skype is not offered in China.
9. Not preinstalled, however available for download at <http://www.hp.com/go/clientmanagement>
10. HP Manageability Integration Kit can be downloaded from <http://www8.hp.com/us/en/ads/clientmanagement/overview.html>
11. Subscription required.
12. Requires Windows and Internet Access
13. Requires Windows and Intel® 7th generation processors.
14. Opt in and internet connection required for updates
15. HP WorkWise smartphone app is available as a free download on the App Store and Google Play
16. HP Password manager requires Windows.

Linux Hardware Matrix for HP Workstations

RHEL 7 certifications pending. As of this edition of this matrix, some Enterprise-class Linux releases enable the Intel® architecture used in this system. HP considers enablement for the CPU, chipset, and the on-board LAN to be minimum requirements.

Features

| Product Items/Features (Blank box indicates the listed component is NOT functional w/ as-is OS) | RHEL 7.3 or later (x86_64) | RHEL 7.3 or later (x86_64) |
|---|----------------------------|----------------------------|
| HP Workstation Base System | | |
| Base system includes: Chassis, System Board, Power Supply, etc. | . | . |
| HP Localization Kit | 1 | 1 |
| All Supported Processors | | |
| All supported 7th generation Intel® Core™ i7, i5 and Xeon® processors | . | . |
| System RAM | | |
| Minimum (GB) | 4GB | 4GB |
| Maximum (GB) | 64GB | 64GB |
| Graphics Card (Video Card) | | |
| Intel® HD integrated graphics 630 on Core™ i7 processors | 5 | 5 |
| Intel® HD integrated graphics P630 on Xeon® processors | 5 | 5 |
| AMD WX4150 with 4 GB of graphics memory | | |
| NVIDIA® Quadro® P1000 with 4 GB of graphics memory | 6 | 6 |
| NVIDIA® Quadro® P2000 with 4 GB of graphics memory | 6 | 6 |
| Display - internal panel | | |
| 15.6" diagonal FHD IPS eDP anti-glare LED-backlit, 220 nits (1920x1080) | . | . |
| 15.6" diagonal FHD IPS eDP + Panel Self Refresh (PSR) anti-glare LED-backlit, 400 nits with ambient light sensor (1920x1080) | . | . |
| HP DreamColor Display, 15.6" diagonal UHD IPS eDP + PSR anti-glare, RG phosphors - LED-backlit, 600 nits, 100% AdobeRGB with 10-bit color (3840x2160) | . | . |
| HP Sure View Display 15.6" diagonal FHD IPS eDP+PSR LED-backlit Touch-screen with Corning Gorilla Glass 4, 650 nits (1920x1080) | 7 | 7 |
| 15.6" diagonal UHD IPS eDP + PSR LED-backlit Touch-screen with Corning Gorilla Glass 4 400 nits with ambient light sensor (3840x2160) | | |
| Hard Disks | | |
| All supported 2.5" AHCI SATA Hard Disk Drives | . | . |
| All Supported M.2 Solid State Drives | . | . |
| All Supported HP Z Turbo Drive NVMe PCIe-attached storage Solid State Drives | . | . |
| All Supported M.2 AHCI SED Solid State Drives | 8 | 8 |
| Onboard Components | | |
| Wired LAN - Intel® i219LM Gigabit Ethernet | . | . |
| Onboard Audio (Conexant codec) | . | . |
| Onboard SATA RAID | 2 | 2 |
| Intel® dual-band wireless AC 8265 802.11 AC/a/b/g/n (2x2) WiFi + Bluetooth (vPro & non-vPro) | . | . |
| Mobile Broadband - Intel® XMM™ 7360 LTE-Advanced | | |
| Mobile Broadband - HP It4132, LTE/HSPA+ 4G w/GPS | | |
| HP HD (720p) webcam | . | . |
| Thunderbolt 3™ ports | 3 | 3 |
| USB 3.0 ports | . | . |
| Input/Output Devices | | |
| Touchpad | . | . |
| TPM Module | 4 | 4 |
| Smart Card | . | . |

Features

| | | |
|--------------------------------|------|-------|
| HP Media Card Reader | . | . |
| External HDMI port | . | . |
| External VGA port | . | . |
| Dock Options | | |
| Zbook dock with Thunderbolt 3™ | 9,11 | 10,11 |
| HP USB Type-C Elite dock | | |

Note 1: Typical Linux distributions support many possible localizations. If you're installing the OS yourself, you can make selections for language and keyboard layout during that process. For a pre-loaded Linux OS, similar choices can be made during the "firstboot" process. In some cases, extra font packages may be available. HP Workstations can be ordered with a variety of localization options that may vary by platform.

Note 2: Hardware RAID is not supported on SATA drives. Software RAID is available in most Linux OSes and can be used with SATA or PCIe storage devices.

Note 3: Newer Linux kernels may provide device functionality through the Thunderbolt ports. Such kernels are likely to be available in leading-edge distributions, but inclusion of the support with any Enterprise Linux distribution is at the distributor's discretion.

Note 4: Support for the TPM or other security devices varies by OS distribution.

Note 5: The Intel® HD graphics works with the in-box frame-buffer drivers. Support for the "native" Intel® driver on v7 processors (Kaby lake) is not available for most release streams as of this edition of the table.

Note 6: HP recommends use of Nvidia driver 375.66 (or newer) on Nvidia graphics options.

Note 7: As of this edition of the table, only basic touch capability was available in most Linux desktop managers and no desktops are optimized for a satisfactory touch experience.

Note 8: SED drives work with Linux. There is, however, no Linux support available for manipulating encryption settings via the Opal API.

Note 9: The Thunderbolt dock is compatible with RHEL 7 on this zbook model, starting with RHEL 7.3.

Note 10: The Thunderbolt dock is compatible with Ubuntu 16.04, starting with 16.04.1. The one known limitation is that the audio headphone jack does not work.

Note 11: With Nvidia-based configurations, it is recommended to use the Nvidia closed source driver when using externally connected displays. It is not currently recommended to use the dock with AMD graphics options at this time.

Workstation ISV Certifications

See the latest list of certifications at: <http://www.hp.com/go/isv>

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>

Other Standard Security Features

BIOS Update via Network

Pre-boot Authentication

SATA 0,1 port disablement (viaBIOS)

RAID configurations

Serial, USB enable/disable (viaBIOS)

Power-on password (viaBIOS)

Setup password (viaBIOS)

Support for chassis padlocks and cable lock devices

Measured Boot

HP Sure Click¹

Features

Integrated Smart Card Reader
One-Step Logon
Security lock slot
Support for Intel® AT
TPM 2.0 Embedded Security Chip shipped with Windows 10 (Common Criteria EAL4+ Certified)
HP Sure Run²
HP Sure Recovery³

TPM

Model: Infineon SLB9670
Version: 7.62.3126.0
Revision: TPM 2.0
FIPS 140-2 Compliant: Yes (select models only)

SmartCard Reader

Optional Security Features

HP Fingerprint Sensor (optional)⁴
IR Camera with Windows Hello
Absolute Data Protect* with GPS Tracking - Subscription based security solution providing the ability to track, initiate physical recovery, conduct asset management, and perform remote data delete by utilizing GPS technology. GPS functionality requires HP Mobile Broadband Module.

* The Absolute Data Protect agent is shipped turned off, and must be activated by customers when they purchase a subscription. Subscriptions can be purchased for terms ranging multiple years. Service is limited, check with Absolute for availability outside the U.S.

1. HP Sure Click is available on select platforms only as a web-download from the HP Support website, is preinstalled on select HP platforms and supports Microsoft® Internet Explorer and Chromium™. Check <http://h20195.www2.hp.com/v2/GetDocument.aspx?docname=4AA7-0922ENW> for all compatible platforms as they become available.
2. HP Sure Run is available on HP Elite products equipped with Intel® or AMD® 8th generation processors
3. HP Sure Recover is available on HP Elite PCs with 8th generation Intel® or AMD processors and requires an open, wired network connection. You must back up important files, data, photos, videos, etc. before using HP Sure Recover to avoid loss of data
4. Finger Sensor is optional

Features

HP CENTRAL MANAGEMENT

HP offers a variety of scalable hardware, software, and BIOS-based security features to help you defend your organization against viruses and other threats. These integrated security features safeguard what matters to you the most - your data, device and identity. Now, be confident your fleet of devices is protected in multiple layers of HP Client Security protection.

HP BIOS Protection keeps you up and running with enhanced protection against virus attacks and other threats. And if the BIOS is accidentally compromised, the auto recovery feature automatically restores it to its fully functional state.

HP Sure Start detects and negates a BIOS attack with automatic recovery of the BIOS even when the installation is accidentally compromised (i.e. power outage). When HP Sure Start heals the BIOS an event log is generated that an IT administrator can retrieve so the business is aware of a BIOS attack. Golden copy of BIOS is stored in protected nonvolatile memory providing redundant, hardware-based protection against a new generation of attacks. This helps to future-proof your technology and business.

An optional fingerprint reader and integrated Smart Card Reader help keep your identity secure. The security cable slot helps keep your notebook physically secure.

You can even permanently destroy data on your hard drive in preparation for your system disposal or redeployment with Secure Erase.

Features

POWER

Power Supply

HP 150W Slim Smart AC adapter
(153 x 66 x 22 mm)

Primary Battery

HP Long Life 4-cell Polymer Battery (90 WHr) *

NOTE: Battery is internal and not replaceable by the customer

Battery Life

Battery life up to TBD**

Battery life up to TBD**

System Standby Time

Up to TBD weeks***

* Available with 3-year limited warranty 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.

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

Power Conservation

NVIDIA® Optimus or AMD Enduro™ technology

Hibernation

Standby

ACPI compliance

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 5.79 lb. (2.60kg.)

Features

Dimensions (w x d x h)

14.8 in x 10.4 in x 1.0 in

376 mm x 264 mm x 26 mm

NOTE: Height varies depending upon where on the notebook the measurement is made. Weight varies by configuration and components. Weight includes Quad Core CPU, FHD, Intel® HD graphics, 8GBx1 SODIMM, HP Z Turbo Drive, WLAN/BT, FPR, 9-cell battery, no wWAN.

PORTS/SLOTS

Ports**Left side:**

- (1) RJ-45 (Ethernet)
- (1) USB 3.0 Charging Port
- (1) USB 3.0
- (1) Security lock slot

Right side:

- (1) HDMI 2.0
- (2) Thunderbolt™ 3* (Supporting DisplayPort™ 1.3, USB 3.1 Gen2, PCIe Gen 3 devices)
- (1) Stereo microphone in / headphone-out combo jack
- (1) Power Connector
- (1) USB 3.0

Thunderbolt™ 3

Thunderbolt™ 3 ports supports DisplayPort™ 1.3, USB 3.1 Gen 2, and PCIe Gen 3 devices over the new USB-C port connector. The port is compatible with existing DisplayPort™ displays, devices, and cables. Install all the latest drivers for your Thunderbolt™ device before connecting the device to the Thunderbolt™ port. Thunderbolt™ cable and Thunderbolt™ device (sold separately) must be compatible with Windows®. To determine whether your device is Thunderbolt™ Certified for Windows, see <https://thunderbolttechnology.net/products>.

Digital Media Slots

- (1) SD UHS-II Flash Media slot (Supports next generation SD (Secure Digital), backward compatible to SDHC, SDXC,
- (1) Integrated Smart Card Reader (Compatible with ISO 7816 compliant Smart Cards PC/SC interface support)

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>.

*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 | DreamColor Without DreamColor | 25W (Windows® 10 64-bit) 16.8 W (Windows® 10 64-bit) |
| | Max Operating Power | < 150 W | |
| Temperature | Operating | 32° to 95° F (0° to 35° C) | |
| | Non-operating | -4° to 140° F (-20° to 60° C) | |
| Relative Humidity | Operating | 10% to 90%, non-condensing | |
| | Non-operating | 5% to 95%, 101.6° F (38.7° C) maximum wet bulb temperature | |
| Shock | Operating | 40 G, 2 ms, half-sine | |
| | Non-operating | 200 G, 2 ms, half-sine | |
| Random Vibration | Operating | 0.75 grms | |
| | Non-operating | 1.50 grms | |
| Altitude (unpressurized) | Operating | -50 to 10,000 ft (-15.24 to 3,048 m) | |
| | Non-operating | -50 to 40,000 ft (-15.24 to 12,192 m) | |
| Industry Standard Certifications | UL | Yes | |
| | CSA | Yes | |
| | FCC Compliance | Yes | |
| | ENERGY STAR® | Select models* | |
| | EPEAT | Gold ** | |
| | ICES | Planned | |
| | Australia / NZ A-Tick Compliance | Planned | |
| | CCC | Planned | |
| | Japan VCCI Compliance | Planned | |
| | KC | Planned | |
| | BSMI | Planned | |
| CE Marking Compliance | Planned | | |
| MIL STD 810G | Planned*** | | |

* Configurations of the HP ZBook 15 G5 that are ENERGY STAR® qualified are identified as HP ZBook 15 G5 ENERGY STAR® on HP websites and on <http://www.energystar.gov>.

** EPEAT® registered where applicable. EPEAT registration varies by country. See <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.

*** MIL STD 810G testing is pending and is not intended to demonstrate fitness for U.S. Department of Defense contract requirements or for military use. Test results are not a guarantee of future performance under these test conditions. Accidental damage requires an optional HP Accidental Damage Protection Care Pack.

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

Technical Specifications - Displays

DISPLAYS

15.6" diagonal FHD AG LED IPS (1920x1080) (220 nits)

| | | |
|----------------------------|--|-------------------|
| Active Area (W x H) | 344.16 x 193.59mm | |
| Dimensions (W x H) | 350.96 x 216.75mm | |
| Weight | 370 g | |
| Diagonal Size | 15.6 in (39.6 cm) | |
| Surface Treatment | Anti-glare | |
| Contrast Ratio | 600:1 (typical) | |
| Refresh Rate | 60 Hz | |
| Brightness* | 220 nits typical | |
| Pixel Resolution | Format | 1920 x 1080 (FHD) |
| | Configuration | RGB Stripe |
| Interface | eDP | |
| 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 FHD AG LED IPS, with Ambient light sensor (1920x1080) (400 nits)

| | | |
|----------------------------|--|-------------------|
| Active Area (W x H) | 344.16 x 193.59mm | |
| Dimensions (W x H) | 350.96 x 216.75mm | |
| Weight | 370 g | |
| Diagonal Size | 15.6 in (39.6 cm) | |
| Surface Treatment | Anti-glare | |
| Contrast Ratio | 600:1 (typical) | |
| Refresh Rate | 60 Hz | |
| Brightness* | 400 nits (typical) | |
| Pixel Resolution | Format | 1920 X 1800 (FHD) |
| | Configuration | RGB Stripe |
| Interface | eDP + PSR | |
| 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."

HP Sure View Display 15.6" diagonal FHD AG LED IPS, Touch-Screen (1920x1080) (650 nits)

| | | |
|----------------------------|--------------------|--|
| Active Area (W x H) | 344.16 x 193.59mm | |
| Dimensions (W x H) | 350.96 x 216.75 mm | |
| Diagonal Size | 15.6 in (39.6 cm) | |
| Weight | 320 g | |
| Surface Treatment | Anti-glare | |
| Contrast Ratio | 600:1 (typical) | |
| Refresh Rate | 120 Hz | |

Technical Specifications - Displays

| | | | |
|-------------------------|--|--------------------|--|
| Brightness* | 650 nits (typical) | | |
| Pixel Resolution | Pitch | 0.1793 x 0.1793 mm | |
| | Format | 1920 X 1080 (FHD) | |
| | Configuration | RGB Stripe | |
| Interface | eDP + PSR | | |
| 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 UHD AG LED IPS, Touch-Screen, with Ambient light sensor (3840x2160) (400 nits)

| | | | |
|----------------------------|--|-------------------|--|
| Active Area (W x H) | 344.2176 x 193.6224mm | | |
| Dimensions (W x H) | 350.96 x 216.95mm | | |
| Diagonal Size | 15.6 in (39.6 cm) | | |
| Weight | 320 g | | |
| Surface Treatment | Anti-glare | | |
| Contrast Ratio | 1200:1 | | |
| Refresh Rate | 60 Hz | | |
| Brightness* | 400 nits (typical) | | |
| Pixel Resolution | Format | 3840 x 2160 (UHD) | |
| | Configuration | RGB Stripe | |
| Interface | eDP + PSR | | |
| 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."

HP Dream Color Display 15.6" diagonal UHD AG IPS 10 (8+2) bit color (3840x2160) (600 nits) 100% Adobe RGB

| | | | |
|-----------------------------|--|-------------------|--|
| Active Area (W x H) | 344.2176 x 193.6224 mm | | |
| Dimensions (W x H) | 350.96 x 217.45 mm | | |
| Diagonal Size | 15.6 in (39.6 cm) | | |
| Weight | 380 g | | |
| Surface Treatment | Anti-glare | | |
| Contrast Ratio | 1200:1 | | |
| Refresh Rate | 60 Hz | | |
| Brightness* | 600 nits (typical) | | |
| Pixel Resolution | Format | 3840 x 2160 (UHD) | |
| | Configuration | RGB Stripe | |
| Color Gamut Coverage | 100 percent Adobe RGB | | |
| Interface | eDP + PSR | | |
| Backlight | LED | | |
| PPI | 282 | | |
| Viewing Angle | 85/85/85/85 (Left/Right/Down/Up) (typical) | | |

Technical Specifications - Displays

| | | |
|---|--------------------|-----------------------------|
| Integrate Color Calibration Sensor for HP DreamColor | Chipset | AMS TCS3430 |
| | Sensor type | XYZ tristimulus colorimeter |
| | System interface | I ² C |
| | Temperature range: | -30 to 85° C |

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

| | | | | |
|---|--|-----------------------|-------------------|--|
| 15.6" diagonal UHD AG LED IPS , with Ambient light sensor (3840x2160) (400 nits) | Active Area (W x H) | 344.2176 x 193.6224mm | | |
| | Dimensions (W x H) | 350.96 x 216.95mm | | |
| | Diagonal Size | 15.6 in (39.6 cm) | | |
| | Weight | 320 g | | |
| | Surface Treatment | Anti-glare | | |
| | Contrast Ratio | 1200:1 | | |
| | Refresh Rate | 60 Hz | | |
| | Brightness* | 400 nits (typical) | | |
| | Pixel Resolution | Format | 3840 x 2160 (UHD) | |
| | | Configuration | RGB Stripe | |
| | Interface | eDP + PSR | | |
| | 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

| | | |
|---|--|---|
| 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 | Single Track 1.5 ms |
| | (typical reads, including settling) | Average 13 ms |
| | | Maximum 32 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 Hard Disk Drive | Drive Weight | 0.21 lbs (95 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 | Single Track 1.5 ms ~ 2 ms |
| | (typical reads, including settling) | Average 11 ms ~ 13 ms |
| | | Maximum 18 ms ~ 22 ms |
| | Cache | Up To 32 MB |
| | 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, 8 GB cache | Drive Weight | 0.20 lbs (92 g) ~ 0.21 lbs (95 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 | 2 ms |
| | | Average | 12 ms |
| | | Maximum | 22 ms |
| | Cache | Up to 64MB | |
| | 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, 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 | |
| | 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 | 1,953,525,168 | |
| | Operating Temperature | 32° to 140° F (0° to 60° C) [case temp] | |
| | Features | ATA Security, S.M.A.R.T., NCQ, Ultra DMA | |

Technical Specifications - Storage and Drives

2 TB Hybrid, 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 FIPS-140-2 compliant 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 1.5 ms |
| | Average 12 ms |
| | Maximum 21 ms |
| Cache | 32 GB |
| 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; TCG Opal 2.x, FIPS, S.M.A.R.T., NCQ, Ultra DMA |
| * FIPS-certified, hardware-based AES-256 encryption image. | |

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 1.5 ms |
| | Average 12 ms |
| | Maximum 21 ms |
| Cache | 32 MB |
| Rotational Speed | 7200 rpm |
| Logical Blocks | 976,773,168 |

Technical Specifications - Storage and Drives

| | |
|------------------------------|--|
| Operating Temperature | 32° to 140° F (0° to 60° C) [case temp] |
| Features | ATA Security, TCG Opal 2.x, 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 Maximum Sequential Write 530 MB/s~560 MB/s 500 MB/s~525 MB/s |
| Logical Blocks | 500,118,192 |
| 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 M.2 SED 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) |
| Interface | ATA-8, SATA 3.0 |
| NAND | TLC |
| Form Factor (I/O) | M.2 2280 |
| Performance | Maximum Sequential Read Maximum Sequential Write 530 MB/s ~ 560 MB/s 500 MB/s ~ 530 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 |

Technical Specifications - Storage and Drives

| | | | | |
|--|--|--|---------------------------------|--|
| 512 GB M.2 FIPS-140-2 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 | Micron 1100 | | |
| | NAND Type | TLC | | |
| | Form-Factor (I/O) | M.2 2280 | | |
| | Interface | ACS-3, SATA 3.2 | | |
| | NAND | TLC | | |
| | Form Factor (I/O) | M.2 2280 | | |
| | Performance | Maximum Sequential Read | Maximum Sequential Write | |
| | | Up to 530MB/s | Up to 400MB/s | |
| | Logical Blocks | 1,000,215,216 | | |
| Operating Temperature | 32° to 158°F (0° to 70°C) [ambient temp] | | | |
| Features | ATA Security; TCG Opal 2.0; FIPS; DIPM; TRIM; DEVSLP | | | |
| 360 GB TLC Solid State Drive | Drive Weight | 0.02 lb. (10 g) | | |
| | Capacity | 360 GB | | |
| | Height | 0.09 in (2.3 mm) | | |
| | Width | 0.87 in (22 mm) | | |
| | Generation | Intel® Pleasant Star | | |
| | NAND Type | TLC | | |
| | Form-Factor (I/O) | M.2 2280 | | |
| | Interface | PCIe NVMe Gen3X4 | | |
| | Performance | Maximum Sequential Read | Maximum Sequential Write | |
| | | Up to 1700MB/s(Compressible Performance) | Up to 1260 MB/s | |
| | Logical Blocks | 703,282,608 | | |
| | 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 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**
 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]

Technical Specifications - Storage and Drives

| | | | | |
|---|------------------------------|--|---------------------------------|--|
| | 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.

Security

Fingerprint reader

SmartCard Reader

Technical Specifications – Networking

NETWORKING/COMMUNICATION

| | | |
|--|-------------------------------|--|
| Intel® I219-LM Gigabit Network Connection | Ethernet Features | <p>10 Mbit/s operation (10BASE-T; IEEE 802.3; IEEE 802.3 clauses 13-14)</p> <p>100 Mbit/s operation (100BASE-TX; IEEE 802.3u; IEEE 802.3 clauses 21-30)</p> <p>1000 Mbit/s operation (1000BASE-T; IEEE 802.3ab; IEEE 802.3. Clauses 40)</p> <p>IEEE 802.3u Auto-Negotiation (Automatic Speed Selection)</p> <p>Full Duplex Operation at all Speeds, Half Duplex operation at 10 and 100 Mbit/s</p> <p>IEEE 802.1p QoS (Quality of Service) Support</p> <p>IEEE 802.1q VLAN support</p> <p>IEEE 802.3x Flow Control (IEEE 802.3 clauses 31-32; configurable)</p> <p>IEEE 802.3az EEE(Energy Efficient Ethernet)</p> <p>IEEE 802.1as/1588 conformance</p> <p>Jumbo Frame 9K</p> <p>Auto MDI/MDIX Crossover cable detection</p> |
| | Power Management | ACPI compliant - multiple power modes |
| | Performance Features | <p>Energy Detect Low Power Mode(Green Ethernet)</p> <p>TCP/IP/UDP Checksum Offload (configurable)</p> <p>Protocol Offload(ARP & NS)</p> <p>Large send offload and Giant send offload</p> <p>Receiving Side Scaling</p> <p>MACSec Offload (802.3ae)</p> <p>Intel® vPro™</p> <p>iSCSI Boot</p> <p>RSS (Receive Side Scaling)</p> <p>Ultra Low Power</p> |
| | Manageability | <p>Wake-on-LAN from standby and hibernation (Magic Packet and Microsoft Wake-Up Frame); Wake-on-LAN from off (Magic Packet only)</p> <p>PXE 2.1 Remote Boot</p> <p>Statistics Gathering (SNMP MIB II, Ethernet-like MIB, Ethernet MIB (802.3x, clause 30))</p> <p>Comprehensive diagnostic and configuration software suite</p> <p>Virtual Cable Doctor for Ethernet cable status</p> |
| | Interface | <p>PCI Express 1.1 x1 to fully support ASPM L0s/L1 and CLKREQ.</p> <p>NOTE: Intel® I219-LM Gigabit interface is not PCIe compliant. It operates at half of PCIe specification V1.1 (2.5GT/S) speed.</p> |
| | NIC Device Driver Name | Intel® Ethernet Network Connection I219-LM |

Technical Specifications – Networking

| | | |
|--------------------------------------|---|--|
| Intel® XMM™ 7360 LTE-Advanced | Technology/Operating bands | FDD LTE: 2100 (Band 1), 1900 (Band 2), 1800 (Band 3), 1700/2100 (Band 4), 850 (Band 5), 2600 (Band 7), 900 (Band 8), 1400 (Band 11), 700 (Band 12 lower), 700 (Band 13 upper), 700 (Band 17 lower), 850 (Band 18 lower), 850 (Band 19 upper), 800 (Band 20), 1400 (Band 21), 850 (Band 26), 700 (Band 28), 700 (Band 29 RX only), 2300 (Band 30), 2100 (Band 66). TDD LTE: 2600 (Band 38), 1900 (Band 39), 2400 (Band 40), 2500 (Band 41). HSPA+: 2100 (Band 1), 1900 (Band 2), 1700/2100 (Band 4), 850 (Band 5), 900 (Band 8) MHz |
| | Wireless protocol standards | 3GPP Release 11 LTE Specification CAT.9, DL 60MHz BW throughput up to 450Mbps; UL 20MHz throughput up to 50Mbps WCDMA R99, 3GPP Release 5, 6, 7 and 8 UMTS Specification |
| | GPS | Standalone, A-GPS (MS-A, MS-B and XTRA) |
| | GPS bands | 1575.42 MHz ± 1.023 MHz, GLONASS 1596-1607MHz, Beidou 1561.098 MHz |
| | Maximum data rates | LTE: 450 Mbps (Download), 50 Mbps (Upload) DC-HSPA+: 42 Mbps (Download), 5.76 Mbps (Upload) HSPA+: 21Mbps (Download), 5.76 Mbps (Upload) |
| | Maximum output power | LTE: 23 dBm HSPA+: 23.5 dBm |
| | Maximum power consumption | LTE: 1,200 mA (peak); 900 mA (average) HSPA+: 1,100 mA (peak); 800 mA (average) |
| | Form Factor | M.2, 3042-S3 Key B |
| | Weight | 5.8g |
| | Dimensions (Length x Width x Thickness) | 1.65 x 1.18 x 0.09 in (42 x 30 x 2.3 mm) |

* Mobile Broadband is an optional feature. Connection requires wireless data service contract, network support, and is not available in all areas. Contact service provider to determine the coverage area and availability. Connection speeds will vary due to location, environment, network conditions, and other factors. 4G LTE not available on all products or in all countries.

| | | |
|---|------------------------------------|---|
| HP It4132 LTE/HSPA+ 4G Mobile Broadband Module | Technology/Operating bands | LTE: 2100 (Band 1), 1900 (Band 2), 1800 (Band 3) MHz, 850 (Band 5), 2600 (Band 7), 900 (Band 8) MHz, 800 (Band 20), 700 (Band 28) MHz. HSPA+: 2100 (Band 1), 1900 (Band 2), 850 (Band 5), 900 (Band 8) MHz E-GPRS: 1900 (Band 2), 1800 (Band 3), 850 (Band 5), 900 (Band 8) MHz |
| | Wireless protocol standards | 3GPP Release 10 LTE Specification CAT.4, 20MHz BW WCDMA R99, 3GPP Release 5, 6, 7 and 8 UMTS Specification E-GPRS: Class B, Multi-slot class 12, coding schemes CS1 - CS4 and MSC1 - MSC9 |
| | GPS | Standalone, A-GPS (MS-B and LTO) |
| | GPS bands | 1575.42 MHz ± 1.023 MHz, GLONASS 1596-1607MHz |
| | Maximum data rates | LTE: 150 Mbps (Download), 50 Mbps (Upload) DC-HSPA+: 42 Mbps (Download), 5.76 Mbps (Upload) HSPA+: 21Mbps (Download), 5.76 Mbps (Upload) EDGE: 236.8 kbps (Download), 236.8 kbps (Upload) GPRS: 85.6 kbps(Download), 85.6 kbps (Upload) |
| | Maximum output power | LTE: 23 dBm |

Technical Specifications – Networking

| | |
|---|---|
| | HSPA+: 23.5 dBm |
| | E-GPRS 1900/1800: 26 dBm |
| | E-GPRS 900/850: 27 dBm |
| | GPRS 1900/1800: 29.5 dBm |
| | GPRS 900/850: 32.5 dBm |
| Maximum power consumption | LTE: 1,200 mA (peak); 900 mA (average) |
| | HSPA+: 1,100 mA (peak); 800 mA (average) |
| | E-GPRS: 2,600 mA (peak); 500 mA (average) |
| Form Factor | M.2, 3042-S3 Key B |
| Weight | 6 g |
| Dimensions (Length x Width x Thickness) | 42 x 30 x 2.3 mm |

* Mobile Broadband is an optional feature. Connection requires wireless data service contract, network support, and is not available in all areas. Contact service provider to determine the coverage area and availability. Connection speeds will vary due to location, environment, network conditions, and other factors. 4G LTE not available on all products or in all countries.

Technical Specifications – Networking

Intel® Dual Band Wireless-AC Wireless LAN Standards 9560AC 802.11 a/b/g/n/ac (2x2) WiFi + Bluetooth 5.0 Combo Adaptor

| | |
|---|---|
| | IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n IEEE 802.11ac |
| Interoperability | Wi-Fi certified |
| Frequency Band | 802.11b/g/n 2.402 - 2.482 GHz Note: The FCC has declared as of January 1, 2015 products that utilize passive scanning on channel 12/13 and are capable of transmitting must fully comply with requirements of 15.247 or otherwise disable those channels 802.11a/n 4.9 - 4.95 GHz (Japan) 5.15 - 5.25 GHz 5.25 - 5.35 GHz 5.47 - 5.725 GHz 5.825 - 5.850 GHz Note: Indonesia 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 |

Technical Specifications – Networking

| | |
|--------------------------|---|
| | 802.11b, 11Mbps : -86dBm maximum |
| | 802.11g, 6Mbps : -88dBm maximum |
| | 802.11g, 54Mbps : -74dBm maximum |
| | 802.11a, 6Mbps : -88dBm maximum |
| | 802.11a, 54Mbps : -74dBm maximum |
| | 802.11n, MCS07 : -69dBm maximum |
| | 802.11n, MCS15 : -66dBm maximum |
| | 802.11ac, 1SS, MCS-0 : -86dBm maximum |
| | 802.11ac, 1SS, MCS-9 : -61dBm maximum |
| | 802.11ac, 2SS, MCS-0 : -83dBm maximum |
| | 802.11ac, 2SS, MCS-9 : -58dBm maximum |
| Antenna Type | High efficiency antenna with spatial diversity, mounted in the display enclosure Two embedded dual band 2.4/5 GHz antennas are provided to the card to support WLAN MIMO communications and Bluetooth communications |
| 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)

Near Field Communications (NFC) Controller (optional)

Controller Supports

NFC Mirage WNC XRAV-1 (NXP NPC300 I2C 10mmx17mm)

- Windows 8, Proximity Events
- Windows 7, PC/SC
- NFC Forum Compliant
- Near Field Communications Controller

Dimensions (L x W x H)

Module 25 mm by 10 mm by 2.0 mm

Chipset

NPC100

System interface

I2C

NFC RF standards

standards ISO/IEC 14443 A ISO/IEC 14443 B ISO/IEC 15693 ISO/IEC 18092 ECMA-340 NFCIP-1 Target and Initiator ECMA-320 NFCIP-2

NFC Forum Support Tag

Type 1, Type 2, Type3 and Type 4, NFCIP-1 and NFCIP-2

Technical Specifications – Networking

| | |
|---------------------------------|--|
| Reader | (PCD-VCD) Mode(1) ISO/IEC 14443 A ISO/IEC 14443 B ISO/IEC 15693 MIFARE 1K MIFARE 4K MIFARE DESFire FeliCa Jewel and Topaz cards |
| Card Emulation | (PICCVICC) |
| Mode | ISO/IEC 14443 A ISO/IEC 14443 B and B' MIFARE FeliCa |
| Frequency | 13.56 MHz |
| NFC Modes Supported | Reader/Writer, Peer-to-Peer |
| Raw RF Data Rates | 106, 212, 424, 848 kbps |
| Operating temperature | 0°C to 70°C |
| Storage temperature | -20°C to 125°C |
| Humidity | 10-90% operating 5-95% non-operating |
| Supply Operating voltage | 2.97 to 5.5 Volts |
| I/O Voltage | 1.8V or 3.3V |
| Power Consumption | Booster enable, VBAT= 3.3V, VCC_BOOST = 5V) Typical ² Polling 7.3 mA Detected Test Tag Type Mode Power 1 Total 283.8 mA Net Module 236.8 mA Consumption, Detected Test Tag Type 2 Total 288.8 mA Net Module 241.8 mA Detected Test Tag Type 3 Total 287.7 mA Net Module 240.7 mA Detected Test Tag Type 4 Total 282.3 mA Net Module 235.3 mA |
| Antenna connector | 0.5mm pitch, 7 connector FPC. Antenna matching is external to module. |
| Notes | <ol style="list-style-type: none">1. With application or UICC support2. Actual Power Consumption is dependent on NFC antenna and matching circuit and on the particular polling sequence and period configured. |

Technical Specifications - Audio and Multimedia

AUDIO/MULTIMEDIA – BANG & OLUFSEN

| | | |
|--------------------------------|----------------------------------|--|
| Hardware | Implementation | Synaptics CX8400 with two NXP TFA9891 discrete smart amplifiers |
| | Function Key | Volume up, volume down, and mute |
| | Volume Controls | |
| | Full Duplex | Yes |
| | Microphone In | Stereo |
| | Headphone/Line Out | Stereo |
| | Integrated Microphone | Yes, three digital microphone array when equipped with optional webcam |
| Audio Output Quality | Frequency Response | 20 Hz - 20 kHz |
| | Signal to Noise Ratio | 106dB (DAC), 102dB (ADC) |
| | Total Harmonic Distortion | 91dB THD+n on LineOut/HP (0.003%) |
| | Noise Floor | -110 dB |
| | Play Sampling Rate(s) | Up to 192kHz |
| | Record Sampling Rate(s) | Up to 96kHz |
| | DAC | 16, 20 or 24-bit |
| | ADC | 16, 20 or 24-bit |
| Internal Stereo Speaker | Power Rating | 1 Watt/per speaker |
| | Impedance | 8 ohms/per speaker |

Technical Specifications - Power

POWER

| | | | |
|--------------------------------------|---|--|---|
| HP 150W Slim Smart AC Adapter | Dimensions | 6.02 x 2.60 x .87 in (153 x 66 x 22 mm) | |
| | Weight | 0.70 lbs (320 g) | |
| | Input | Input | 100 to 240 VAC |
| | | Input Efficiency | 88% min at 115 VAC |
| | | Input frequency range | 47 to 63 Hz |
| | Output | Input AC current | 2.9 A at 90 VAC, 1.45 A at 180 VAC |
| | | Output power | 150W |
| | | 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 104° F (0° to 40° C) |
| | | Non-operating (storage) temperature | -4° to 149° F (-20° to 65° C) |
| | | Altitude | 0 to 10,000 ft (0 to 3,048 m) |
| | | Humidity | 20% to 80% |
| Storage Humidity | | 10% to 90% | |
| EMI and Safety Certifications | CE Mark- full compliance with LVD and EMC directives; Worldwide safety standards- IEC950, EN60950, UL1950, Class 1, SELV; Agency approvals- C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CISPR22 Class B, CCIB, NOM-1 NYCE; MTBF- over 200,000 hours at 25°C ambient condition. | | |

| | | | |
|---|-------------------------------|---|-------------------------------|
| HP Long Life 4-cell Polymer Battery (90 WHr) | Dimensions (H x W x L) | 10.15x2.49x0.521 in(25.8x6.32x1.324 cm) | |
| | Weight (max) | 0.82lb (372g) | |
| | Cells/Type | 4-cell; Polymer | |
| | Energy | Voltage | 15.4V |
| | | Amp-hour capacity | 5.84Ah |
| | | Watt-hour capacity | 90Wh |
| | 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®
- US Federal Energy Management Program (FEMP)
- EPEAT® GOLD registered in the United States. See <http://www.epeat.net> for registration status in your country.

System Configuration

The configuration used for the Energy Consumption and Declared Noise Emissions data for the Notebook model is based on a “Typically Configured Notebook”.

Energy Consumption (in accordance with US ENERGY STAR® test method)

| | 115VAC, 60Hz | 230VAC, 50Hz | 100VAC, 50Hz |
|------------------------------|--------------|--------------|--------------|
| Normal Operation (Sort idle) | 11.20 W | 10.51 W | 11.24 W |
| Normal Operation (Long idle) | 6.70 W | 6.30 W | 6.37 W |
| Sleep | 1.13 W | 1.12 W | 1.14 W |
| Off | 0.41 W | 0.43 W | 0.42 W |

Note:

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

Heat Dissipation*

| | 115VAC, 60Hz | 230VAC, 50Hz | 100VAC, 50Hz |
|-------------------------------|--------------|--------------|--------------|
| Normal Operation (Short idle) | 38 BTU/hr | 36 BTU/hr | 38 BTU/hr |
| Normal Operation (Long idle) | 23 BTU/hr | 22 BTU/hr | 22 BTU/hr |
| Sleep | 4 BTU/hr | 4 BTU/hr | 4 BTU/hr |
| Off | 1.4 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 | 3.2 | 22 |
| Fixed Disk – Random writes | 3.2 | 21 |

Longevity and Upgrading

This product can be upgraded, possibly extending its useful life by several years. Upgradeable features and/or components contained in the product may include:

- 3 USB ports
- 2 Thunderbolt™ 3 ports
- 1 2.5" Storage Bay Drive
- 2 M.2 SATA SED Solid State Drives
- 1 Smart Card reader

Technical Specifications - Environmental Data

- 4 SODIMM memory slots
- 1 HDMI 1.4 port

Spare parts are available throughout the warranty period and or for up to “5” years after the end of production.

Batteries

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

Batteries used in the product do not contain:

- Mercury greater than 1ppm by weight
- Cadmium greater than 20ppm by weight

Battery size: CR2032 (coin cell)

Battery type: Lithium

Battery size: 6-cell high capacity Lithium-Ion battery (optional 8 cell available)

Battery type:

Additional Information

- This product is in compliance with the Restrictions of Hazardous Substances (RoHS) directive - 2011/65/EC.
- This HP product is designed to comply with the Waste Electrical and Electronic Equipment (WEEE) Directive – 2002/96/EC.
- This product is in compliance with California Proposition 65 (State of California; Safe Drinking Water and Toxic Enforcement Act of 1986).
- This product is in compliance with the IEEE 1680 (EPEAT) standard at the Gold level, see www.epeat.net
- Plastics parts weighing over 25 grams used in the product are marked per ISO11469 and ISO1043.
- This product contains 0.0% post-consumer recycled plastic (by wt.)
- This product is 95.6% recycle-able when properly disposed of at end of life.

Packaging Materials

| | | |
|------------------|---|-------|
| External: | PAPER/Corrugated | 383 g |
| Internal: | PLASTIC/Polyethylene Expanded - EPE | 90 g |
| | PLASTIC/Polyethylene low density - LDPE | 10 g |
| | PLASTIC/Polypropylene - PP | 5 g |

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

The corrugated paper packaging materials contains at least 80 % 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

Technical Specifications - Environmental Data

- Nickel – finishes must not be used on the external surface designed to be frequently handled or carried by the user.
- Ozone Depleting Substances
- Polybrominated Biphenyls (PBBs)
- Polybrominated Biphenyl Ethers (PBBEs)
- Polybrominated Biphenyl Oxides (PBBOs)
- Polychlorinated Biphenyl (PCB)
- Polychlorinated Terphenyls (PCT)
- Polyvinyl Chloride (PVC) – except for wires and cables, and certain retail packaging has been voluntarily removed from most applications.
- Radioactive Substances
- Tributyl Tin (TBT), Triphenyl Tin (TPT), Tributyl Tin Oxide (TBTO)

Packaging Usage

HP follows these guidelines to decrease the environmental impact of product packaging:

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

End-of-life Management and Recycling

HP Inc. offers end-of-life HP product return and recycling programs in many geographic areas. To recycle your product, please go to: <http://www.hp.com/go/reuse-recycle> or contact your nearest HP sales office. Products returned to HP will be recycled, recovered or disposed of in a responsible manner.

The EU WEEE directive (2002/95/EC) requires manufacturers to provide treatment information for each product type for use by treatment facilities. This information (product disassembly instructions) is posted on the HP Inc. 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>

Technical Specifications - Environmental Data

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 4GB DDR4-2666 SODIMM | TBD |
| | HP 8GB DDR4-2666 SODIMM | TBD |
| | HP 16GB DDR4-2666 SODIMM | TBD |
| | HP 8GB DDR4-2666 ECC SODIMM | TBD |
| | HP 16GB DDR4-2666 ECC SODIMM | TBD |
| Cases | 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 |
| | HP Essential Top Load Case (up to 15.6") | H2W17AA#xxx |
| 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 Smart AC Adapter | 4SC18UT#xxx |
| | HP 200W Slim Smart AC Adapter | 4SC19UT#xxx |
| Battery | ZBook G5 Replacement Battery 90Whr Battery | Battery |
| 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 |

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

| | | |
|-----------------------------------|---|-------------|
| | USB-C to RJ45 | V7W66AA |
| | HP USB-C™ to USB Hub | Z6A00AA |
| 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 External USB DVDRW Drive | F2B56AA |
| Security | HP Nano Keyed Cable Lock | 1AJ39AA |
| | HP Nano Dual Head Keyed Cable Lock | 1AJ41AA |
| | HP Docking Station Cable Lock | AU656AA#XXX |
| | HP 15.6" Notebook PC Privacy Filter | J7H71AA |
| | 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: |
|------------------------|-------------------------|--------|-------------------------------|
| June 7, 2018 | From v1 to v2 | Update | Format changes |

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