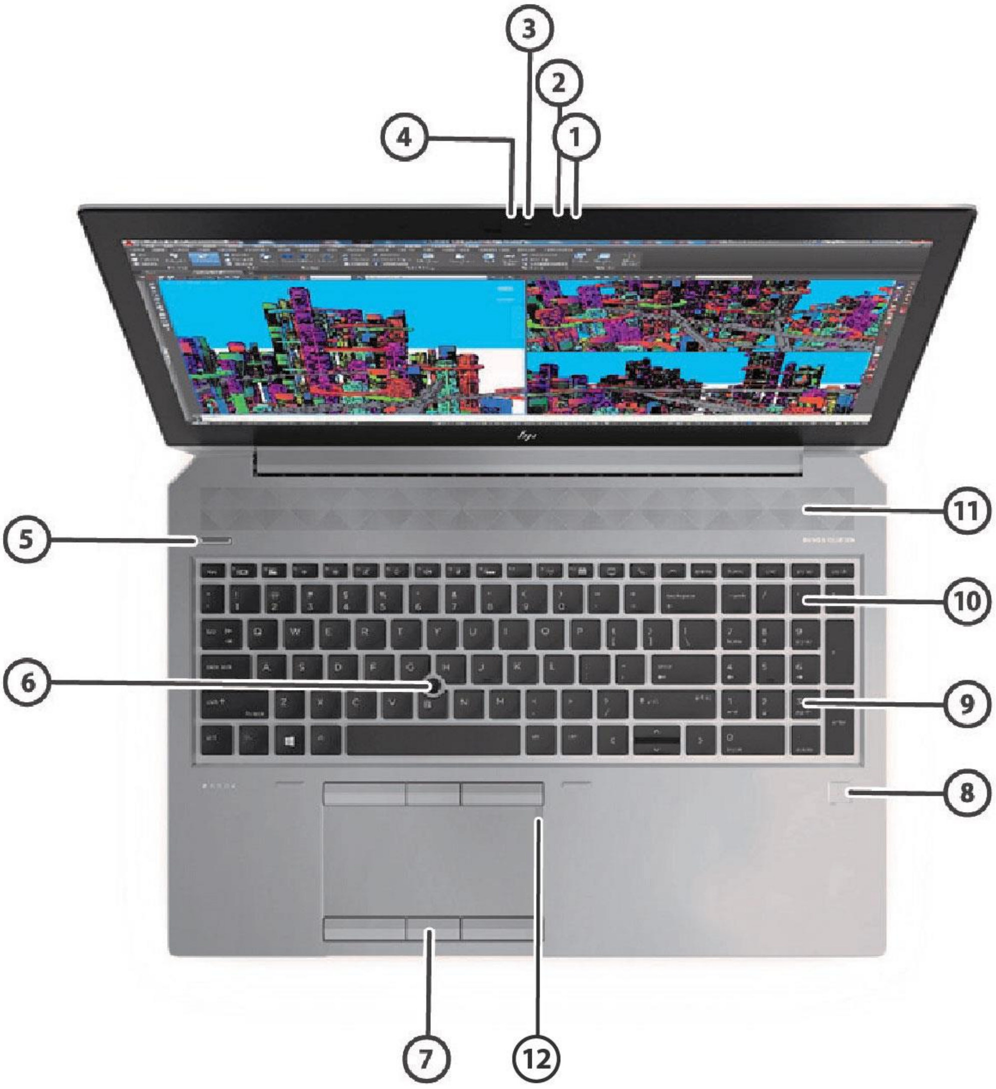
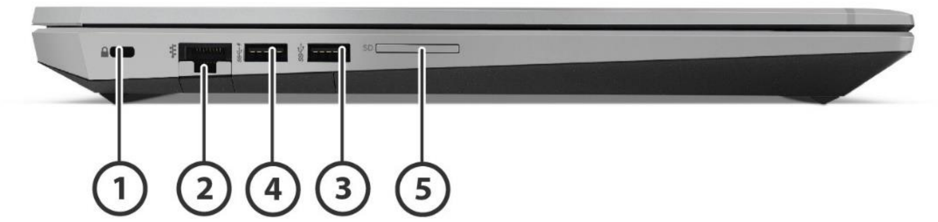
HP ZBook 15 G5 Mobile Workstation



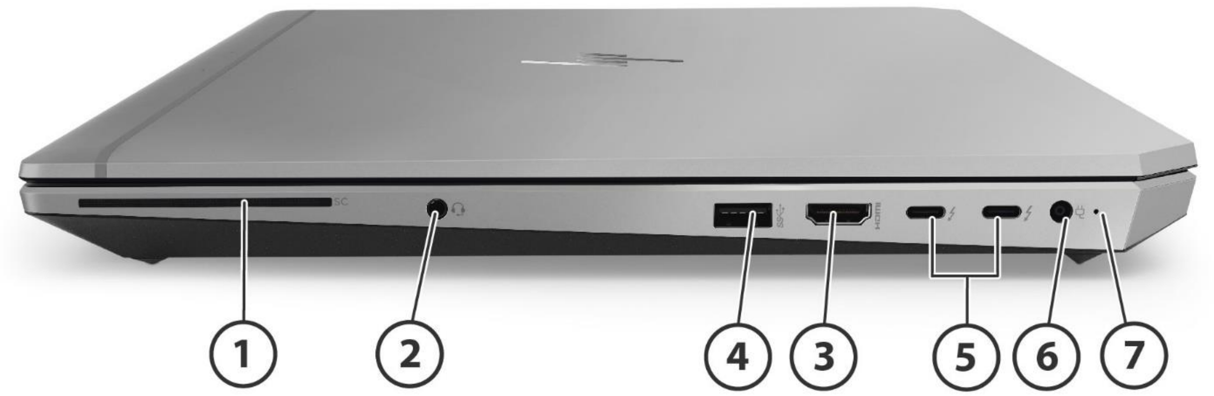
FRONT VIEW

1. Microphone
2. IR camera
3. Camera
4. HP Privacy Camera shutter
5. Power button
6. Pointstick
7. 3-button Touchpad
8. Fingerprint sensor
9. Numeric Keypad
10. Collaboration Keys
11. Speakers
12. Integrated Color Calibration Sensor



LEFT VIEW

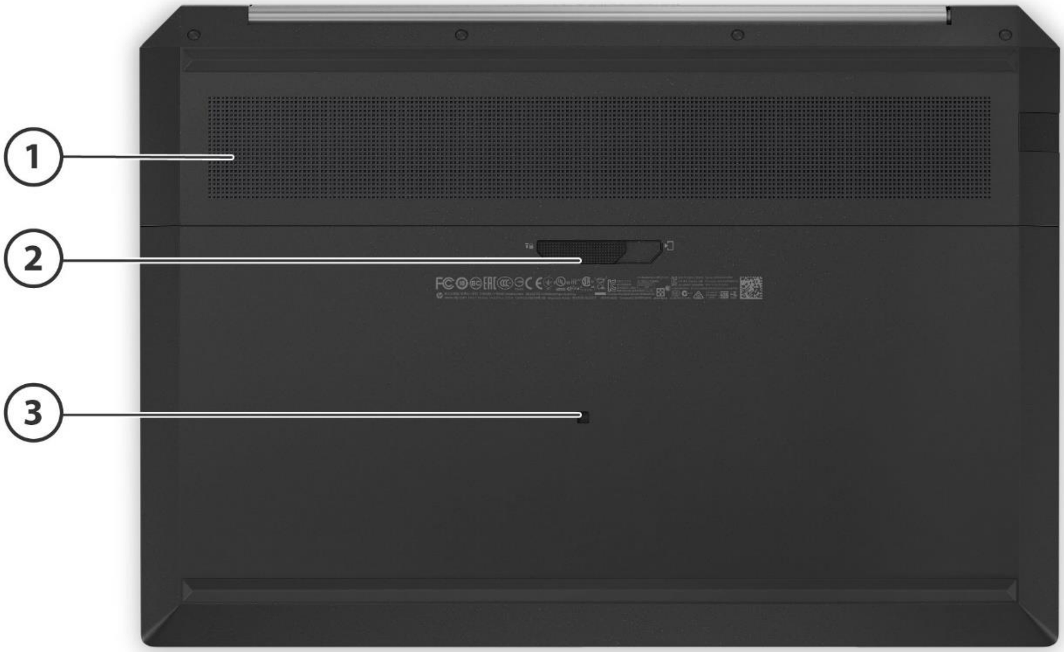
1. Security cable slot
2. RJ-45/Ethernet
3. USB 3.0
4. USB 3.0 charging port
5. SD Card reader



RIGHT VIEW

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

Overview



BOTTOM VIEW

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

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 techonology:
    - 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.

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

OPERATING SYSTEM

Preinstalled	Windows 10 Pro 64[1] Windows 10 Pro for Workstations 64[1] Windows 10 Home 64[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

[1] Not all features are available in all editions or versions of Windows. Systems may require upgraded and/or separately purchased hardware, drivers, software or BIOS update to take full advantage of Windows functionality. Windows 10 is automatically updated, which is always enabled. ISP fees may apply and additional requirements may apply over time for updates. See http://www.windows.com

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® Core™ i5+ 8300H (Core i5 and 16GB Intel® Optane™ memory) 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® 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® Core™ i5+ 8400H vPro™ processor (Core i5 and 16GB Intel® Optane™ memory) 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)

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)

Intel® Core™ i7+ 8850H vPro™ processor (Core i7 and 16GB Intel® Optane™ memory) 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)

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)

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)

Intel® Xeon® E-2186M vPro™ processor with Intel® UHD Graphics P630 (2.9 GHz base frequency, up to 4.8 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.
**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

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];

Discrete[3]
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.
- 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.

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)

NVMe Solid State Drives
16 GB Intel® Optane™ memory**, ***
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

Features

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.

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/s[1])
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 lt4132 LTE/HSPA+ 4G Mobile Broadband Module

Features

Near Field Communication[1]

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.

[1] Sold separately or as an optional feature.

AUDIO/MULTIMEDIA

Audio[1]

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

SOFTWARE AND SECURITY

Preinstalled Software with Windows® Operating System

BIOS
HP BIOSphere Gen4[1]
HP Sure Start Gen4 [2]
HP DriveLock | HP Automatic DriveLock
BIOS Update via Network
Master Boot Record Security
Power On Authentication
Secure Erase[3]
Absolute Persistence Module[4]
Pre-boot Authentication
HP LAN-WLAN Protection

Multi Media
Cyberlink Power MediaPlayer CMIT

Communication / Connectivity
HP Mobile Connect Pro[5]
Native Miracast Support[6]
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 + JetAdvantage[7]
HP Hotkey Support
HP Recovery Manager
HP Jumpstart
HP Support Assistant[12]
HP Noise Cancellation Software
HP Performance Advisor
HP Remote Graphics Software
HP Velocity

Microsoft Products
Buy Office
Bing Search
Skype[8]

Manageability
HP Driver Packs [9]
HP SoftPaq Download Manager (SDM)
HP System Software Manager (SSM) [9]
HP BIOS Config Utility (BCU) [9]
HP Client Catalog [9]
HP Manageability Integration Kit for Microsoft SCCM [10]
HP Image Assistant
LANDESK Management [11]

For more information on HP Client Management Solutions refer to: http://www.hp.com/go/clientmanagement.
Client Security Software
- HP Client Security Suite Gen3[13]

Features

- HP Security Manager (including Credential Manager and Password Manager[16])
- HP Fingerprint Sensor
- IR Camera with Windows Hello
- Device Access Manager
- Microsoft Defender [14]
- HP WorkWise[15]

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.

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

Features

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 Click[1]
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 Run[2]
HP Sure Recovery[3]

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
Smartcard Reader
Model number: Alcor AU9560

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

Features

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

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 accidently 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.

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 17 hours for UMA graphics only configuration **
Battery life up to 16.5 hours for Hybrid graphics configuration **

System Standby Time
Up to 1.8 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.)

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	25W (Windows® 10 64-bit)
		Without DreamColor	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	Complete	
	Australia / NZ A-Tick Compliance	Complete	
	CCC	Complete	
	Japan VCCI Compliance	Complete	
	KC	Complete	
	BSMI	Complete	
	CE Marking Compliance	Complete	
	MIL STD 810G	Complete ***	

* 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

	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^2C
	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."

STORAGE AND DRIVES

Internal Storage

Intel® Optane™ Memory (SSD 16 GB 2280 PCI3-3x2 NVMe 3D Xpoint)	**Form Factor**	M.2 2280	
	Capacity	16 GB	
	NAND Type	3D Xpoint	
	Height	0.09 in (2.3 mm)	
	Width	0.87 in (22 mm)	
	Interface	PCIe NVMe Gen3X2	
	Maximum Sequential Read	900 MB/s	
	Maximum Sequential Write	145 MB/s	
	Logical Blocks	28,181,188	
	Operating Temperature	32° to 158°F (0° to 70°C) [ambient temp]	
	Features	L1.2	
	Must be configured with either a standard Hard Disk Drive or Solid-State Hybrid Drive. Cannot be configured with an additional M.2		

2 TB 5400 rpm SATA Hard Disk Drive	**Drive Weight**	0.21 lbs (95 g)	
	Capacity	2 TB	
	Height	0.28 in (7 mm)	
	Width	2.75 in (69.85 mm)	
	Interface	ATA-8, SATA 3.0	
	Transfer Rate	**Synchronous** (maximum)	600 MB/s
	Seek Time (typical reads, including settling)	**Single Track**	1.5 ms
		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 (typical reads, including settling)	**Single Track**	1.5 ms ~ 2 ms
		Average	11 ms ~ 13 ms
		Maximum	18 ms ~ 22 ms
	Cache	Up To 32 MB	

Technical Specifications - Storage and Drives

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

Technical Specifications - Storage and Drives

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

500 GB Hybrid Drive, 8 GB cache	**Drive Weight**	0.20 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 Drive, 8 GB cache	**Drive Weight**	90g	
	Capacity	1 TB	
	Height	0.28 in (7 mm)	
	Width	2.75 in (69.85 mm)	
	Interface	ATA-8, SATA 3.0	
	Transfer Rate	**Synchronous (maximum)**	600 MB/s
	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 Drive, 8 GB cache	**Drive Weight**	90g	
	Capacity	2 TB	
	Height	0.28 in (7 mm)	
	Width	2.75 in (69.85 mm)	
	Interface	ATA-8, SATA 3.0	
	Transfer Rate	**Synchronous (maximum)**	600 MB/s
	Seek Time (typical reads, including settling)	**Single Track**	1.5 ms
		Average	13 ms
		Maximum	32 ms
	Cache	Up to 128MB	
	Rotational Speed	5400 rpm	
	Logical Blocks	3,907,029,168	
	Operating Temperature	32° to 140° F (0° to 60° C) [case temp]	
	Features	ATA Security, S.M.A.R.T., NCQ, Ultra DMA	

500 GB 7200 rpm SATA SED 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	

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	

	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

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

Smart Card Reader	**Smart card standard**	PC/SC 2.0 for Windows smart card standard
	Dimensions (L x W x H)	0.41x 0.08 x 0.32 in (10.5 x 2 x 8.2 mm)
	Smart Card support	ISO 7816 Class A and AB smart cards
	Smart Card Interface	Smart Card Interface with T = 0 and T = 1 support Support I2C memory card, SLE4418, SLE4428, SLE4432, SLE4442, SLE4436, SLE5536, SLE6636, AT88SC1608, AT45D041 card and AT45DB041 card via external EEPROM
	Operating systems	Normal Mode With card present, before being suspended: 40.9 mA Without card present, before being suspended: 33.16 mA After being suspended with smart card present: 380 µA After being suspended without smart card present: 380 µA
	Features	**Power Saving Mode**: With card present, before being suspended: 40.6 mA Without card present: 380 µA After being suspended with smart card present: 380 µA • Support single slot • Support T0, T1 protocol • Support I2C memory card, SLE4418, SLE4428, SLE4432, SLE4442, SLE4436, • SLE5536, SLE6636, AT88SC1608, AT45D041 card and AT45DB041 card via external EEPROM • Support ISO7816 Class A, B and C (5V/3V/1.8V) card • Implemented as an USB full speed device with bulk transfer endpoint, Mass • Storage endpoint • Built-in PLL for USB and Smart Card clocks requirement • Support EEPROM for USB descriptors customization (PID/VID/ iManufacturer/iProduct/Serial Number), Direct Web Page Link, and accessing memory card module. • EEPROM programmable via USB interface • Support software update for memory card module • Support Direct Web Page Link via configuration in external EEPROM • Support short APDU and extended APDU • Compatible with Microsoft USB-CCID driver • Support remote wake up through inserting card/removing card • Support USB selective suspend

Technical Specifications - Security

- Support Power Saving Mode (Using one pin to select between Normal/PWR Saving Mode)
- Support card power over current protection mechanism
- Built in resonator.
- Support USB LPM (Link Power Management) features.
- Embedded clock source.

Technical Specifications – Networking

NETWORKING/COMMUNICATION

Intel® I219-LM Gigabit Network Connection	**Ethernet Features**	10 Mbit/s operation (10BASE-T; IEEE 802.3; IEEE 802.3 clauses 13-14) 100 Mbit/s operation (100BASE-TX; IEEE 802.3u; IEEE 802.3 clauses 21-30) 1000 Mbit/s operation (1000BASE-T; IEEE 802.3ab; IEEE 8023. Clauses 40) IEEE 802.3u 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) IEEE 802.1as/1588 conformance 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) Intel® vPro™ iSCSI Boot RSS (Receive Side Scaling) Ultra Low Power
	Manageability	Wake-on-LAN from standby and hibernation (Magic Packet and Microsoft Wake-Up Frame); Wake-on-LAN from off (Magic Packet only) PXE 2.1 Remote Boot Statistics Gathering (SNMP MIB II, Ethernet-like MIB, Ethernet MIB (802.3x, clause 30)) Comprehensive diagnostic and configuration software suite Virtual Cable Doctor for Ethernet cable status
	Interface	PCI Express 1.1 x1 to fully support ASPM L0s/L1 and CLKREQ. **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

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 lt4132 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

	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 9560AC 802.11 a/b/g/n/ac (2x2) WiFi + Bluetooth 5.0 Combo Adaptor	**Wireless LAN Standards**	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n IEEE 802.11ac	
	Interoperability	Wi-Fi certified	
	Frequency Band	802.11b/g/n	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	
	Security[1]	• IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only • AES-CCMP: 128 bit in hardware • 802.1x authentication • WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES. • WPA2 certification • IEEE 802.11i • Cisco Certified Extensions, all versions through CCX4 and CCX Lite • WAPI	
	Network Architecture Models	Ad-hoc (Peer to Peer) Infrastructure (Access Point Required)	
	Roaming	IEEE 802.11 compliant roaming between band Access Points	
	Output Power[2]	802.11b : +16dBm minimum 802.11g : +14dBm minimum 802.11a : +14dBm minimum 802.11n HT20(2.4GHz) : +14dBm minimum 802.11n HT40(2.4GHz) : +12dBm minimum 802.11n HT20(5GHz) : +14dBm minimum 802.11n HT40(5GHz) : +12dBm minimum	
	Power Management	ACPI and PCI Express compliant power management 802.11 compliant power saving mode	
	Receiver Sensitivity[3]	802.11b, 1Mbps : -94dBm maximum	

	802.11b, 11Mbps : -86dBm maximum 802.11g, 6Mbps : -88dBm maximum 802.11g, 54Mbps : -74dBm maximum 802.11a, 6Mbps : -88dBm maximum 802.11a, 54Mbps : -74dBm maximum 802.11n, MCS07 : -69dBm maximum 802.11n, MCS15 : -66dBm maximum 802.11ac, 1SS, MCS-0 : -86dBm maximum 802.11ac, 1SS, MCS-9 : -61dBm maximum 802.11ac, 2SS, MCS-0 : -83dBm maximum 802.11ac, 2SS, MCS-9 : -58dBm maximum	
Antenna Type	High efficiency antenna with spatial diversity, mounted in the display enclosure Two embedded dual band 2.4/5 GHz antennas are provided to the card to support WLAN MIMO communications and Bluetooth communications	
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
π/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**	NFC Mirage WNC XRAV-1 (NXP NPC300 I2C 10mmx17mm)
	Supports	• 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, VCC_BOOST = 5V) Mode Power Consumption,** VBAT= 3.3V, Typical[2] Polling 7.3 mA Detected Test Tag Type 1 Total 283.8 mA Net Module 236.8 mA 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	1. With application or UICC support 2. Actual Power Consumption is dependent on NFC antenna and matching circuit and on the particular polling sequence and period configured.

AUDIO/MULTIMEDIA – BANG & OLUFSEN

Hardware	**Implementation**	Synaptics CX8400 with two NXP TFA9891 discrete smart amplifiers
	Function Key Volume Controls	Volume up, volume down, and mute
	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

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	100 to 240 VAC	
		Input Efficiency	88% min at 115 VAC
		Input frequency range	47 to 63 Hz
		Input AC current	2.9 A at 90 VAC, 1.45 A at 180 VAC
	Output	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.

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 the1ppm 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

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	Changed	Format changes
June 26, 2018	From v2 to v3	Changed	Front view, Processors, Storage and Drives, Software and Security, Power, System Unit, Security sections and format changes

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