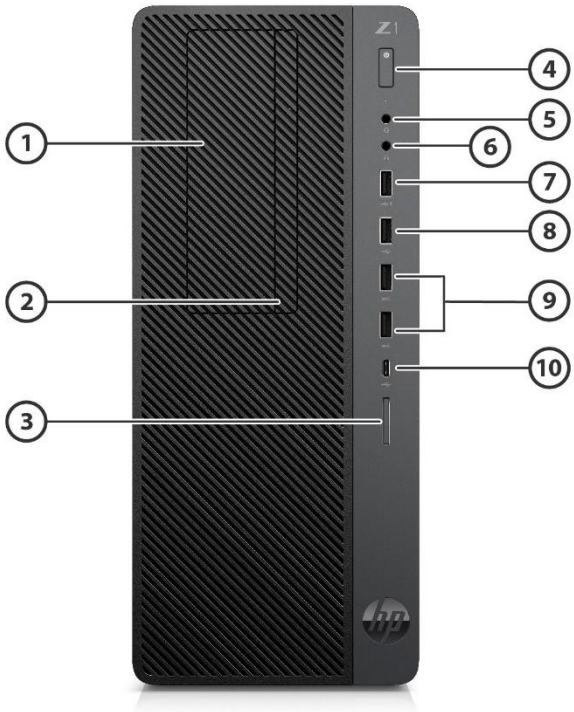
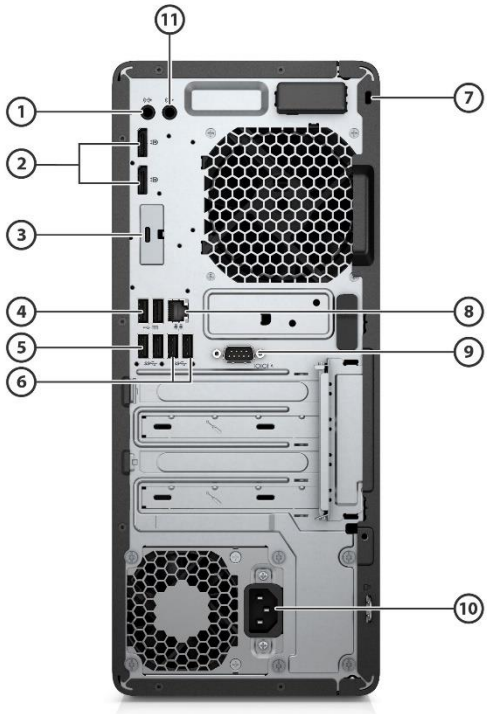
Overview

HP Z1 Entry Tower G5





1. 5.25-inch Half-Height Drive Bay (behind bezel)
2. Slim optical drive (optional)
3. SD 4 Card Reader (optional)
4. Dual-state power button
5. Universal Audio Jack with CTIA headset support
6. Headphone connector
7. USB 2.0 port (fast charging port)
8. USB 2.0 port
9. USB 3.1 Gen2 ports (2)
10. USB Type-C™ port

1. Audio-out jack for powered audio devices
2. Dual-Mode DisplayPort™ 1.2 (DP++) (2)
3. Optional Flex I/O port (DisplayPort™ 1.2, HDMI, VGA or USB-C™) (USB-C™ option has alt mode DisplayPort™ 1.2 or 15W output) – Shown here USB-C™ installed
4. USB 2.0 ports with wake from S4/S5 (2)
5. USB 3.1 Gen2 ports (2)
6. USB 3.1 Gen1 ports (2)
7. Cable lock slot
8. RJ-45 (network) jack
9. Optional serial port – shown here installed
10. Power cord connector
11. Audio-in jack

Features

AT A GLANCE

- Intel® Q370 chipset supporting Intel® 8th generation Core™ processors, featuring integrated Intel® UHD Graphics and Intel® vPro™ Technology (available with Core i5 and Core i7 processors) [1,4]
- Processors up to 95W
- Intel® UHD graphics as well as optional discrete graphics
- Intel® Ethernet Connection I219LM GbE LOM integrated network connection
- DDR4 Synchronous Dynamic Random Access
- (SDRAM) (Transfer rates up to 2666 MT/s)
- Support for up to three monitors via two standard DisplayPort™ 1.2 connectors and an optional third video port connector which provides the following choices: HDMI, VGA, DisplayPort™ 1.2, or USB Type-C™ with DisplayPort™ 1.2 for all platforms[2]
- Configurable 3rd rear I/O with video port (HDMI, DisplayPort™ 1.2, VGA, Type-C™ with DisplayPort™ 1.2) or Thunderbolt™ 3.0 (PCIe card)
- Selection of discrete graphic cards to configure systems to up to 7 displays[2]
- VR ready cards on the HP Z1 Entry Tower G5
- Models can be configured with multiple data drives in a RAID array
- Enhanced Security With:
  HP Sure Click
  HP Sure Start Gen4
  HP Sure Run
  HP Sure Recover
  HP Manageability Integration Kit
  HP WorkWise
  HP BIOSphere Gen4
  HP Client Security Manager Gen4
  Notification with HP Image Assistant Gen3
  Multifactor Authentication
- High efficiency energy saving power supply options
- EPEAT®2019 Gold registered in the United States*
- Workstation chassis and all internal components and modules are manufactured with low halogen content [3]
- Dust filter available for all platforms
- Protected by HP Services, including limited warranties up to 3-3-3 (terms and conditions vary by country; certain restrictions and exclusions apply); Care Packs available with up to 5 years Next Business Day Onsite Hardware Support

1. Multi core 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
2. DisplayPort™ multi-stream monitors 'daisy-chained' together.
3. External power supplies, power cords, cables and peripherals are not low halogen. Service parts obtained after purchase may not be low halogen.
4. Some functionality of vPro technology, such as Intel Active management technology and Intel Virtualization technology, requires additional 3rd party software in order to run. Availability of future "virtual appliances" applications for Intel vPro technology is dependent on 3rd party software providers. Compatibility of this generation of Intel vPro technology-based hardware with with future "virtual appliances" is yet to be determined."

*Based on US EPEAT® registration according to IEEE 1680.1-2018 EPEAT®. EPEAT® status varies by country. Visit www.epeat.net for more information.

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

Features

OPERATING SYSTEM

Preinstalled	Windows® 10 Pro 64[1] Windows® 10 Pro 64 (National Academic License)[2] Windows® 10 Home 64[1] Windows® 10 Home Single Language 64[1] FreeDos 2.0
Web-supported only	Windows® 10 Enterprise 64[1]

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

2. Some devices for academic use will automatically be updated to Windows 10 Pro Education with the Windows 10 Anniversary Update. Features vary; see https://aka.ms/ProEducation for Windows 10 Pro Education feature information.

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

In accordance with Microsoft's support policy, HP does not support the Windows® 8 or Windows 7 operating system on 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

Intel® Q370 PCH-H– vPro™

PROCESSORS

Intel® 9th Generation Core™ Processors

Intel® Core™ i9 9900K Processor with Intel® UHD Graphics 630 (3.6GHz, up to 5.0GHz with Intel® Turbo Boost,16MB cache, 8 cores) 95W[1]
Supports Intel® vPro™Technology[4]

Intel® Core™ i9 9900 Processor with Intel® UHD Graphics 630 (3.1GHz, up to 5.0GHz with Intel® Turbo Boost,16MB cache, 8 cores) 95W[1]
Supports Intel® vPro™Technology[4]

Intel® Core™ i7 9700K Processor with Intel® UHD Graphics 630 (3.6GHz, up to 4.9GHz with Intel® Turbo Boost,12MB cache, 8 cores) 95W[1]
Supports Intel® vPro™Technology[4]

Intel® Core™ i7 9700 Processor with Intel® UHD Graphics 630 (3.0GHz, up to 4.7GHz with Intel® Turbo Boost,12MB cache, 8 cores) 95W[1]
Supports Intel® vPro™Technology[4]

Intel® Core™ i5 9600K Processor with Intel® UHD Graphics 630 (3.7GHz, up to 4.6GHz with Intel® Turbo Boost,9MB cache, 6 cores) 95W[1]
Supports Intel® vPro™Technology[4]

Intel® Core™ i5 9600 Processor with Intel® UHD Graphics 630 (3.1GHz, up to 4.6GHz with Intel® Turbo Boost,9MB cache, 6 cores) 95W[1]
Supports Intel® vPro™Technology[4]

Intel® Core™ i5 9500 Processor with Intel® UHD Graphics 630 (3.0GHz, up to 4.4GHz with Intel® Turbo Boost,9MB cache, 6 cores) 95W[1]
Supports Intel® vPro™Technology[4]

Features

Intel® Core™ i3 9300 Processor with Intel® UHD Graphics 630 (3.7GHz, up to 4.3GHz with Intel® Turbo Boost,8MB cache, 4 cores) 95W[1]
Supports Intel® vPro™Technology[4]

Intel® 8th Generation Core™ Processors

Intel® Core™ i7 8700K Processor with Intel® UHD Graphics 630 (3.7GHz, up to 4.7GHz with Intel® Turbo Boost,12MB cache, 6 cores) 95W[1]
Supports Intel® vPro™Technology[4]

Intel® Core™ i7 8700 processor with Intel® UHD Graphics 630 (3.2 GHz, up to 4.6 GHz with Intel® Turbo Boost, 12 MB cache, 6 cores)[1,3]
Supports Intel® vPro™Technology[4]

Intel® Core™ i5 8600K Processor with Intel® UHD Graphics 630 (up to 3.6GHz, 9MB cache, 6 cores) 95W[1]
Supports Intel® vPro™Technology[4]

Intel® Core™ i5 8600 processor with Intel® UHD Graphics 630 (3.1 GHz, up to 4.3 GHz with Intel® Turbo Boost, 9 MB cache, 6 cores)[1,3]
Supports Intel® vPro™Technology[4]

Intel® Core™ i5 8500 processor with Intel® UHD Graphics 630 (3.0 GHz, up to 4.1 GHz with Intel® Turbo Boost, 9 MB cache, 6 cores)[1,3]
Supports Intel® vPro™Technology[4]

Intel® Core™ i3 8300 processor with Intel® UHD Graphics 630 (3.7 GHz, 8 MB cache, 4 cores)[1]

Intel® Core™ i3 8100 processor with Intel® UHD Graphics 630 (3.6 GHz, 6 MB cache, 4 cores)[1]

Intel® 9th Generation Pentium® Processors

Intel® Pentium® Gold G5620 processor with Intel® UHD Graphics 630 (4.0 GHz, 4 MB cache, 2 cores)[1]

Intel® Pentium® Gold G5420 processor with Intel® UHD Graphics 610 (3.8 GHz, 4 MB cache, 2 cores)[1]

Intel® 8th Generation Pentium® Processors

Intel® Pentium® Gold G5600 processor with Intel® UHD Graphics 630 (3.9 GHz, 4 MB cache, 2 cores)[1]

Intel® Pentium® Gold G5500 processor with Intel® UHD Graphics 630 (3.8 GHz, 4 MB cache, 2 cores)[1]

Intel® Pentium® Gold G5400 processor with Intel® UHD Graphics 610 (3.7 GHz, 4 MB cache, 2 cores)[1]

Intel® 8th Generation Celeron™ Processors

Intel® Celeron® G4900 processor with Intel® UHD Graphics 610 (3.1 GHz, 2 MB cache, 2 cores)[1]

1. Multi-core 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.
2. Intel® Optane™ memory system acceleration does not replace or increase the DRAM in your system.

3. Intel® Turbo Boost technology requires a Workstation with a processor with Intel Turbo Boost capability. Intel Turbo Boost performance varies depending on hardware, software and overall system configuration. See http://www.intel.com/technology/turboboost for more information.
4. Some functionality of vPro technology, such as Intel Active management technology and Intel Virtualization technology, requires additional 3rd party software in order to run. Availability of future "virtual appliances" applications for Intel vPro technology is dependent on 3rd party software providers. Compatibility of this generation of Intel vPro technology-based hardware with future "virtual appliances" is yet to be determined."

Features

GRAPHICS

Integrated Intel® Graphics

Intel® UHD Graphics 630 (integrated on 8th gen Core i7/i5/i3, Pentium® Gold G5600, G5500)
Intel® UHD Graphics 610 (integrated on 8th gen Pentium® Gold G5400, Celeron® G4900)

Optional Discrete Graphics Solutions

AMD® Radeon™ 520 1GB VGA +DP
AMD® Radeon™ RX 550X 4GB Graphics Card
AMD® Radeon™ RX 550 4GB 2DP 1HDMI Graphics Card
AMD® Radeon™ RX 580 4GB FH PCIe x16*
AMD® Radeon™ RX 580 8GB FH GDDR5*
AMD® Radeon™ R7 430 2GB VGA+DP Graphics Card
AMD® Radeon™ R7 430 2GB GDDR5 64bit 2DP
AMD® Radeon™ R7 430 2GB 2DP Graphics Card
NVIDIA® GeForce RTX™ 2060 6GB FH Graphics Card*
NVIDIA® GeForce RTX™ 2070 8GB Graphics Card*
NVIDIA® GeForce RTX™ 2080 8GB Graphics Card*
NVIDIA® Quadro® P620 2GB Graphics Card
NVIDIA® Quadro® P400 2GB Graphics Card
*Requires 500W chassis

Adapters and Cables

HP DisplayPort™ Cable
HP DisplayPort™ to DVI-D Adapter
HP DisplayPort™ to HDMI 4K Adapter
HP DisplayPort™ to VGA Adapter
HP USB-C™ to USB 3.0
HP USB to Serial Port Adapter

STORAGE

3.5 inch SATA Hard Disk Drives (HDD)

500GB 7200RPM 3.5in SATA HDD
1TB 7200RPM 3.5in SATA HDD
2TB 7200RPM 3.5in SATA HDD

2.5 inch SATA Hard Disk Drives (HDD)

500GB 7200RPM 2.5in SATA HDD
1TB 7200RPM 2.5in SATA HDD
2TB 5400RPM 2.5in SATA HDD
500GB 7200RPM 2.5in Self Encrypted OPAL2 SATA HDD
500GB 7200RPM 2.5in Self Encrypted Federal Information Processing Standard SATA HDD

2.5 inch SATA Solid State Hybrid Drives (SSHD)

Features

500GB 5400RPM 2.5in SATA SSHD
1TB 5400RPM 2.5in SATA SSHD
2TB 5400RPM 2.5in SATA SSHD

2.5 inch Solid State Drives (SSD)

128GB 2.5in SATA Three Layer Cell SSD
256GB 2.5in SATA Three Layer Cell SSD
512GB 2.5in SATA Three Layer Cell SSD
256GB 2.5in SATA Self Encrypted OPAL2 Three Layer Cell SSD
512GB 2.5in SATA Self Encrypted OPAL2 Three Layer Cell SSD
256GB 2.5in SATA Self Encrypted Federal Information Processing Standard SSD
512GB 2.5in SATA Self Encrypted Federal Information Processing Standard SSD

Storage Acceleration

16GB Intel® Optane™ memory*

*Intel® Optane™ memory (cache) is sold separately. Intel® Optane™ memory system acceleration does not replace or increase the DRAM in your system. Available for HP commercial desktops and notebooks and for select HP workstations (HP Z2 Tower/SFF/Mini G4, ZBook Studio, 15 and 17 G5) and requires a SATA HDD, 7th Gen or higher Intel® Core™ processor or Intel® Xeon® processor E3-1200 V6 product family or higher, BIOS version with Intel® Optane™ supported, Windows 10 version 1703 or higher, M.2 type 2280-S1-B-M connector on a PCH Remapped PCIe Controller and Lanes in a x2 or x4 configuration with B-M keys that meet NVMe™ Spec 1.1, and an Intel® Rapid Storage Technology (Intel® RST) 16.5 driver.

M.2 PCIe NMVe Solid State Drives (SSD)

128GB M.2 2280 PCIe NVMe SSD
256GB M.2 2280 PCIe NVMe SSD
512GB M.2 2280 PCIe NVMe SSD
128GB M.2 2280 PCIe NVMe Three Layer Cell SSD
256GB M.2 2280 PCIe NVMe Three Layer Cell SSD
512GB M.2 2280 PCIe NVMe Three Layer Cell SSD
1TB M.2 2280 PCIe NVMe Three Layer Cell SSD
256GB M.2 2280 PCIe NVMe Self Encrypted OPAL2 Three Layer Cell SSD
512GB M.2 2280 PCIe NVMe Self Encrypted OPAL2 Three Layer Cell SSD

Optical Disc Drives

HP 9.5mm Slim DVD-ROM Drive*
HP 9.5mm Slim DVD Writer Drive**
HP 9.5mm Slim Blu-Ray Writer Drive***

Media Card Reader

SD 4.0 with 5-in-1 Interface (Supports SD, SDXC, SDHC, UHS-I, UHS-II)

* HD-DVD disks cannot be played on this drive. No support for DVD-RAM. Actual speeds may vary. Don't copy copyright-protected materials. Double Layer discs can store more data than single layer discs. Discs burned with this drive may not be compatible with many existing single-layer DVD drives and players.
** Don't copy copyright protected material. Note that DVD-RAM cannot read or write to 2.6GB Single Sided/5.2 GB Double Sided – Version 1.0 media.

Features

***Don't copy copyright protected material. With Blu-Ray, certain disc, digital connection, compatibility and/or performance issues may arise, and do not constitute defects in the product. Flawless playback on all systems is not guaranteed. In order for some Blu-ray titles to play, they may require a DVI or HDMI digital connection and your display may require HDCP support. HD-DVD movies cannot be played on this Workstation

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

MEMORY

Integrated Intel® Graphics

DDR4-2666 (Transfer rates up to 2666 MT/s), 128 GB, 4 DIMM

Memory Configuration

4 GB (4 GB x 1)
8 GB (4 GB x 2)
8 GB (8 GB x 1)
16 GB (8 GB x 2)
16 GB (16 GB x 1)
32 GB (8 GB x 4)
32 GB (16 GB x 2)
32 GB (32 GB x 1)
64 GB (16 GB x 4)
64 GB (32 GB x 2)
128 GB (32 GB x 4)

NOTE: For systems configured with more than 3 GB of memory and a 32-bit operating system, all memory may not be available due to system resource requirements. Addressing memory above 4 GB requires a 64-bit operating system.
Memory modules support data transfer rates up to 2666 MT/s; actual data rate is determined by the system's configured processor. See processor specifications for supported memory data rate.
NOTE: All memory slots are customer accessible / upgradeable.

Features

NETWORKING/COMMUNICATIONS

Ethernet (RJ-45) Integrated

Intel® I219-LM Gigabit Network Connection LOM (standard)

Intel® Ethernet I210-T1 PCIe x1 Gb Network Interface Card (optional)

Wireless[1]

Intel® 9560 802.11AC 2x2 with Bluetooth® M.2 Combo Card vPro™

Intel® 9560 802.11AC 2x2 with Bluetooth® M.2 Combo Card non-vPro™

Realtek RTL8822BE 802.11ac 2x2 with Bluetooth® M.2 Combo Card

Realtek RTL8821CE 802.11ac 1x1 with Bluetooth® M.2 Combo Card

Intel® AX200 802.11 a/b/g/n/ac/ax(WiFi 6) WLAN + Bluetooth 5 PCIe NIC

1. Wireless access point and Internet service required and not included. Wi-Fi 6 is backwards compatible with prior 802.11 specs. The specifications for Wi-Fi 6 (802.11ax) are draft 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 802.11ax devices. Only available in countries where 802.11ax is supported.

KEYBOARDS AND POINTING DEVICES

Keyboards

HP USB Conferencing Keyboard

HP Wireless Collaboration Keyboard

HP USB and PS/2 Washable Keyboard

HP USB Smart Card (CCID) Keyboard

HP USB Business Slim Keyboard

HP USB Keyboard

HP PS/2 Business Slim Keyboard

HP PS/2 Keyboard

HP Wireless Business Slim Keyboard and Mouse

Mouse

HP PS/2 Mouse

HP USB Optical Mouse

HP USB Premium Mouse

HP USB 1000dpi Laser Mouse

HP USB and PS/2 Washable Mouse

Antimicrobial USB Mouse[1]

HP USB Hardened Mouse[1]

1. Not available in all regions

Features

SECURITY

Trusted Platform Module (TPM) 2.0 (Infineon SLB9670). Common Criteria EAL4+ Certified. FIPS 140-2 Level 2 Certified
Solenoid Lock & Intrusion Sensor
Support for chassis cable lock devices
Support for chassis padlocks devices
SATA port disablement (via BIOS)
Serial, USB enable/disable (via BIOS)
Intel® Identify Protection Technology (IPT)[1]
Serial, parallel, USB enable/disable (via BIOS)
Optional USB Port Disable at factory (user configurable via BIOS)
Removable media write/boot control
Power-on password (via BIOS)
Setup password (via BIOS)

1. Models configured with Intel® Core™ processors have the ability to utilize advanced security protection for online transactions. IPT, used in conjunction with participating web sites, provides double identity authentication by adding a hardware component in addition to the usual user name and password. IPT is initialized through an HP Client Security module.

PORTS

I/O Ports – Standard

USB 2.0	2 including 1 fast charging (front); 2 including wake from S4/S5 (rear)
USB 3.1 Gen 1	2 rear
USB 3.1 Gen 2	2 front; 2 rear
USB Type-C™ 3.1 Gen 2	1 front; 1 rear (option)
Video	2 DisplayPort™ 1.2 (rear) 1 Configurable video port (rear) (Choice of DisplayPort™ 1.2, HDMI™ 2.0, VGA, or USB Type-C™ with alt mode display port or 15W output)
Audio	1 Headphone (front), 1 Universal Audio Jack with CTIA headset support (front)); 1 Audio-out (rear), 1 Audio-in (rear)
Network Interface	RJ45

I/O Ports – Optional

Serial (RS-232)	1 (rear) (optional)
Serial (RS-232) and PS/2 combination	(rear) (optional)

I/O Ports – Internal Ports

Internal SATA storage connector(s)	4

Features

Internal SATA storage connector (Data and Power)	N/A

Slots

M.2 PCIe	(1) M.2 PCIe x1 2230 (for WLAN) (2) M.2 PCIe x4 2280/2230 Combo (for storage)
PCI Express v3.0 x1	2
PCI Express v3.0 x16 (wired as x4)	1
PCI Express v3.0 x16	1

Bays

5.25" Half Height	1
9mm Slim Optical Disc Drive (ODD)	1
SD Card Reader	1
2.5" Internal Storage Drive	1
3.5" Internal Storage Drive	2

NOTE: The HP Z1 Entry Tower G5 can support a single graphics card up to 75W. When configured with dual graphics cards support is limited to 35W for each.

SOFTWARE COMPONENTS AND APPLICATIONS WITH WINDOWS

BIOS
HP BIOSphere Gen4[17]
HP DriveLock & Automatic DriveLock
BIOS Update via Network
Master Boot Record Security
Power On Authentication
Secure Erase [18]
Absolute Persistence Module[19]
Pre-boot Authentication
HP Wireless Wakeup

Software
HP Native Miracast Support[15]
HP Velocity
HP ePrint Driver + JetAdvantage[20]
HP Hotkey Support - CMIT
HP Recovery Manager
HP Jumpstart
HP Support Assistant[21]
HP Noise Cancellation Software
HP WorkWise[36]
Buy Office (sold separately)

Manageability Features
HP Driver Packs[22]
HP System Software Manager (SSM)
HP BIOS Config Utility (BCU)
HP Client Catalog
HP Manageability Integration Kit Gen2[23]
Ivanti Management Suite[24]

Client Security Software
HP Client Security Suite Gen4[25] including:
HP Security Manager[26] (including Credential Manager, HP Password Manager, HP Spare Key)
HP Device Access Manager
HP Power On Authentication
Microsoft Defender[27]

Security Management
Secure Erase[18]
TPM 2.0 Embedded Security Chip shipped with Windows 10 (Common Criteria EAL4+ Certified) [31]
SATA 0,1 port disablement (viaBIOS)
RAID configurations[32]
Serial, USB enable/disable (viaBIOS)
Power-on password (viaBIOS)
Setup password (viaBIOS)
Support for chassis padlocks and cable lock devices
Integrated hood sensor
HP Sure Click[37]
HP Sure Start Gen4[30]
HP Sure Run[34]
HP Sure Recover[35]

15. Miracast is a wireless technology your Workstation can use to project your screen to TVs, projectors, and streaming

Features

17. HP BIOSphere Gen4 requires Intel® or AMD 8th Gen processors. Features may vary depending on the platform and configurations.
18. For the methods outlined in the National Institute of Standards and Technology Special Publication 800-88 "Clear" sanitation method. HP Secure Erase does not support platforms with Intel® Optane™.
19. Absolute agent is shipped turned off, and will be activated when customers activate a purchased subscription. Subscriptions can be purchased for terms ranging multiple years. Service is limited, check with Absolute for availability outside the U.S. The Absolute Recovery Guarantee is a limited warranty. Certain conditions apply. For full details visit: http://www.absolute.com/company/legal/agreements/computrace-agreement. Data Delete is an optional service provided by Absolute Software. If utilized, the Recovery Guarantee is null and void. In order to use the Data Delete service, customers must first sign a Pre-Authorization Agreement and either obtain a PIN or purchase one or more RSA SecurID tokens from Absolute Software.
20. HP ePrint Driver 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 www.hp.com/go/eprintcenter). Print times and connection speeds may vary.
21. HP Support Assistant requires Windows and Internet access.
22. HP Driver Packs not preinstalled, however available for download at http://www.hp.com/go/clientmanagement.
23. HP Manageability Integration Kit can be downloaded from http://www.hp.com/go/clientmanagement.
24. Ivanti Management Suite subscription required.
25. HP Client Security Suite Gen4 requires Windows and Intel® or AMD® 8th generation processors.
26. HP Password Manager requires Internet Explorer or Chrome or FireFox. Some websites and applications may not be supported. User may need to enable or allow the add-on / extension in the internet browser.
27. Microsoft Defender Opt in and internet connection required for updates. Windows 10 required.
30. HP Sure Start Gen4 is available on HP Workstation products equipped with Intel® 8th generation processors
31. Firmware TPM is version 2.0. Hardware TPM is v1.2, which is a subset of the TPM 2.0 specification version v0.89 as implemented by Intel Platform Trust Technology (PTT).
32. RAID configuration is optional and does require a second hard drive.
34. HP Sure Run is available on HP Workstation products equipped with 8th generation Intel® or AMD® processors.
35. HP Sure Recover is available on HP Elite PCs with 8th generation Intel® or AMD processors and requires an open, wired network connection. Not available on platforms with multiple internal storage drives, Intel® Optane™. You must back up important files, data, photos, videos, etc. before use to avoid loss of data.
36. HP WorkWise smartphone app is available as a free download on Google Play.
37. HP Sure Click is available on most HP PCs and supports Microsoft® Internet Explorer, Google Chrome, and Chromium™. Supported attachments include Microsoft Office (Word, Excel, PowerPoint) and PDF files in read only mode, when Microsoft Office or Adobe Acrobat are installed.

Features

ENVIRONMENTAL & INDUSTRY

ENERGY STAR® certified models available

EPEAT®2019 Gold registered in the United States*
Low halogen (chassis, all internal components and modules)[1]
TAA compliant models available

*Based on US EPEAT® registration according to IEEE 1680.1-2018 EPEAT®. EPEAT® status varies by country. Visit www.epeat.net for more information.

1. External power supplies, power cords, cables and peripherals are not Low Halogen. Service parts obtained after purchase may not be Low Halogen.

UNIT ENVIRONMENT AND OPERATING CONDITIONS

General Unit Operating Guidelines

- Keep the computer away from excessive moisture, direct moisture and the extremes of heat and cold, to ensure that unit is operated within the specified operating range.
- Leave a 10.2 cm (4 in) clearance on all vented sides of the computer to permit the required airflow.
- Never restrict airflow into the computer by blocking any vents or air intakes.
- Do not stack computers on top of each other or place computers so near each other that they are subject to each other's re-circulated or preheated air.
- Occasionally clean the air vents on the front, back, and any other vented side of the computer. Lint, dust and other foreign matter can block the vents and limit the airflow.
- If the computer is to be operated within a separate enclosure, intake and exhaust ventilation must be provided on the enclosure, and the same operating guidelines listed above will still apply.

Temperature Range	Operating: 50° to 95° F (10° to 35° C)[1] Non-operating: -22° to 140° F (-30° to 60° C)
Relative Humidity	Operating: 10% to 90% (non-condensing at ambient) Non-operating: 5% to 95% (non-condensing at ambient)
Maximum Altitude (unpressurized)	Operating: 5000m Non-operating: 50000ft (15240 m)

1. Operating temperature is de-rated 1.0 deg C per 300 m (1000 ft) to 3000 m (10,000 ft) above sea level, no direct sustained sunlight. Maximum rate of change is 10 deg C/Hr. The upper limit may be limited by the type and number of options installed.

Environmental Data

Eco-Label Certifications & declarations	This product has received or is in the process of being certified to the following approvals and may be labeled with one or more of these marks: • IT ECO declaration • US ENERGY STAR® • EPEAT®2019 Gold registered in the United States* *Based on US EPEAT® registration according to IEEE 1680.1-2018 EPEAT®. EPEAT® status varies by country. Visit www.epeat.net for more information.		
System Configuration	The configuration used for the Energy Consumption and Declared Noise Emissions data for the Desktop model is based on a Typically Configured Desktop.		
Energy Consumption (in accordance with US ENERGY STAR® test method)	**115VAC, 60Hz**	**230VAC, 50Hz**	**100VAC, 60Hz**
Normal Operation (Short idle)	17.22 W	15.78 W	17.40 W
Normal Operation (Long idle)	16.51 W	15.22 W	16.42 W
Sleep	1.38 W	1.36 W	1.39 W
Off	0.77 W	0.79 W	0.78 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, 60Hz**
Normal Operation (Short idle)	60 BTU/hr	54 BTU/hr	59 BTU/hr
Normal Operation (Long idle)	56 BTU/hr	52 BTU/hr	56 BTU/hr
Sleep	5 BTU/hr	5 BTU/hr	5 BTU/hr
Off	3 BTU/hr	3 BTU/hr	3 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	3.3	24	
Fixed Disk – Random writes	3.3	23	
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: Spare parts are available throughout the warranty period and or for up to “5” years after the end of production.		

Features

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		
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 in the U.S. See http://www.epeat.net for registration status by country. Search keyword generator on HP's 3rd party option store for solar generator accessories at http://www.hp.com/go/options • Plastics parts weighing over 25 grams used in the product are marked per ISO11469 and ISO1043. • This product contains 0% post-consumer recycled plastic (by wt.) • This product is 95.1% recycle-able when properly disposed of at end of life.		
Packaging Materials	**External:**	PAPER/Corrugated	145 g
	Internal:	PLASTIC/EPE (Expanded Polyethylene)	288 g
		PLASTIC/Polyethylene low density	30 g
Material Usage	This product does not contain any of the following substances in excess of regulatory limits (refer to the HP General Specification for the Environment at http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/gse.pdf): • Asbestos • Certain Azo Colorants • Certain Brominated Flame Retardants – may not be used as flame retardants in plastics • Cadmium • Chlorinated Hydrocarbons • Chlorinated Paraffins • Formaldehyde • Halogenated Diphenyl Methanes • Lead carbonates and sulfates • Lead and Lead compounds • Mercuric Oxide Batteries • Nickel – finishes must not be used on the external surface designed to be frequently handled or carried by the user. • Ozone Depleting Substances • Polybrominated Biphenyls (PBBs) • Polybrominated Biphenyl Ethers (PBBEs) • Polybrominated Biphenyl Oxides (PBBOs) • Polychlorinated Biphenyl (PCB) • Polychlorinated Terphenyls (PCT) • Polyvinyl Chloride (PVC) – except for wires and cables, and certain retail packaging has been voluntarily removed from most applications. • Radioactive Substances • Tributyl Tin (TBT), Triphenyl Tin (TPT), Tributyl Tin Oxide (TBTO)		

Features

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 Hewlett Packard 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. 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://www.hp.com/hpinfo/globalcitizenship/environment/pdf/PC_GBU_Product_Design_ISO_14K_Certificate.pdf and http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/cert.pdf

SERVICE AND SUPPORT

On-site Warranty[15]: Three-year (3-3-3) limited warranty delivers three years of on-site, next business day[16] service for parts and labor and includes free support 24 x 7[17]. Three-year onsite and labor are not available in all countries. Service offers terms up to 5 years by choosing an optional HP Care Pack. To choose the right level of service for your HP product, visit HP Care Pack Central: http://www.hp.com/go/cpc.[18]

15. Terms and conditions may vary by country. Certain restrictions and exclusions apply. Other warranty variations may be offered in your region.
16. On-site service may be provided pursuant to a service contract between HP and an authorized HP third-party provider, and is not available in certain countries. Global service response times are based on commercially reasonable best effort and may vary by country.
17. Technical telephone support applies only to HP-configured and third-party HP qualified hardware and software. Toll-free calling and 24 x 7 support may not be available in some countries.
18. 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. For details, visit www.hp.com/go/cpc. 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.

CERTIFICATION AND COMPLIANCE

Features

Energy Efficiency Compliance

ENERGY STAR® certified and EPEAT® 2019 registered [19]

19. Based on US EPEAT® registration according to IEEE 1680.1-2018 EPEAT®. EPEAT® status varies by country. Visit www.epeat.net for more information.

GRAPHICS

Intel® UHD Graphics (integrated)	
VGA Controller	Integrated
DisplayPort™ 1.2	Multimode capable; supports HDCP, Display Port Audio (2 streams), HBR2 link rates and Multi-Stream Technology for a maximum of 3 displays connected to any output controlled by Intel® Graphics
HDMI (optional)	Supports HDMI 2.0a features Supports HDCP 2.2 Supports BT2020 and HDR playback (7th Gen processors only)
VGA (optional)	VGA ouput
USB-C™ DP Alt Mode (optional)	DisplayPort over the optional USB-C™ module
Memory	The actual amount of maximum graphics memory can be >4GB. System memory is allocated for graphics as needed using Intel's Dynamic Video Memory Technology (DVMT), to provide an optimal balance between graphics and system memory use.
Maximum Color Depth	up to 10 bits/color
Graphics/Video API Support	HEVC 10b Enc/Dec HW VP9 10b Dec HW HDR Rec. 2020 DX12
34" UHD Supported Resolutions and Refresh Rates. Other resolutions may also work.	640x480 60 Hz640x480 67Hz 640x480 72Hz 640x480 75Hz 720x400 70Hz 800x600 60Hz 800x600 75Hz 1024x768 60Hz 1024x768 75Hz 1280x960 60Hz 1280x720 60Hz 1280x1024 60Hz 1280x1024 75Hz 1440x900 60Hz 1440x900 75Hz 1680x1050 60Hz 1920x1080 60Hz 3440x1440 60Hz (Native Resolution) 3440x1440 30Hz

NVIDIA® GeForce® RTX 2060 6 GB Graphics Card

Engine Clock	1680 MHz
Memory Clock	7000 MHz
Memory Size(width)	6GB (256-bit)
Memory Type	256M x 32 GDDR6
Max. Resolution(Virtual Link)	2560 x 1600@60Hz
Max. Resolution(HDMI)	4096 x 2160@60Hz
Max. Resolution(DP)	7680 x 4320@60Hz
Multi Display Support	3 displays

HDCP Compliance	Yes
Rear I/O connectors(bracket)	DVI + HDMI + DP
Cooling(active/passive)	Active fan-sink (Active cooling with dynamic speed)
Total power consumption(W)	<170W
PCB form-factor with bracket	ATX (Full height) PCB with ATX dual slot bracket

NVIDIA® GeForce® RTX 2070 8GB GDDR6

Engine Clock	1620 MHz
Memory Clock	7000 MHz
Memory Size(width)	8GB (256-bit)
Memory Type	256M x 32 GDDR6
Max. Resolution(Virtual Link)	3840 x 2160@60Hz
Max. Resolution(HDMI)	4096 x 2160@60Hz
Max. Resolution(DP)	7680 x 4320@60Hz
Multi Display Support	4 displays
HDCP Compliance	Yes
Rear I/O connectors(bracket)	DPx2 + HDMI + DVI + Virtual Link
Cooling(active/passive)	Active fan-sink (Active cooling with dynamic speed)
Total power consumption(W)	<210W
PCB form-factor with bracket	ATX (Full height) PCB with ATX dual slot bracket

NVIDIA® GeForce® RTX 2080 8GB Graphics Card

Engine Clock	1710 MHz
Memory Clock	7000 MHz
Memory Size(width)	8GB (256-bit)
Memory Type	256M x 32 GDDR6
Max. Resolution(Virtual Link)	3840 x 2160@60Hz
Max. Resolution(HDMI)	4096 x 2160@60Hz
Max. Resolution(DP)	7680 x 4320@60Hz
Multi Display Support	4 displays
HDCP Compliance	Yes
Rear I/O connectors(bracket)	DPx3 + HDMI + Virtual Link
Cooling(active/passive)	Active fan-sink (Active cooling with dynamic speed)
Total power consumption(W)	<250W
PCB form-factor with bracket	ATX (Full height) PCB with ATX dual slot bracket

NVIDIA® GeForce® GT730 2GB DP DVI PCIe x8 GFX

Engine Clock	902 MHz
Memory Clock	1250 MHz
Memory Size(width)	2GB (64-bit)
Memory Type	256M x 32 GDDR6
Max. Resolution(Virtual Link)	2560 x 1600 x 30 bpp @ 60Hz (Dual Link)
Max. Resolution(DP)	4096 x 2160 x 24 bpp @ 60 Hz (DP1.2)

Multi Display Support	2 displays
HDCP Compliance	Yes
Rear I/O connectors(bracket)	DL DVI-I + DP
Cooling(active/passive)	Active fan-sink (Active cooling with dynamic speed)
Total power consumption(W)	35W
PCB form-factor with bracket	2-pin fan connector for fan sink power/speed control

AMD® Radeon™ RX550 4 GB FH PCIe x16

Engine Clock	1183MHz
Memory Clock	7 Gbps
Memory Size(width)	4 GB(128-bit)
Memory Type	GDDR5
Max. Resolution(HDMI)	4096x2160 @ 60Hz
Max. Resolution(DP)	5120x2880 @ 60Hz
Multi Display Support	3 displays
HDCP Compliance	Yes
Rear I/O connectors(bracket)	HDMI, DPx2
Cooling(active/passive)	Active fan-sink (Active cooling with dynamic speed)
Total power consumption(W)	<62W
PCB form-factor with bracket	ATX (Full height) PCB with ATX single slot bracket

AMD® Radeon™ RX580 4 GB FH PCIe x16

Engine Clock	1266 MHz
Memory Clock	8gbs
Memory Size(width)	4 GB (256-bit)
Memory Type	128M x 32 GDDR5
Max. Resolution(HDMI)	4096x2160@60Hz
Max. Resolution(DP)	5120x3200@60Hz
Multi Display Support	4 displays
HDCP Compliance	Yes
Rear I/O connectors(bracket)	DP*3 + HDMI
Cooling(active/passive)	Active fan-sink (Active cooling with dynamic speed)
Total power consumption(W)	<150W
PCB form-factor with bracket	ATX (Full height) PCB with ATX dual slot bracket

AMD Radeon™ 520 1GB Graphics Card

Engine Clock	780 MHz
Memory Clock	1100 MHz
Memory Size(width)	1GB(128-bit)
Memory Type	256M x 32 GDDR5
Max. Resolution(HDMI)	2048x1536
Multi Display Support	2 displays
HDCP Compliance	Yes

Rear I/O connectors(bracket)	VGA+DP
Cooling(active/passive)	Active fan-sink (Active cooling with dynamic speed)
Total power consumption(W)	<50W
PCB form-factor with bracket	LP PCB with FH/LP bracket

NVIDIA® Quadro® P620 2GB Graphics Card

Engine Clock	1354 MHz
Memory Clock	2500 MHz
Memory Size(width)	2GB (64-bit)
Memory Type	128M x 32 GDDR5
Max. Resolution(DP)	5120x2880@60Hz
Multi Display Support	4 displays
HDCP Compliance	Yes
Rear I/O connectors(bracket)	mDPx3
Cooling(active/passive)	Active fan-sink (Active cooling with dynamic speed)
Total power consumption(W)	<40W
PCB form-factor with bracket	LP PCB with LP bracket

NVIDIA® Quadro® P400 2GB Graphics Card

Engine Clock	1252 MHz
Memory Clock	2000 MHz
Memory Size(width)	2GB (64-bit)
Memory Type	256M x 32 GDDR5
Max. Resolution(DP)	5120x2880@60Hz
Multi Display Support	3 displays
HDCP Compliance	Yes
Rear I/O connectors(bracket)	mDPx3
Cooling(active/passive)	Active fan-sink (Active cooling with dynamic speed)
Total power consumption(W)	<30W
PCB form-factor with bracket	LP PCB with LP bracket

NVIDIA® Quadro® P1000 4GB Graphics Card

Engine Clock	1354 MHz
Memory Clock	2500 MHz
Memory Size(width)	4GB (64-bit)
Memory Type	128M x 32 GDDR5
Max. Resolution(DP)	5120x2880@60Hz
Multi Display Support	4 displays
HDCP Compliance	Yes
Rear I/O connectors(bracket)	4 mDP Connectors
Cooling(active/passive)	Active fan-sink (Active cooling with dynamic speed)
Total power consumption(W)	<50W
PCB form-factor with bracket	LP PCB with LP bracket

AMD® Radeon™ R7 430 2GB VGA+DP Graphics Card

Engine Clock	780 MHz
Memory Clock	1100 MHz
Memory Size(width)	2GB(128-bit)
Memory Type	128M x 32 GDDR5
Max. Resolution(HDMI)	2048x1536
Max. Resolution(DP)	4096x2160@60Hz
Multi Display Support	2 displays
HDCP Compliance	Yes
Rear I/O connectors(bracket)	VGA+DP
Cooling(active/passive)	Active fan-sink (Active cooling with dynamic speed)
Total power consumption(W)	<50W
PCB form-factor with bracket	LP PCB with FH/LP bracket

AMD® Radeon™ R7 430 2GB 2DP Graphics Card

Engine Clock	780 MHz
Memory Clock	1100 MHz
Memory Size(width)	2GB(128-bit)
Memory Type	128M x 32 GDDR5
Max. Resolution(DP)	4096x2160@60Hz
Multi Display Support	2 displays
HDCP Compliance	yes
Rear I/O connectors(bracket)	2DP
Cooling(active/passive)	Active fan-sink(Active cooling with dynamic speed)
Total power consumption(W)	<50W
PCB form-factor with bracket	LP PCB with FH/LP bracket

STORAGE

500 GB 7200RPM 3.5in SATA HDD

Capacity	500 GB
Rotational Speed	7,200 rpm
Interface	SATA 6.0 Gb/s
Buffer Size	16 MB
Logical Blocks	976,773,168
Seek Time	11 ms (Average)
Height	1 in/2.54 cm
Width	Media diameter: 3.5 in/8.89 cm Physical size: 4 in/10.2 cm
Operating Temperature	41° to 131° F (5° to 55° C)

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

1 TB 7200RPM 3.5in SATA HDD

Capacity	1TB
Rotational Speed	7,200 rpm
Interface	SATA 6 Gb/s
Buffer Size	32 MB
Logical Blocks	1,953,525,168
Seek Time	11 ms (Average)
Height	1 in/2.54 cm
Width (nominal)	Media diameter: 3.5 in/8.89 cm Physical size: 4 in/10.2 cm
Operating Temperature	41° to 131° F (5° to 55° C)

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

2 TB 7200RPM 3.5in SATA HDD

Capacity	2 TB
Rotational Speed	7,200 rpm
Interface	SATA 6 Gb/s
Buffer Size	64 MB
Logical Blocks	1,953,525,168
Seek Time	11 ms (Average)
Height	1.028 in/26.11 mm
Width (nominal)	4.0 in/101.6 mm

Operating Temperature	41° to 131° F (5° to 55° C)

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

500 GB 7200RPM 2.5in SATA HDD

Capacity	500 GB
Rotational Speed	7,200 rpm
Interface	SATA 6 Gb/s
Buffer Size	16 MB
Logical Blocks	976,773,168
Seek Time	12 ms (Average)
Height	0.267 in/6.8 mm (nominal)
Width (nominal)	2.75 in/70 mm (nominal)
Operating Temperature	41° to 131° F (5° to 55° C)

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

1 TB 7200RPM 2.5in SATA HDD

Capacity	1 TB
Rotational Speed	7,200 rpm
Interface	SATA 6 Gb/s
Buffer Size	32 MB
Logical Blocks	1,953,525,168
Seek Time	12 ms (Average)
Height	0.374 in/9.5 mm (nominal)
Width (nominal)	2.75 in/70 mm (nominal)
Operating Temperature	41° to 131° F (5° to 55° C)

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

2 TB 5400RPM 2.5in SATA HDD

Capacity	2TB
Rotational Speed	5,400 rpm
Interface	SATA 6 Gb/s
Buffer Size	128MB
Logical Blocks	3,907,050,336
Seek Time	12 ms (Average)

Height	0.374 in/9.5 mm (nominal)
Width (nominal)	2.75 in/70 mm (nominal)
Operating Temperature	41° to 131° F (5° to 55° C)

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

500 GB 7200RPM 2.5in Self Encrypted OPAL2 SATA HDD

Capacity	500 GB
Architecture	Self-Encrypting (SED) Solid State Drive with SATA interface
Interface	SATA 6 Gb/s
Buffer Size	32 MB
Logical Blocks	976,773,168
Seek Time	12 ms (Average)
Height	0.267 in/6.8 mm (nominal)
Width	2.75 in/70 mm (nominal)
Operating Temperature	41° to 131° F (5° to 55° C)

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

500 GB 7200RPM 2.5in Self Encrypted Federal Information Processing Standard SATA HDD

Capacity	500 GB
Architecture	Self-Encrypting (SED) Solid State Drive with SATA interface
Interface	SATA 6 Gb/s
Buffer Size	32 MB
Logical Blocks	976,773,168
Seek Time	12 ms (Average)
Height	0.267 in/6.8 mm (nominal)
Width	2.75 in/70 mm (nominal)
Operating Temperature	41° to 131° F (5° to 55° C)

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

500 GB 5400RPM 2.5in SATA SSHD

Capacity	500 GB
Rotational Speed	5,400 rpm
Drive Type	Solid State Hybrid Drive (SSHD) technology with NAND Flash
Interface	SATA 6 Gb/s

Buffer Size	64 MB
NAND Flash	8GB
Seek Time	12 ms (Average)
Height	0.267 in/6.8 mm (nominal)
Width	2.75 in/70 mm (nominal)
Operating Temperature	41° to 131° F (5° to 55° C)

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

1 TB 5400RPM 2.5in SATA SSHD

Capacity	1 TB
Rotational Speed	5,400 rpm
Drive Type	Solid State Hybrid Drive (SSHD) technology with NAND Flash
Interface	SATA 6 Gb/s
Buffer Size	64 MB
NAND Flash	8GB
Seek Time	12 ms (Average)
Height	0.374 in/9.5 mm (nominal)
Width	2.75 in/70 mm (nominal)
Operating Temperature	41° to 131° F (5° to 55° C)

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

128 GB 2.5in SATA Three Layer Cell SSD

Drive Weight	<50g
Capacity	128 GB
Height	7mm
Length	100.45mm
Width	69.85mm
Interface	SATA 3.0 (6Gb/s)
Performance	Up to Random Read/Write = 70K/40K IOPS
Maximum Sequential Read	Up to 530MB/s
Maximum Sequential Write	Up to 380MB/s
Logical Blocks	250,069,680
Operating Temperature	0° to 70°C (32° to 158°F) [ambient temp]
Features	DIPM; TRIM

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

256 GB 2.5in SATA Three Layer Cell SSD

Drive Weight	<62g
Capacity	256GB
Height	7mm
Length	100.45mm
Width	69.85mm
Interface	SATA 3.0 (6Gb/s)
Performance	Up to Random Read/Write = 55K/68K IOPS
Maximum Sequential Read	Up to 530MB/s
Maximum Sequential Write	Up to 450MB/s
Logical Blocks	500,118,192
Operating Temperature	0° to 70°C (32° to 158°F) [ambient temp]
Features	DIPM; TRIM

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

512GB 2.5in SATA Three Layer Cell SSD

Drive Weight	<50g
Capacity	512 GB
Height	7mm
Length	100.45mm
Width	69.85mm
Interface	SATA 3.0 (6Gb/s)
Performance	Up to Random Read/Write = 92K/83K IOPS
Maximum Sequential Read	Up to 530MB/s
Maximum Sequential Write	Up to 500MB/s
Logical Blocks	1,000,215,216
Operating Temperature	0° to 70°C (32° to 158°F) [ambient temp]
Features	DIPM; TRIM

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

256 GB 2.5in SATA Self Encrypted OPAL2 Three Layer Cell SSD

Drive Weight	<50g
Capacity	256 GB
Height	7mm
Length	100.45mm
Width	69.85mm
Interface	SATA 3.0 (6Gb/s)
Performance	Up to Random Read/Write = 55K/80K IOPS
Maximum Sequential Read	Up to 530MB/s
Maximum Sequential Write	Up to 500MB/s
Logical Blocks	500,118,192
Operating Temperature	0° to 70°C (32° to 158°F) [ambient temp]
Features	DIPM; TRIM; TCG-OPAL2.0 security

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

512 GB 2.5in SATA Self Encrypted OPAL2 Three Layer Cell SSD

Drive Weight	<50g
Capacity	512 GB
Height	7mm
Length	100.45mm
Width	69.85mm
Interface	SATA 3.0 (6Gb/s)
Performance	Up to Random Read/Write = 92K/83K IOPS
Maximum Sequential Read	Up to 530MB/s
Maximum Sequential Write	Up to 500MB/s
Logical Blocks	1,000,215,216
Operating Temperature	0° to 70°C (32° to 158°F) [ambient temp]
Features	DIPM; TRIM; TCG-OPAL2.0 security

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

256 GB 2.5in SATA Self Encrypted Federal Information Processing Standard SSD

Drive Weight	<40g
Capacity	256 GB
Height	7mm
Length	100.45mm
Width	69.85mm
Interface	SATA 3.0 (6Gb/s)
Performance	Up to Random Read/Write = 55K/83K IOPS
Maximum Sequential Read	Up to 530MB/s
Maximum Sequential Write	Up to 500MB/s
Logical Blocks	500,118,192
Operating Temperature	0° to 70°C (32° to 158°F) [ambient temp]
Features	DIPM; TRIM; FIPS 140-2 security

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

512 GB 2.5in SATA Self Encrypted Federal Information Processing Standard SSD

Drive Weight	<45g
Capacity	512 GB
Height	7mm
Length	100.45mm
Width	69.85mm
Interface	SATA 3.0 (6Gb/s)
Performance	Up to Random Read/Write = 92K/83K IOPS
Maximum Sequential Read	Up to 530MB/s
Maximum Sequential Write	Up to 500MB/s
Logical Blocks	1,000,215,216
Operating Temperature	0° to 70°C (32° to 158°F) [ambient temp]
Features	DIPM; TRIM; FIPS 140-2 security

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

128 GB M.2 2280 PCIe NVMe SSD

Drive Weight	< 10g
Capacity	128GB
Height	2.38mm
Length	80mm
Width	22mm
Interface	PCIE Gen3
Performance	Up to Random Read/Write = 60K/50K IOPS
Maximum Sequential Read	Up to 1400MB/s
Maximum Sequential Write	Up to 395MB/s
Logical Blocks	250,069,680
Operating Temperature	0° to 70°C (32° to 158°F) [ambient temp]
Features	APST; ASPM L1.2; NVME spec 1.2

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

256 GB M.2 2280 PCIe NVMe SSD

Drive Weight	< 10g
Capacity	256GB
Height	2.38mm
Length	80mm
Width	22mm
Interface	PCIE Gen3
Performance	Up to Random Read/Write = 120K/170K IOPS
Maximum Sequential Read	Up to 1600MB/s
Maximum Sequential Write	Up to 780MB/s
Logical Blocks	500,118,192
Operating Temperature	0° to 70°C (32° to 158°F) [ambient temp]
Features	APST; ASPM L1.2; NVME spec 1.2

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

512 GB M.2 2280 PCIe NVMe SSD

Drive Weight	< 10g
Capacity	512GB
Height	2.38mm
Length	80mm
Width	22mm
Interface	PCIE Gen3
Performance	Up to Random Read/Write = 200K/180K IOPS
Maximum Sequential Read	Up to 1600MB/s
Maximum Sequential Write	Up to 860MB/s
Logical Blocks	1,000,215,216
Operating Temperature	0° to 70°C (32° to 158°F) [ambient temp]
Features	APST; ASPM L1.2; NVME spec 1.2

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

128 GB M.2 2280 PCIe NVMe Three Layer Cell SSD

Drive Weight	< 10g
Capacity	128GB
Height	2.38mm
Length	80mm
Width	22mm
Interface	PCIE Gen3x4
Performance	Up to Random Read/Write = 140K/40K IOPS
Maximum Sequential Read	Up to 2800MB/s
Maximum Sequential Write	Up to 600MB/s
Logical Blocks	250,069,680
Operating Temperature	0° to 70°C (32° to 158°F) [ambient temp]
Features	APST; ASPM L1.2; NVME spec 1.2

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

256 GB M.2 2280 PCIe NVMe Three Layer Cell SSD

Drive Weight	< 10g
Capacity	256GB
Height	2.38mm
Length	80mm
Width	22mm
Interface	PCIE Gen3x4
Performance	Up to Random Read/Write = 150K/180K IOPS
Maximum Sequential Read	Up to 2700MB/s
Maximum Sequential Write	Up to 1000MB/s
Logical Blocks	500,118,192
Operating Temperature	0° to 70°C (32° to 158°F) [ambient temp]
Features	APST; ASPM L1.2; NVME spec 1.2

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

512 GB M.2 2280 PCIe NVMe Three Layer Cell SSD

Drive Weight	< 10g
Capacity	512GB
Height	2.38mm
Length	80mm
Width	22mm
Interface	PCIE Gen3x4
Performance	Up to Random Read/Write = 270K/235K IOPS
Maximum Sequential Read	Up to 2900MB/s
Maximum Sequential Write	Up to 1100MB/s
Logical Blocks	1,000,215,216
Operating Temperature	0° to 70°C (32° to 158°F) [ambient temp]
Features	APST; ASPM L1.2; NVME spec 1.2

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

1 TB M.2 2280 PCIe NVMe Three Layer Cell SSD

Drive Weight	< 10g
Capacity	1TB
Height	2.38mm
Length	80mm
Width	22mm
Interface	PCIE Gen3x4
Performance	Up to Random Read/Write = 290K/240K IOPS
Maximum Sequential Read	Up to 2900MB/s
Maximum Sequential Write	Up to 2100MB/s
Logical Blocks	2,000,409,264
Operating Temperature	0° to 70°C (32° to 158°F) [ambient temp]
Features	APST; ASPM L1.2; NVME spec 1.2

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

256 GB M.2 2280 PCIe NVMe Self Encrypted OPAL2 Three Layer Cell SSD

Drive Weight	< 10g
Capacity	256GB
Height	2.38mm
Length	80mm
Width	22mm
Interface	PCIE Gen3x4
Performance	Up to Random Read/Write = 150K/180K IOPS
Maximum Sequential Read	Up to 2700MB/s
Maximum Sequential Write	Up to 1000MB/s
Logical Blocks	500,118,192
Operating Temperature	0° to 70°C (32° to 158°F) [ambient temp]
Features	APST; ASPM L1.2; NVME spec 1.2; TCG-OPAL2 security

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

512 GB M.2 2280 PCIe NVMe Self Encrypted OPAL2 Three Layer Cell SSD

Drive Weight	< 10g
Capacity	512 GB
Height	2.38mm
Length	80mm
Width	22mm
Interface	PCIE Gen3x4
Performance	Up to Random Read/Write = 270K/235K IOPS
Maximum Sequential Read	Up to 2900MB/s
Maximum Sequential Write	Up to 1100MB/s
Logical Blocks	1,000,215,216
Operating Temperature	0° to 70°C (32° to 158°F) [ambient temp]
Features	APST; ASPM L1.2; NVME spec 1.2; TCG-OPAL2 security

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

HP 9.5mm Slim DVD-ROM Drive

Height	9.5 mm height
Orientation	Either horizontal or vertical
Interface type	SATA/ATAPI
Dimensions (W x H x D)	5.04 x 0.37 x 5.0 in (128 x 9.5 x 127 mm) without bezel
Weight (max)	Up to 0.31 lb (140g) without bezel
Read Speeds	DVD+R/-R/+RW/ -RW/+R DL /-R DL Up to 8X DVD-ROM Up to 8X CD-ROM, CD-R Up to 24X CD-RW Up to 24X
Access time (typical reads, including settling)	Random: DVD-ROM: 170 ms (typical), CD-ROM: 170 ms (typical) Full stroke: DVD-ROM: 320 ms (typical), CD-ROM: 320 ms (typical)
Power	Source Slimline SATA DC power receptacle DC Power Requirement 5 VDC ± 5%-100 mV ripple p-p DC Current 5 VDC (< 1000 mA typical, 1600 mA maximum)
Environmental conditions (operating - non-condensing)	Temperature 41° to 122° F (5° to 50° C) Relative Humidity 10% to 80% Maximum Wet Bulb Temperature 84° F (29° C)
	No support for DVD-RAM. Actual speeds may vary.

HP 9.5mm Slim DVD Writer Drive

Height	9.5 mm height
Orientation	Either horizontal or vertical
Interface type	SATA/ATAPI
Disc recording capacity	Up to 8.5 GB DL or 4.7 GB standard
Dimensions (W x H x D)	5.04 x 0.37 x 5.0 in (128 x 9.5 x 127 mm) without bezel
Weight (max)	0.31 lb (140 g)
Read Speeds	DVD-R DL - Up to 6X DVD+R - Up to 8X DVD+RW - Up to 8X DVD+R DL - Up to 6X DVD-R - Up to 8X DVD-RW - Up to 6X CD-R - Up to 24X CD-RW - Up to 10X DVD-RW, DVD+RW - Up to 8X DVD-R DL, DVD+R DL - Up to 8X DVD+R, DVD-R - Up to 8X DVD-ROM DL, DVD-ROM - Up to 8X CD-ROM, CD-R - Up to 24X CD-RW - Up to 24X
Access time (typical reads, including settling)	Random DVD-ROM: 170 ms (typical), CD-ROM: 170 ms (typical) Full Stroke DVD-ROM: 320 ms (typical), CD-ROM: 320 ms (typical) Stop Time 6 seconds (typical)
Power	Source Slimline SATA DC power receptacle

	DC Power Requirement 5 VDC ± 5%-100 mV ripple p-p DC Current 5 VDC (< 1000 mA typical, 1600 mA maximum)
Environmental conditions (operating - non-condensing)	Temperature 41° to 122° F (5° to 50° C) Relative Humidity 10% to 80% Maximum Wet Bulb Temperature 84° F (29° C)
	No support for DVD-RAM. Actual speeds may vary. Don't copy copyright-protected materials. Double Layer discs can store more data than single layer discs. Discs burned with this drive may not be compatible with many existing single-layer DVD drives and players.

HP 9.5mm Slim Blu-Ray Writer Drive

Height	9.5 mm height
Orientation	Either horizontal or vertical
Interface type	SATA/ATAPI
Disc recording capacity	Up to 128 GB QL, 100 GB TL, 50 GB DL or 25 GB standard SL
Dimensions (W x H x D)	5.04 x 0.37 x 5.0 in (128 x 9.5 x 127 mm) without bezel
Weight (max)	0.29 lb (132 g)
Write Speeds	BD-R Up to 4X BD-RE Up to 2X BD-R Up to 6X BD-RE Up to 2X DVD-R Up to 8X DVD-RW Up to 6X DVD+R Up to 8X DVD+RW Up to 8X DVD-RAM Up to 5X CD-R Up to 24X CD-RW Up to 10X
Read Speeds	BD-R Up to 6X BD-RE Up to 4X BD-ROM Up to 6X BD-R Up to 6X BD-RE Up to 6X DVD-ROM Up to 8X DVD-R Up to 8X DVD-RW Up to 8X DVD+R Up to 8X DVD+RW Up to 8X BDMV (AACS Compliant Disc) Up to 6x/2x (Read/Play) DVD-RAM Up to 5x DVD-Video (CSS Compliant Disc) Up to 8x/4x (Read/Play) CD-R/RW/ROM Up to 24x CD-DA (DAE) Up to 24X/10X (Read/Play)
Access time (typical reads, including settling)	Random BD-ROM: 205 ms (typical), DVD-ROM: 185 ms (typical), CD-ROM: 165 ms (typical) Full Stroke BD-ROM: 350 ms (typical), DVD-ROM: 345 ms (typical), CD-ROM: 340 ms (typical)

Technical Specifications

Power	Source Slimline SATA DC power receptacle DC Power Requirement 5 VDC ± 5%-100 mV ripple p-p DC Current 5 VDC -1200 mA typical, 2000 mA maximum
Environmental conditions (operating - non-condensing)	Temperature 41° to 122° F (5° to 50° C) Relative Humidity 10% to 80% Maximum Wet Bulb Temperature 84° F (29° C)
	With Blu-Ray, certain disc, digital connection, compatibility and/or performance issues may arise, and do not constitute defects in the product. Flawless playback on all systems is not guaranteed. In order for some Blu-ray titles to play, they may require a DVI or HDMI digital connection and your display may require HDCP support. HD-DVD movies cannot be played on this PC. Don't copy copyright protected content.

NETWORKING AND COMMUNICATIONS

Intel® I219LM 10/100/1000 Integrated NIC	
Connector	RJ-45
System Interface	PCI (Intel® proprietary) + SMBus
Data rates supported	10 Mbit/s operation (10BASE-T; IEEE 802.3i; IEEE 802.3 clauses 13-14)
	100 Mbit/s operation (100BASE-TX; IEEE 802.3u; IEEE 802.3 clauses 21-30)
	1000 Mbit/s operation (1000BASE-T; IEEE 802.3ab; IEEE 8023 clauses 40)
	Auto-Negotiation (Automatic Speed Selection)
	Full Duplex Operation at all Speeds, Half Duplex operation at 10 and 100 Mbit/s
IEEE Compliance	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)
Performance	TCP/IP/UDP Checksum Offload (configurable)
	Protocol Offload (ARP & NS)
	Large send offload and Giant send offload
	Receiving Side Scaling
	Jumbo Frame 9K
Power consumption	Cable Disconnetion: 25mW
	100Mbps Full Run: 450mW
	1000bp Full Run: 1000mW
	WoL Enable(S3/S4/S5): 50mW
	WoL Disable(S3/S4/S5): 25mW
Power Management	ACPI compliant – multiple power modes
	Situation-sensitive features reduce power consumption
	Advanced link down power saving for reducing link down power consumption
Management Interface	Auto MDI/MDIX Crossover cable detection
IT 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

Technical Specifications

Security & Manageability	Intel® vPro™ support with appropriate Intel® chipset components
Intel® I210 10/100/1000 Integrated NIC (Optional)	
Connector	RJ-45
System Interface	PCI (Intel® proprietary) + SMBus
Data rates supported	10 Mbit/s operation (10BASE-T; IEEE 802.3i; IEEE 802.3 clauses 13-14) 100 Mbit/s operation (100BASE-TX; IEEE 802.3u; IEEE 802.3 clauses 21-30) 1000 Mbit/s operation (1000BASE-T; IEEE 802.3ab; IEEE 8023 clauses 40) Auto-Negotiation (Automatic Speed Selection) Full Duplex Operation at all Speeds, Half Duplex operation at 10 and 100 Mbit/s
IEEE Compliance	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)
Performance	TCP/IP/UDP Checksum Offload (configurable) Protocol Offload (ARP & NS) Large send offload and Giant send offload Receiving Side Scaling Jumbo Frame 9K
Power consumption	Cable Disconnetion: 25mW 100Mbps Full Run: 450mW 1000bp Full Run: 1000mW WoL Enable(S3/S4/S5): 50mW WoL Disable(S3/S4/S5): 25mW
Power Management	ACPI compliant – multiple power modes Situation-sensitive features reduce power consumption Advanced link down power saving for reducing link down power consumption
Management Interface	Auto MDI/MDIX Crossover cable detection
IT 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

Technical Specifications

Security & Manageability	Intel® vPro™ support with appropriate Intel® chipset components

Intel® 9560 802.11AC 2x2 with Bluetooth® M.2 Combo Card vPro™

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 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
Data Rates	• 802.11b: 1, 2, 5.5, 11 Mbps • 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps • 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps • 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz) • 802.11ac: MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, ,80MHz & 160MHz)
Modulation	Direct Sequence Spread Spectrum BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM
Security[1]	• IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only • AES-CCMP: 128 bit in hardware • 802.1x authentication • WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES. • WPA2 certification • IEEE 802.11i • Cisco Certified Extensions, all versions through CCX4 and CCX Lite • WAPI
Network Architecture	Ad-hoc (Peer to Peer)
Models	Infrastructure (Access Point Required)
Roaming	IEEE 802.11 compliant roaming between access points
Output Power[2]	• 802.11b: +18.5dBm minimum • 802.11g: +17.5dBm minimum • 802.11a: +18.5dBm minimum • 802.11n HT20(2.4GHz): +15.5dBm minimum • 802.11n HT40(2.4GHz): +14.5dBm minimum • 802.11n HT20(5GHz): +15.5dBm minimum • 802.11n HT40(5GHz): +14.5dBm minimum • 802.11ac VHT80(5GHz): +11.5dBm minimum • 802.11ac VHT160(5GHz): +11.5dBm minimum
Power Consumption	• Transmit mode2.0 W • Receive mode 1.6 W • Idle mode (PSP) 180 mW (WLAN Associated) • Idle mode 50 mW (WLAN unassociated) • Connected Standby 10mW • Radio disabled 8 mW
Power Management	ACPI and PCI Express compliant power management 802.11 compliant power saving mode
Receiver Sensitivity[3]	802.11b, 1Mbps : -93.5dBm maximum 802.11b, 11Mbps : -84dBm maximum 802.11a/g, 6Mbps : -86dBm maximum

	802.11a/g, 54Mbps : -72dBm maximum 802.11n, MCS07 : -67dBm maximum 802.11n, MCS15 : -64dBm maximum 802.11ac, MCS0 : -84dBm maximum 802.11ac, MCS9 : -59dBm 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).

HP Integrated Module with Bluetooth® 4.0/4.1/4.2/5.0 Wireless Technology

Bluetooth® Specification	4.0/4.1/4.2/5.0 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
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.
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)
Bluetooth® Software Supported Link Topology	Microsoft Windows Bluetooth® Software
Power Management	Microsoft Windows ACPI, and USB Bus Support
Certifications	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	BT4.1-ESR 5/6/7 Compliance LE Link Layer Ping LE Dual Mode LE Link Layer

	LE Low Duty Cycle Directed Advertising LE L2CAP Connection Oriented Channels Train Nudging & Interlaced Scan BT4.2 ESR08 Compliance LE Secure Connection- Basic/Full LE Privacy 1.2 –Link Layer Privacy LE Privacy 1.2 –Extended Scanner Filter Policies LE Data Packet Length Extension FAX Profile (FAX) Basic Imaging Profile (BIP)2 Headset Profile (HSP) Hands Free Profile (HFP) Advanced Audio Distribution Profile (A2DP)
Security & Manageability	Intel® vPro™ support with appropriate Intel® chipset components

Intel® 9560 802.11AC 2x2 with Bluetooth® M.2 Combo Card non-vPro™

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 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
Data Rates	• 802.11b: 1, 2, 5.5, 11 Mbps • 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps • 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps • 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz) • 802.11ac : MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, ,80MHz & 160MHz)
Modulation	Direct Sequence Spread Spectrum BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM
Security[1]	• IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only • AES-CCMP: 128 bit in hardware • 802.1x authentication • WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES. • WPA2 certification • IEEE 802.11i • Cisco Certified Extensions, all versions through CCX4 and CCX Lite • WAPI
Network Architecture	Ad-hoc (Peer to Peer)
Models	Infrastructure (Access Point Required)
Roaming	IEEE 802.11 compliant roaming between access points
Output Power[2]	• 802.11b : +18.5dBm minimum • 802.11g : +17.5dBm minimum • 802.11a : +18.5dBm minimum • 802.11n HT20(2.4GHz) : +15.5dBm minimum • 802.11n HT40(2.4GHz) : +14.5dBm minimum • 802.11n HT20(5GHz) : +15.5dBm minimum • 802.11n HT40(5GHz) : +14.5dBm minimum

	• 802.11ac VHT80(5GHz) : +11.5dBm minimum • 802.11ac VHT160(5GHz) : +11.5dBm minimum
Power Consumption	• Transmit mode2.0 W • Receive mode 1.6 W • Idle mode (PSP) 180 mW (WLAN Associated) • Idle mode 50 mW (WLAN unassociated) • Connected Standby 10mW • Radio disabled 8 mW
Power Management	ACPI and PCI Express compliant power management 802.11 compliant power saving mode
Receiver Sensitivity[3]	802.11b, 1Mbps : -93.5dBm maximum 802.11b, 11Mbps : -84dBm maximum 802.11a/g, 6Mbps : -86dBm maximum 802.11a/g, 54Mbps : -72dBm maximum 802.11n, MCS07 : -67dBm maximum 802.11n, MCS15 : -64dBm maximum 802.11ac, MCS0 : -84dBm maximum 802.11ac, MCS9 : -59dBm 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).

HP Integrated Module with Bluetooth® 4.0/4.1/4.2/5.0 Wireless Technology

Bluetooth® Specification	4.0/4.1/4.2/5.0 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
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.
Power Consumption	Peak (Tx) 330 mW Peak (Rx) 230 mW Selective Suspend 17 mW

Technical Specifications

Range	Legacy Up to 33 ft (10 m) BLE Up to 99 ft (30 m)
Bluetooth® Software Supported	Microsoft Windows Bluetooth® Software
Link Topology	
Power Management	Microsoft Windows ACPI, and USB Bus Support
Certifications	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	BT4.1-ESR 5/6/7 Compliance LE Link Layer Ping LE Dual Mode LE Link Layer LE Low Duty Cycle Directed Advertising LE L2CAP Connection Oriented Channels Train Nudging & Interlaced Scan BT4.2 ESR08 Compliance LE Secure Connection- Basic/Full LE Privacy 1.2 –Link Layer Privacy LE Privacy 1.2 –Extended Scanner Filter Policies LE Data Packet Length Extension FAX Profile (FAX) Basic Imaging Profile (BIP)2 Headset Profile (HSP) Hands Free Profile (HFP) Advanced Audio Distribution Profile (A2DP)

Realtek RTL8822BE 802.11ac 2x2 with Bluetooth® M.2 Combo Card

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 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
Data Rates	• 802.11b: 1, 2, 5.5, 11 Mbps • 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps • 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps • 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz) • 802.11ac : MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, ,80MHz & 160MHz)
Modulation	Direct Sequence Spread Spectrum BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM
Security[1]	• IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only • AES-CCMP: 128 bit in hardware • 802.1x authentication • WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES. • WPA2 certification

	• IEEE 802.11i • Cisco Certified Extensions, all versions through CCX4 and CCX Lite • WAPI
Network Architecture	Ad-hoc (Peer to Peer)
Models	Infrastructure (Access Point Required)
Roaming	IEEE 802.11 compliant roaming between access points
Output Power[2]	• 802.11b: +14dBm minimum • 802.11g: +12dBm minimum • 802.11a: +12dBm minimum • 802.11n HT20(2.4GHz): +12dBm minimum • 802.11n HT40(2.4GHz): +12dBm minimum • 802.11n HT20(5GHz): +10dBm minimum • 802.11n HT40(5GHz): +10dBm minimum • 802.11ac VHT80(5GHz): +10dBm minimum
Power Consumption	• Transmit mode2.0 W • Receive mode 1.6 W • Idle mode (PSP) 180 mW (WLAN Associated) • Idle mode 50 mW (WLAN unassociated) • Connected Standby 10mW • Radio disabled 8 mW
Power Management	ACPI and PCI Express compliant power management 802.11 compliant power saving mode
Receiver Sensitivity[3]	802.11b, 1Mbps: -93.5dBm maximum 802.11b, 11Mbps: -84dBm maximum 802.11a/g, 6Mbps: -86dBm maximum 802.11a/g, 54Mbps: -72dBm maximum 802.11n, MCS07: -67dBm maximum 802.11n, MCS15: -64dBm maximum 802.11ac, MCS0: -84dBm maximum 802.11ac, MCS9: -59dBm 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
Weight	Type 2230 : 2.8g
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).

HP Integrated Module with Bluetooth® 4.0/4.1/4.2 Wireless Technology

Bluetooth® Specification	4.0/4.1/4.2 Compliant
Frequency Band	2402 to 2480 MHz
Number of Available Channels	Legacy : 0~79 (1 MHz/CH) BLE : 0~39 (2 MHz/CH)
Data Rates and Throughput	Legacy : 3 Mbps data rate; throughput up to 2.17 Mbps

	BLE : 1 Mbps data rate; throughput up to 0.2 Mbps Legacy : Synchronous Connection Oriented links up to 3, 64 kbps, voice channels Legacy : Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric (3-DH5) or 864 kbps symmetric (3-EV5)
Transmit Power	The Bluetooth® component shall operate as a Class II Bluetooth® device with a maximum transmit power of +4 dBm for BR and EDR.
Power Consumption	Peak (Tx) 330 mW Peak (Rx) 230 mW Selective Suspend 17 mW
Electrical Interface	USB 2.0 compliant
Bluetooth® Software Supported Link Topology	Microsoft Windows Bluetooth® Software
Power Management	Microsoft Windows ACPI, and USB Bus Support
Certifications	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	BT4.1-ESR 5/6/7 Compliance LE Link Layer Ping LE Dual Mode LE Link Layer LE Low Duty Cycle Directed Advertising LE L2CAP Connection Oriented Channels Train Nudging & Interlaced Scan BT4.2 ESR08 Compliance LE Secure Connection- Basic/Full LE Privacy 1.2 –Link Layer Privacy LE Privacy 1.2 –Extended Scanner Filter Policies LE Data Packet Length Extension FAX Profile (FAX) Basic Imaging Profile (BIP)2 Headset Profile (HSP) Hands Free Profile (HFP) Advanced Audio Distribution Profile (A2DP)

Realtek RTL8821CE 802.11ac 1x1 with Bluetooth® M.2 Combo Card

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 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
Data Rates	• 802.11b: 1, 2, 5.5, 11 Mbps • 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps • 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps

	• 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz) • 802.11ac : MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, and 80MHz)
Modulation	Direct Sequence Spread Spectrum BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM
Security[1]	• IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only • AES-CCMP: 128 bit in hardware • 802.1x authentication • WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES. • WPA2 certification • IEEE 802.11i • Cisco Certified Extensions, all versions through CCX4 and CCX Lite • WAPI
Network Architecture	Ad-hoc (Peer to Peer)
Models	Infrastructure (Access Point Required)
Roaming	IEEE 802.11 compliant roaming between access points
Output Power[2]	• 802.11b : +14dBm minimum • 802.11g : +12dBm minimum • 802.11a : +12dBm minimum • 802.11n HT20(2.4GHz) : +12dBm minimum • 802.11n HT40(2.4GHz) : +12dBm minimum • 802.11n HT20(5GHz) : +10dBm minimum • 802.11n HT40(5GHz) : +10dBm minimum • 802.11ac VHT80(5GHz) : +10dBm minimum
Power Consumption	• Transmit mode2.0 W • Receive mode 1.6 W • Idle mode (PSP) 180 mW (WLAN Associated) • Idle mode 50 mW (WLAN unassociated) • Connected Standby 10mW • Radio disabled 8 mW
Power Management	ACPI and PCI Express compliant power management 802.11 compliant power saving mode
Receiver Sensitivity[3]	802.11b, 1Mbps : -93.5dBm maximum 802.11b, 11Mbps : -84dBm maximum 802.11a/g, 6Mbps : -86dBm maximum 802.11a/g, 54Mbps : -72dBm maximum 802.11n, MCS07 : -67dBm maximum 802.11n, MCS15 : -64dBm maximum 802.11ac, MCS0 : -84dBm maximum 802.11ac, MCS9 : -59dBm maximum
Antenna type	High efficiency antenna. One embedded dual band 2.4/5 GHz antenna is provided to the card to support WLAN communications and Bluetooth communications
Form Factor	PCI-Express M.2 MiniCard
Dimensions	Type 2230 : 2.3 x 22.0 x 30.0 mm
Weight	Type 2230 : 2.8g
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)
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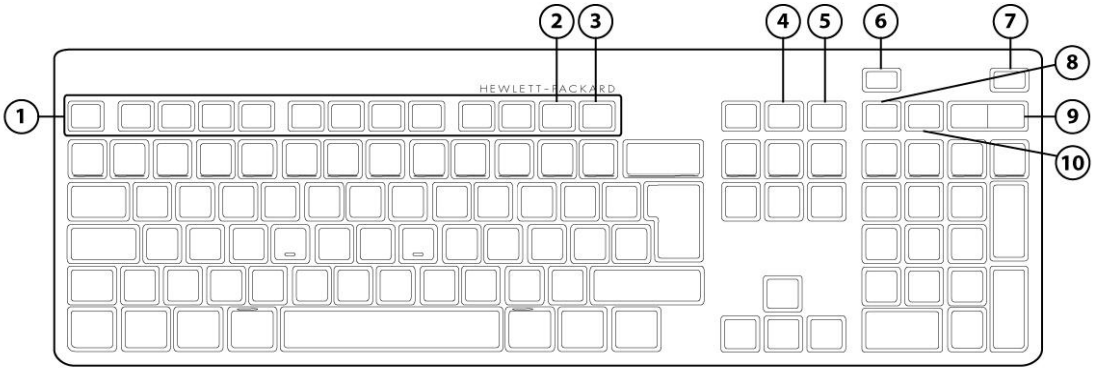
Electrical Interface	USB 2.0 compliant
Bluetooth® Software Supported	Microsoft Windows Bluetooth® Software
Link Topology	
Power Management	Microsoft Windows ACPI, and USB Bus Support
Certifications	ETS 300 328, ETS 300 826 Low Voltage Directive IEC950 UL, CSA, and CE Mark
Bluetooth Profiles Supported	BT4.1-ESR 5/6/7 Compliance LE Link Layer Ping LE Dual Mode LE Link Layer LE Low Duty Cycle Directed Advertising LE L2CAP Connection Oriented Channels Train Nudging & Interlaced Scan BT4.2 ESR08 Compliance LE Secure Connection- Basic/Full LE Privacy 1.2 –Link Layer Privacy LE Privacy 1.2 –Extended Scanner Filter Policies LE Data Packet Length Extension FAX Profile (FAX) Basic Imaging Profile (BIP)2 Headset Profile (HSP) Hands Free Profile (HFP) Advanced Audio Distribution Profile (A2DP)

I/O DEVICES

HP Conferencing Keyboard



1. Function Keys
2. F11 Lync or Skype for Business Contact list[1]
3. F12 Lync or Skype for Business Calendar[2]
4. Share Screen
5. Stop Webcam
6. End/Decline a Call
7. Answer a Call
8. Microphone Mute
9. Volume Up/Down
10. Audio Mute

[1]Microsoft Lync 2013, or Skype for Business, or Microsoft Outlook 2013 Contact list
[2]Microsoft Lync 2013, or Skype for Business, or Microsoft Outlook 2013 Calendar

HP USB Premium Keyboard

Physical Characteristics	Keys	104, 105 layout (depending upon country)
	Dimensions (L x W x H)	17.04 x 5.55 x 0.52 in (433 x 141 x13.2 mm)
	Weight	1.54 lb (698g)
Electrical	Operating voltage	5 VDC, +/-5%
	Power consumption	35mA (All LED on)
	System interface	USB Type A plug connector
	ESD	Contact Discharge: 8 KV Air Discharge: 15 KV
	EMI - RFI	Conforms to FCC rules for a Class B computing device
	Microsoft® PC 99 - 2001	Functionally compliant
Mechanical	Keycaps	Low-profile design
	Switch actuation	60±10g nominal peak force with tactile feedback
	Switch life	10 million keystrokes (Life tester)
	Switch type	Contamination-resistant switch membrane
	Key-leveling mechanisms	For all double-wide and greater-length keys
	Cable length	6 ft (1.8 m)
	Microsoft PC 99 - 2001	Mechanically compliant

Environmental	Acoustics	43-dBA maximum sound pressure level
	Operating temperature	50° to 122° F (10° to 50° C)
	Non-operating temperature	-22° to 140° F (-30° to 60° C)
	Operating humidity	10% to 90% (non-condensing at ambient)
	Non-operating humidity	20% to 80% (non-condensing at ambient)
	Operating shock	40 g, six surfaces
	Non-operating shock	80 g, six surfaces
	Operating vibration	2-g peak acceleration
	Non-operating vibration	4-g peak acceleration
	Drop (out of box)	26 in (66 cm) on carpet, six-drop sequence
	Drop (in box)	30 in (76.2 cm) on concrete, 16-drop sequence
Approvals	UL, FCC, CE Mark, TUV GS, VCCI, BSMI, C-Tick, KC	
Ergonomic compliance	TUVGS	
Kit contents	Keyboard, QSP	
Warranty Card	Product Notice	

Skylab USB Wired Keyboard

Physical Characteristics	Keys	104, 105, 106, 107, 109 layout (depending upon country)
	Dimensions (L x W x H)	171.97 x 68.35 x 8.27 in (436.8± 1.5 x 137.6± 1.0 x 21.0± 1.0 cm)
	Weight	1.32 lb (0.6± 0.08 kg)
Electrical	Operating voltage	4.4-5.25VDC
	Power consumption	50-mA maximum (with 5 VDC power supplied and three LEDs ON)
	System interface	USB
	ESD	Contact Discharge: 2, 4,6,8KV Air Discharge: 2, 4, 8,10,12.5KV
	EMI - RFI	Conforms to FCC rules for a Class B computing device
Mechanical	Keycaps	Low-profile design
	Switch actuation	60±10g nominal peak force with tactile feedback
	Switch life	10 million keystrokes (Life tester)
	Switch type	Contamination-resistant switch membrane
	Key-leveling mechanisms	For all double-wide and greater-length keys
	Cable length	6 ft (1.8 m)
	Microsoft PC 99 - 2001	Mechanically compliant
Environmental	Acoustics	43-dBA maximum sound pressure level

	Operating temperature	50° to 122° F (10° to 50° C)
	Non-operating temperature	Minus 30 degress to 60 degress Celsius
	Operating humidity	10% to 90% (non-condensing at ambient)
	Non-operating humidity	20% to 80% (non-condensing at ambient)
	Operating shock	40 g, six surfaces
	Non-operating shock	80 g, six surfaces
	Operating vibration	2-g peak acceleration
	Non-operating vibration	4-g peak acceleration
	Drop (out of box)	26 in (66 cm) on carpet, six-drop sequence
	Drop (in box)	30 in (76.2 cm) on concrete, 16-drop sequence
Approvals	UL, FCC, CE Mark, TUV GS, VCCI, BSMI, C-Tick, KC	
Ergonomic compliance	ANSI HFS 100, ISO 9241-4, and TUVGS	
Kit contents	Keyboard, Installation Guide, Warranty card, Safety and Comfort Guide	

HP USB Premium Mouse

Dimensions (H x L x W)	4.21 x 2.64 x 1.52 in (107 x 67 x 38.7 mmm)	
Weight	0.19lb (90g)	
Environmental	Operating temperature	50° to 122°F (10° to 50° C)
	Non-operating temperature	-22° to 140°F (-30° to 60° C)
	Operating humidity	10% to 90% (non-condensing at ambient)
	Non-operating humidity	20% to 80% (non-condensing at ambient)
	Operating shock	50 g, 6 surfaces
	Non-operating shock	80 g, 6 surfaces
	Operating vibration	2 g peak acceleration
	Non-operating vibration	4 g peak acceleration
Electrical	Operating voltage	5 VDC, +/-5%
	Power consumption	12mA
Mechanical	Connector	USB 2.0
	Type	3D mouse (3 keys and wheel)
	Resolution	800, 1200, 1600 DPI
	Sensor	Pixart PAN3606DL
Tracking speed	Tracking acceleration	8G(max), 1G=9.8m/s2
	Cable length	6 ft (1.8 m)
	Color	Jack Black
Regulatory approvals	Compliant	UL, FCC, CE Mark, TUV GS, VCCI, BSMI, C-Tick, KC

HP USB Mouse

Dimensions (H x L x W)	37mm*115mm*62.9mm

Weight	90 +10g/- 5 g	
Color	Black	
Connector	USB	
Mechanical	Resolution	800 DPI sensitivity
	Buttons	Two primary buttons and clickable scroll wheel

AUDIO/MULTIMEDIA

Type	Integrated
HD Stereo Codec	Conexant CX20632
Audio I/O Ports	Front: 1 - Headset connector supports a CTIA style headset and is re-taskable as a Line-in, Line-out, Microphone-in or Headphone-out port 1 - Headphone port Rear: Line-out Line-in which is retaskable as a Microphone Input All ports are 3.5mm and support stereo
Internal Speaker Amplifier	2W class D mono amplifier for the internal speaker only. External speakers must be powered
Multi-streaming Capable	Playback multi-streaming can be enabled in the audio control panel to allow independent audio streams to be sent to/from the front and rear jacks or integrated speaker.
Sampling	Independent sampling rates for DAC's and ADC's; supports resolutions from 16 to 24-bit; 44.1 kHz to 192 kHz for DAC and 44.1 kHz to 96 kHz for ADC
Wavetable Syntheses	Yes - Uses OS soft wavetable
Analog Audio	Yes
# of Channels on Line-Out	Stereo (Left & Right channels)
Internal Speaker	Yes

POWER

Unit Environment and Operating Conditions

Temperature Range	Operating : 5°C ~45°C Non-Operating : -40°C ~66°C
Relative Humidity	Operating 5% to 90% relative humidity at max inlet temperature Non Operating 5% to 90% relative humidity at max inlet temperature
Maximum Altitude (unpressurized)	Operating: 5000m Non-operating: 50,000 ft (15240 m)

80 PLUS Gold	500W active PFC / 80 PLUS Gold 87/90/87% efficient at 20/50/100% load (115V)
80 PLUS Platinum	250W active PFC / 80 PLUS Platinum 90/92/89% efficient at 20/50/100% load (115V) 91/93/90% efficient at 20/50/100% load (230V)
Operating Voltage Range	90Vac~264Vac
Rated Voltage Range	100Vac~240Vac
Rated Line Frequency	50HZ~60HZ
Operating Line Frequency	47HZ~63HZ
Rated Input Current	500W ≦ 6A 250W≦ 3A
Rated Input Current with Energy Efficient* Power Supply	500W ≦ 6A 250W ≦ 3A
DC Output	+12V
Current Leakage (NFPA 99: 2102)	Less than 500 microamps of leakage current at 120 Vac with the ground wire disconnected, as required for Non-patient Electrical Appliances and Equipment used in a patient care facility or that contact patients in normal use. Per section 10.3.5.1. Less than 100 microamps of leakage current at 120 Vac with the ground wire intact with normal polarity, as required for Non-patient Electrical Appliances and Equipment used in a patient care facility or that contact patients in normal use. Per section 10.3.5.1.
Power Supply Fan	70mm variable speed
Power cord length	6.0 ft. (1.83 m)
External Power Adapter	Internal power supply
Dimensions	165mm x 95mm x 73mm
Total Cord Length	6.0 ft. (1.83 m)

WEIGHTS & DIMENSIONS

Chassis (W x D x H)	6.1 x 14.6 x 14.4 in 154 x 370 x 365 mm
System Volume	1269 cu in 20.8 L
System Weight	21.74 lb 9.86 kg
Max Supported Weight (desktop orientation)	77 lb 35 kg
Packaging (W x D x H)	11.77 x 18.82 x 20.35 in 299 x 478 x 517 mm
Shipping Weight	24.98 lb 11.34 kg
Palletization Profile	8 units per layer 4 layers ax 32 units per pallet 1200*1000*2203 mm (include the pallet)

Technical Specifications – Miscellaneous Features

MISCELLANEOUS FEATURES

Management Features

- Advanced Configuration and Power Management Interface (ACPI). Allows the system to wake from a low power mode. Controls system power consumption, making it possible to place individual cards and peripherals in a low-power or powered-off state without affecting other elements of the system.
- Intel® Wired for Management support; industry wide initiative to make Intel® architecture based PCs, servers and mobile computers more inherently manageable out-of-the-box and over the network
- Dual State Power Button; acts as both an on/off button and a suspend-to-sleep button

Serviceability Features

- Dual colored power LED on front of computer to indicate either normal or fault condition
- Diagnostic LED Explanation Table:
  - Power LED will blink red 2 to 5 times, then blink white 2 or more times, then repeat (with beep tones for each blink initially):
    - 2 red + 2 white User must provide file for BIOS recovery (USB storage typically)
    - 2 red + 3 white User must enter a key sequence to proceed with recovery by policy
    - 2 red + 4 white BIOS recovery is in progress
    - 3 red + 2 white Memory could not be initialized
    - 3 red + 3 white Graphics adaptor could not be found
    - 3 red + 4 white Power supply failure / not connected
    - 3 red + 5 white Processor not installed
    - 3 red + 6 white Current processor does not support an enabled feature
    - 4 red + 2 white Processor has exceeded its temperature threshold / system thermal shutdown
    - 4 red + 3 white System internal temperature has exceeded its threshold
    - 5 red + 2 white System controller firmware is not valid
    - 5 red + 3 white System controller detected BIOS is not executing
    - 5 red + 4 white BIOS could not complete initialization / PCA failure
    - 5 red + 5 white System controller rebooted the system after a health or recovery timer triggered
- HP PC Hardware Diagnostics UEFI:
  - This utility enables hardware level testing outside the operating system on many components. The diagnostics can be invoked by pressing F2 at POST, and is available as a download from HP Support
- System/Emergency ROM
- Flash ROM
- CMOS Battery Holder for easy replacement
- Flash Recovery with Video Configuration Record Software5 Aux Power LED on System PCA
- Processor ZIF Socket for easy Upgrade
- Over-Temp Warning on Screen (Requires IM Agents)
- Clear Password Jumper
- DIMM Connectors for easy Upgrade
- Clear CMOS Button
- NIC LEDs (integrated) (Green & Amber)
- Dual Color Power and HD LED - To Indicate Normal Operations and Fault Conditions
- Color coordinated cables and connectors
- Tool-less Hood Removal
- Front power switch
- System memory can be upgraded without removing the system board or any internal components
- Green Pull Tabs, and Quick Release Latches for easy Identification

Technical Specifications – Miscellaneous Features

Additional Features	Description
Tower Orientation	Product can be oriented as either a desktop (horizontal) or tower (vertical)
Drive Lock	Implementation of the industry standard ATA Security feature set. When enabled, it prevents software access to user data on the drive until one or two user-defined passwords are provided.
Boot Sectors Protection	MBR and GPT sectors of the hard drive are critical to booting the operating system. By saving the MBR or GPT data (depending on the how the OS was installed), the BIOS will be able to monitor for changes and allow the user to override them with the backup copy at boot-up.
Drive Protection System	DPS Access through F10 Setup during Boot A diagnostic hard drive self- test. It scans critical physical components and every sector of the hard drive for physical faults and then reports any faults to the user Running independently of the operating system, it can be accessed through a Windows-based diagnostics utility or through the computer's setup procedure. It produces an evaluation on whether the hard drive is the source of the problem and needs to be replaced The system expands on the Self-Monitoring, Analysis, and Reporting Technology (SMART), a continuously running systems diagnostic that alerts the user to certain types of failures
SMART Technology (Self-Monitoring, Analysis and Reporting Technology)	Allows hard drives to monitor their own health and to raise flags if imminent failures were predicted
SMART I - Drive Failure Prediction	Predicts failures before they occur. Tracks fault prediction and failure indication parameters such as re-allocated sector count, spin retry count, calibration retry count
SMART II - Off-Line Data Collection	By avoiding actual hard drive failures, SMART hard drives act as "insurance" against unplanned user downtime and potential data loss from hard drive failure
SMART III - Off-Line Read Scanning with Defect Reallocation	IOEDC: I/O Error Detection Circuitry
SMART IV - End-to-End CRC for hard drives	Detects erro rs in Read/Write buffers on HDD cache RAM

AFTER MARKET OPTIONS

Graphics Solutions

	Part Number
AMD Radeon RX 550 4GB 2DP Card	3TK71AA
AMD Radeon R7 430 2GB 2DP Card	3MQ82AA
HP DisplayPort To HDMI True 4k Adapter	2JA63AA
HP DVI Cable Kit	DC198A
HP HDMI Standard Cable Kit	T6F94AA
HP DisplayPort Cable Kit	VN567AA
HP DisplayPort To VGA Adapter	AS615AA
HP DisplayPort To DVI-D Adapter	FH973AA

Data Storage Drives

	Part Number
HP 256GB SATA TLC Non-SED Solid State Drive	P1N68AA
HP PCIe NVME TLC 256GB SSD M.2 Drive	1CA51AA
HP PCIe NVME TLC 512GB SSD M.2 Drive	X8U75AA
HP PCIe NVME TLC 512GB SSD PCIe Drive	Z4L70AA
HP 500GB 7200PRM SATA 6.0Gb/s 3.5” Hard Drive	QK554AA
HP 1TB 7200rpm SATA 6Gb/s 3.5” Hard Drive	QK555AA
HP SATA SuperMulti JB Drive	QS208AA
HP 9.5mm Slim Removable SATA 500GB	T7G14AA

Input Devices

	Part Number
HP USB (Grey) SmartCard CCID Keyboard	J7H70AA
HP USB Antimicrobial Business Slim Keyboard and Mouse (China Only)	Z9H50AA
HP USB Buisness Slim CCID SmartCard Keyboard	Z9H48AA
HP USB Business Slim (Grey) Keyboard (EMEA Only)	Z9H49AA
HP USB Business Slim Keyboard	N3R87AA
HP USB Business Slim Keyboard and Mouse and Mousepad	T4E63AA
HP USB Collaboration Keyboard	Z9N38AA
HP USB Keyboard	QY776AA
HP USB Keyboard and Mouse Healthcare Edition	1VD81AA
HP USB Premium Keyboard	Z9N40AA
HP USB PS/2 Washable Keyboard & Mouse	BU207AA
HP Wireless Business Slim Keyboard and Mouse	N3R88AA
HP Wireless Collaboration Keyboard	Z9N39AA
HP Wireless Premium Keyboard	Z9N41AA
HP PS/2 Business Slim Keyboard	N3R86AA
HP USB Grey v2 Mouse (EMEA only)	Z9H74AA
HP USB Premium Mouse	1JR32AA
HP PS/2 Mouse	QY775AA
HP USB 1000dpi Laser Mouse	QY778AA
HP USB Hardened Mouse	P1N77AA

Technical Specifications – After Market Options

HP USB Mouse	QY777AA

System Memory	Part Number
HP 4GB DDR4-2666 DIMM	3TK85AA
HP 8GB DDR4-2666 DIMM	3TK87AA
HP 16GB DDR4-2666 DIMM	3TK83AA

Multimedia Devices	Part Number
HP Business Headset v2	T4E61AA
HP USB Business Speakers v2	N3R89AA

Security Devices	Part Number
HP Solenoid Lock & Hood Sensor (MT)	J6L42AA
HP Business PC Security Lock v3 Kit	3XJ17AA
HP Dual Head Keyed Cable Lock	T1A64AA
HP Keyed Cable Lock 10mm	T1A62AA
HP Master Keyed Cable Lock 10mm	T1A63AA

I/O Devices	Part Number
HP DisplayPort™ Port Flex IO	3TK72AA
HP HDMI Port Flex IO (400/600/800)	3TK74AA
HP Thunderbolt™ 3.0 PCIe Card	4CX35AA
HP Type-C™ USB 3.1 Gen2 Port Flex IO	3TK78AA
HP VGA Port Flex IO	3TK80AA
HP Internal Serial Port (600/705/800)	3TK82AA
HP PCIe x1 Parallel Port Card	N1M40AA
HP 800/600/400 G4 Serial/ PS/2 Adapter	1VD82AA

Communication Devices	Part Number
Intel® 9260 802.11ac non-vPro PCIe x1 Card	3TK89AA
Realtek 8822BE 802.11ac PCIe x1 Card	3TK90AA

Intel® Optane Memory	Part Number
Intel® Optane Memory 16GB (Cache)	1WV97AA

Change Log

Date	Version History	Action	Description of Change
June 12, 2019	From v1 to v2	Added	NVIDIA GeForce RTX 2070 8GB and NVIDIA GeForce RTX 2080 8GB Graphics Cards
October 1, 2019	From v2 to v3	Added	Intel AX200 802.11 a/b/g/n/ac/ax(WiFi 6) WLAN + Bluetooth 5 PCIe NIC to NETWORKING/COMMUNICATIONS section
		Changed	Graphics section
October 2, 2019	From v3 to v4	Removed	NVIDIA GeForce RTX 2060 Graphics Card
November 1, 2019	From v4 to v5	Changed	Memory section
January 16, 2020	From v5 to v6	Changed	Graphics section
February 20, 2020	From v6 to v7	Changed	Format page 1