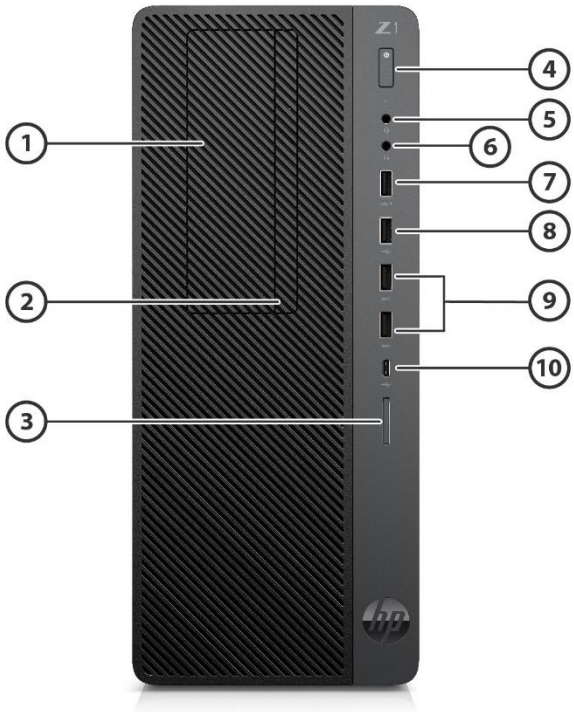
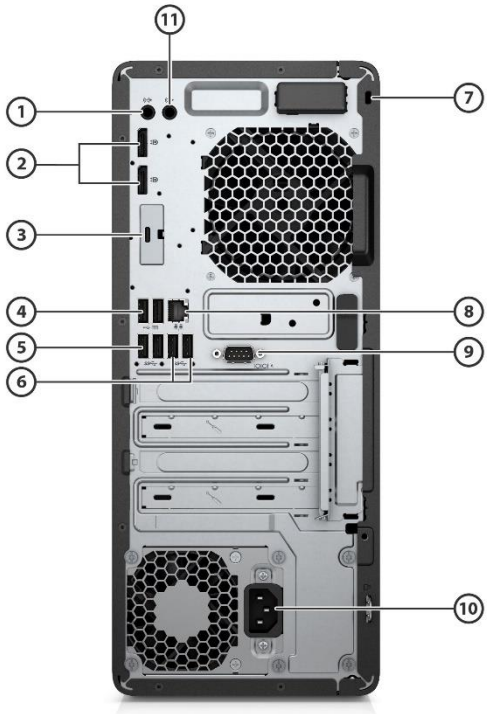
Overview

## 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 HDMI 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]<br>Windows® 10 Pro 64 (National Academic License)[2]<br>Windows® 10 Home 64[1]<br>Windows® 10 Home Single Language 64[1]<br>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);<br>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)<br>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),<br>1 Universal Audio Jack with CTIA headset support (front));<br>1 Audio-out (rear),<br>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)<br>(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]<br>Non-operating: -22° to 140° F (-30° to 60° C) |
| Relative Humidity | Operating: 10% to 90% (non-condensing at ambient)<br>Non-operating: 5% to 95% (non-condensing at ambient) |
| Maximum Altitude (unpressurized) | Operating: 5000m<br>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:<br>• IT ECO declaration<br>• US ENERGY STAR®<br>• EPEAT®2019 Gold registered in the United States*<br><br>*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:<br><br>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<br><br>Batteries used in the product do not contain:<br>Mercury greater the1ppm by weight<br>Cadmium greater than 20ppm by weight<br><br>Battery size: CR2032 (coin cell)<br>Battery type: Lithium | | |
| **Additional Information** | • This product is in compliance with the Restrictions of Hazardous Substances (RoHS) directive - 2011/65/EC.<br>• This HP product is designed to comply with the Waste Electrical and Electronic Equipment (WEEE) Directive – 2002/96/EC.<br>• This product is in compliance with California Proposition 65 (State of California; Safe Drinking Water and Toxic Enforcement Act of 1986).<br>• 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<br>• Plastics parts weighing over 25 grams used in the product are marked per ISO11469 and ISO1043.<br>• This product contains 0% post-consumer recycled plastic (by wt.)<br>• 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):<br>• Asbestos<br>• Certain Azo Colorants<br>• Certain Brominated Flame Retardants – may not be used as flame retardants in plastics<br>• Cadmium<br>• Chlorinated Hydrocarbons<br>• Chlorinated Paraffins<br>• Formaldehyde<br>• Halogenated Diphenyl Methanes<br>• Lead carbonates and sulfates<br>• Lead and Lead compounds<br>• Mercuric Oxide Batteries<br>• Nickel – finishes must not be used on the external surface designed to be frequently handled or carried by the user.<br>• Ozone Depleting Substances<br>• Polybrominated Biphenyls (PBBs)<br>• Polybrominated Biphenyl Ethers (PBBEs)<br>• Polybrominated Biphenyl Oxides (PBBOs)<br>• Polychlorinated Biphenyl (PCB)<br>• Polychlorinated Terphenyls (PCT)<br>• Polyvinyl Chloride (PVC) – except for wires and cables, and certain retail packaging has been voluntarily removed from most applications.<br>• Radioactive Substances<br>• 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:<br>• Eliminate the use of heavy metals such as lead, chromium, mercury and cadmium in packaging materials.<br>• Eliminate the use of ozone-depleting substances (ODS) in packaging materials.<br>• Design packaging materials for ease of disassembly.<br>• Maximize the use of post-consumer recycled content materials in packaging materials.<br>• Use readily recyclable packaging materials such as paper and corrugated materials.<br>• Reduce size and weight of packages to improve transportation fuel efficiency.<br>• 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.<br><br>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.<br>Global Citizenship Report<br>http://www.hp.com/hpinfo/globalcitizenship/gcreport/index.html<br>Eco-label certifications<br>http://www8.hp.com/us/en/hp-information/environment/ecolabels.html<br>ISO 14001 certificates:<br>http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/PC_GBU_Product_Design_ISO_14K_Certificate.pdf<br>and<br>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<br>Supports HDCP 2.2<br>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<br>VP9 10b Dec HW<br>HDR<br>Rec. 2020<br>DX12 |
| **34" UHD Supported Resolutions and Refresh Rates. Other resolutions may also work.** | 640x480 60 Hz640x480 67Hz<br>640x480 72Hz<br>640x480 75Hz<br>720x400 70Hz<br>800x600 60Hz<br>800x600 75Hz<br>1024x768 60Hz<br>1024x768 75Hz<br>1280x960 60Hz<br>1280x720 60Hz<br>1280x1024 60Hz<br>1280x1024 75Hz<br>1440x900 60Hz<br>1440x900 75Hz<br>1680x1050 60Hz<br>1920x1080 60Hz<br>3440x1440 60Hz (Native Resolution)<br>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<br>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<br>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/<br>-RW/+R DL /-R DL Up to 8X<br>DVD-ROM Up to 8X<br>CD-ROM, CD-R Up to 24X<br>CD-RW Up to 24X |
| **Access time (typical reads, including settling)** | Random: DVD-ROM: 170 ms (typical), CD-ROM: 170 ms (typical)<br>Full stroke: DVD-ROM: 320 ms (typical), CD-ROM: 320 ms (typical) |
| **Power** | Source Slimline SATA DC power receptacle<br>DC Power Requirement 5 VDC ± 5%–100 mV ripple p-p<br>DC Current 5 VDC (< 1000 mA typical, 1600 mA maximum) |
| **Environmental conditions (operating - non-condensing)** | Temperature 41° to 122° F (5° to 50° C)<br>Relative Humidity 10% to 80%<br>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<br>DVD+R - Up to 8X<br>DVD+RW - Up to 8X<br>DVD+R DL - Up to 6X<br>DVD-R - Up to 8X<br>DVD-RW - Up to 6X<br>CD-R - Up to 24X<br>CD-RW - Up to 10X<br>DVD-RW, DVD+RW - Up to 8X<br>DVD-R DL, DVD+R DL - Up to 8X<br>DVD+R, DVD-R - Up to 8X<br>DVD-ROM DL, DVD-ROM - Up to 8X<br>CD-ROM, CD-R - Up to 24X<br>CD-RW - Up to 24X |
| **Access time (typical reads, including settling)** | Random DVD-ROM: 170 ms (typical), CD-ROM: 170 ms (typical)<br>Full Stroke DVD-ROM: 320 ms (typical), CD-ROM: 320 ms (typical)<br>Stop Time 6 seconds (typical) |
| **Power** | Source Slimline SATA DC power receptacle |

| | |
|---|---|
| | DC Power Requirement 5 VDC ± 5%-100 mV ripple p-p<br>DC Current 5 VDC (< 1000 mA typical, 1600 mA maximum) |
| **Environmental conditions (operating - non-condensing)** | Temperature 41° to 122° F (5° to 50° C)<br>Relative Humidity 10% to 80%<br>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<br>BD-RE Up to 2X<br>BD-R Up to 6X<br>BD-RE Up to 2X<br>DVD-R Up to 8X<br>DVD-RW Up to 6X<br>DVD+R Up to 8X<br>DVD+RW Up to 8X<br>DVD-RAM Up to 5X<br>CD-R Up to 24X<br>CD-RW Up to 10X |
| **Read Speeds** | BD-R Up to 6X<br>BD-RE Up to 4X<br>BD-ROM Up to 6X<br>BD-R Up to 6X<br>BD-RE Up to 6X<br>DVD-ROM Up to 8X<br>DVD-R Up to 8X<br>DVD-RW Up to 8X<br>DVD+R Up to 8X<br>DVD+RW Up to 8X<br>BDMV (AACS Compliant Disc)<br>Up to 6x/2x (Read/Play)<br>DVD-RAM Up to 5x<br>DVD-Video (CSS Compliant Disc)<br>Up to 8x/4x (Read/Play)<br>CD-R/RW/ROM Up to 24x<br>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)<br>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<br>DC Power Requirement 5 VDC ± 5%-100 mV ripple p-p<br>DC Current 5 VDC -1200 mA typical, 2000 mA maximum |
| **Environmental conditions (operating - non-condensing)** | Temperature 41° to 122° F (5° to 50° C)<br>Relative Humidity 10% to 80%<br>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)<br>100 Mbit/s operation (100BASE-TX; IEEE 802.3u; IEEE 802.3 clauses 21-30)<br>1000 Mbit/s operation (1000BASE-T; IEEE 802.3ab; IEEE 8023 clauses 40)<br>Auto-Negotiation (Automatic Speed Selection)<br>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<br>IEEE 802.1q VLAN support<br>IEEE 802.3x Flow Control (IEEE 802.3 clauses 31-32; configurable)<br>IEEE 802.3az EEE (Energy Efficient Ethernet) |
| **Performance** | TCP/IP/UDP Checksum Offload (configurable)<br>Protocol Offload (ARP & NS)<br>Large send offload and Giant send offload<br>Receiving Side Scaling<br>Jumbo Frame 9K |
| **Power consumption** | Cable Disconnetion: 25mW<br>100Mbps Full Run: 450mW<br>1000bp Full Run: 1000mW<br>WoL Enable(S3/S4/S5): 50mW<br>WoL Disable(S3/S4/S5): 25mW |
| **Power Management** | ACPI compliant – multiple power modes<br>Situation-sensitive features reduce power consumption<br>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)<br>PXE 2.1 Remote Boot<br>Statistics Gathering (SNMP MIB II, Ethernet-like MIB, Ethernet MIB (802.3x, clause 30))<br>Comprehensive diagnostic and configuration software suite<br>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<br>IEEE 802.11b<br>IEEE 802.11g<br>IEEE 802.11n<br>IEEE 802.11ac |
| **Interoperability** | Wi-Fi certified |
| **Frequency Band** | 802.11b/g/n<br>• 2.402 – 2.482 GHz<br>802.11a/n<br>• 4.9 – 4.95 GHz (Japan)<br>• 5.15 – 5.25 GHz<br>• 5.25 – 5.35 GHz<br>• 5.47 – 5.725 GHz<br>• 5.825 – 5.850 GHz |
| **Data Rates** | • 802.11b: 1, 2, 5.5, 11 Mbps<br>• 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps<br>• 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps<br>• 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)<br>• 802.11ac: MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, ,80MHz & 160MHz) |
| **Modulation** | Direct Sequence Spread Spectrum<br>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<br>• AES-CCMP: 128 bit in hardware<br>• 802.1x authentication<br>• WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES.<br>• WPA2 certification<br>• IEEE 802.11i<br>• Cisco Certified Extensions, all versions through CCX4 and CCX Lite<br>• 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<br>• 802.11g: +17.5dBm minimum<br>• 802.11a: +18.5dBm minimum<br>• 802.11n HT20(2.4GHz): +15.5dBm minimum<br>• 802.11n HT40(2.4GHz): +14.5dBm minimum<br>• 802.11n HT20(5GHz): +15.5dBm minimum<br>• 802.11n HT40(5GHz): +14.5dBm minimum<br>• 802.11ac VHT80(5GHz): +11.5dBm minimum<br>• 802.11ac VHT160(5GHz): +11.5dBm minimum |
| **Power Consumption** | • Transmit mode2.0 W<br>• Receive mode 1.6 W<br>• Idle mode (PSP) 180 mW (WLAN Associated)<br>• Idle mode 50 mW (WLAN unassociated)<br>• Connected Standby 10mW<br>• Radio disabled 8 mW |
| **Power Management** | ACPI and PCI Express compliant power management<br>802.11 compliant power saving mode |
| **Receiver Sensitivity**[3] | 802.11b, 1Mbps : -93.5dBm maximum<br>802.11b, 11Mbps : -84dBm maximum<br>802.11a/g, 6Mbps : -86dBm maximum |

| | |
|---|---|
| | 802.11a/g, 54Mbps : -72dBm maximum<br>802.11n, MCS07 : -67dBm maximum<br>802.11n, MCS15 : -64dBm maximum<br>802.11ac, MCS0 : -84dBm maximum<br>802.11ac, MCS9 : -59dBm maximum |
| **Antenna type** | High efficiency antenna with spatial diversity, mounted in the display enclosure<br><br>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<br>Or<br>Type 1630 : 2.3 x 16.0 x 30.0 mm |
| **Weight** | Type 2230 : 2.8g<br>Or<br>Type 1630 : 2g |
| **Operating Voltage** | 3.3v +/- 9% |
| **Temperature** | Operating 14° to 158° F (–10° to 70° C)<br>Non-operating –40° to 176° F (–40° to 80° C) |
| **Humidity** | Operating 10% to 90% (non-condensing)<br>Non-operating 5% to 95% (non-condensing) |
| **Altitude** | Operating 0 to 10,000 ft (3,048 m)<br>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)<br>BLE : 0~39 (2 MHz/CH) |
| **Data Rates and Throughput** | Legacy : 3 Mbps data rate; throughput up to 2.17 Mbps<br>BLE : 1 Mbps data rate; throughput up to 0.2 Mbps<br>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<br>Peak (Rx) 230 mW<br>Selective Suspend 17 mW |
| **Range** | Legacy Up to 33 ft (10 m)<br>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<br>ETS 300 328, ETS 300 826<br>Low Voltage Directive IEC950<br>UL, CSA, and CE Mark |
| **Bluetooth Profiles Supported** | BT4.1-ESR 5/6/7 Compliance<br>LE Link Layer Ping<br>LE Dual Mode<br>LE Link Layer |

| | |
|---|---|
| | LE Low Duty Cycle Directed Advertising<br>LE L2CAP Connection Oriented Channels<br>Train Nudging & Interlaced Scan<br>BT4.2 ESR08 Compliance<br>LE Secure Connection- Basic/Full<br>LE Privacy 1.2 –Link Layer Privacy<br>LE Privacy 1.2 –Extended Scanner Filter Policies<br>LE Data Packet Length Extension<br>FAX Profile (FAX)<br>Basic Imaging Profile (BIP)2<br>Headset Profile (HSP)<br>Hands Free Profile (HFP)<br>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<br>IEEE 802.11b<br>IEEE 802.11g<br>IEEE 802.11n<br>IEEE 802.11ac |
| **Interoperability** | Wi-Fi certified |
| **Frequency Band** | 802.11b/g/n<br>• 2.402 – 2.482 GHz<br>802.11a/n<br>• 4.9 – 4.95 GHz (Japan)<br>• 5.15 – 5.25 GHz<br>• 5.25 – 5.35 GHz<br>• 5.47 – 5.725 GHz<br>• 5.825 – 5.850 GHz |
| **Data Rates** | • 802.11b: 1, 2, 5.5, 11 Mbps<br>• 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps<br>• 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps<br>• 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)<br>• 802.11ac : MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, ,80MHz & 160MHz) |
| **Modulation** | Direct Sequence Spread Spectrum<br>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<br>• AES-CCMP: 128 bit in hardware<br>• 802.1x authentication<br>• WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES.<br>• WPA2 certification<br>• IEEE 802.11i<br>• Cisco Certified Extensions, all versions through CCX4 and CCX Lite<br>• 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<br>• 802.11g : +17.5dBm minimum<br>• 802.11a : +18.5dBm minimum<br>• 802.11n HT20(2.4GHz) : +15.5dBm minimum<br>• 802.11n HT40(2.4GHz) : +14.5dBm minimum<br>• 802.11n HT20(5GHz) : +15.5dBm minimum<br>• 802.11n HT40(5GHz) : +14.5dBm minimum |

| | |
|---|---|
| | • 802.11ac VHT80(5GHz) : +11.5dBm minimum<br>• 802.11ac VHT160(5GHz) : +11.5dBm minimum |
| **Power Consumption** | • Transmit mode2.0 W<br>• Receive mode 1.6 W<br>• Idle mode (PSP) 180 mW (WLAN Associated)<br>• Idle mode 50 mW (WLAN unassociated)<br>• Connected Standby 10mW<br>• Radio disabled 8 mW |
| **Power Management** | ACPI and PCI Express compliant power management<br>802.11 compliant power saving mode |
| **Receiver Sensitivity**[3] | 802.11b, 1Mbps : -93.5dBm maximum<br>802.11b, 11Mbps : -84dBm maximum<br>802.11a/g, 6Mbps : -86dBm maximum<br>802.11a/g, 54Mbps : -72dBm maximum<br>802.11n, MCS07 : -67dBm maximum<br>802.11n, MCS15 : -64dBm maximum<br>802.11ac, MCS0 : -84dBm maximum<br>802.11ac, MCS9 : -59dBm maximum |
| **Antenna type** | High efficiency antenna with spatial diversity, mounted in the display enclosure<br><br>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<br>Or<br>Type 1630 : 2.3 x 16.0 x 30.0 mm |
| **Weight** | Type 2230 : 2.8g<br>Or<br>Type 1630 : 2g |
| **Operating Voltage** | 3.3v +/- 9% |
| **Temperature** | Operating 14° to 158° F (–10° to 70° C)<br>Non-operating –40° to 176° F (–40° to 80° C) |
| **Humidity** | Operating 10% to 90% (non-condensing)<br>Non-operating 5% to 95% (non-condensing) |
| **Altitude** | Operating 0 to 10,000 ft (3,048 m)<br>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)<br>BLE : 0~39 (2 MHz/CH) |
| **Data Rates and Throughput** | Legacy : 3 Mbps data rate; throughput up to 2.17 Mbps<br>BLE : 1 Mbps data rate; throughput up to 0.2 Mbps<br>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<br>Peak (Rx) 230 mW<br>Selective Suspend 17 mW |

Technical Specifications

| | |
|---|---|
| **Range** | Legacy Up to 33 ft (10 m)<br>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<br>ETS 300 328, ETS 300 826<br>Low Voltage Directive IEC950<br>UL, CSA, and CE Mark |
| **Bluetooth Profiles Supported** | BT4.1-ESR 5/6/7 Compliance<br>LE Link Layer Ping<br>LE Dual Mode<br>LE Link Layer<br>LE Low Duty Cycle Directed Advertising<br>LE L2CAP Connection Oriented Channels<br>Train Nudging & Interlaced Scan<br>BT4.2 ESR08 Compliance<br>LE Secure Connection- Basic/Full<br>LE Privacy 1.2 –Link Layer Privacy<br>LE Privacy 1.2 –Extended Scanner Filter Policies<br>LE Data Packet Length Extension<br>FAX Profile (FAX)<br>Basic Imaging Profile (BIP)2<br>Headset Profile (HSP)<br>Hands Free Profile (HFP)<br>Advanced Audio Distribution Profile (A2DP) |

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

| | |
|---|---|
| **Wireless LAN Standards** | IEEE 802.11a<br>IEEE 802.11b<br>IEEE 802.11g<br>IEEE 802.11n<br>IEEE 802.11ac |
| **Interoperability** | Wi-Fi certified |
| **Frequency Band** | 802.11b/g/n<br>• 2.402 – 2.482 GHz<br>802.11a/n<br>• 4.9 – 4.95 GHz (Japan)<br>• 5.15 – 5.25 GHz<br>• 5.25 – 5.35 GHz<br>• 5.47 – 5.725 GHz<br>• 5.825 – 5.850 GHz |
| **Data Rates** | • 802.11b: 1, 2, 5.5, 11 Mbps<br>• 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps<br>• 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps<br>• 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)<br>• 802.11ac : MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, ,80MHz & 160MHz) |
| **Modulation** | Direct Sequence Spread Spectrum<br>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<br>• AES-CCMP: 128 bit in hardware<br>• 802.1x authentication<br>• WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES.<br>• WPA2 certification |

| | |
|---|---|
| | • IEEE 802.11i<br>• Cisco Certified Extensions, all versions through CCX4 and CCX Lite<br>• 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<br>• 802.11g: +12dBm minimum<br>• 802.11a: +12dBm minimum<br>• 802.11n HT20(2.4GHz): +12dBm minimum<br>• 802.11n HT40(2.4GHz): +12dBm minimum<br>• 802.11n HT20(5GHz): +10dBm minimum<br>• 802.11n HT40(5GHz): +10dBm minimum<br>• 802.11ac VHT80(5GHz): +10dBm minimum |
| **Power Consumption** | • Transmit mode2.0 W<br>• Receive mode 1.6 W<br>• Idle mode (PSP) 180 mW (WLAN Associated)<br>• Idle mode 50 mW (WLAN unassociated)<br>• Connected Standby 10mW<br>• Radio disabled 8 mW |
| **Power Management** | ACPI and PCI Express compliant power management<br>802.11 compliant power saving mode |
| **Receiver Sensitivity**[3] | 802.11b, 1Mbps: -93.5dBm maximum<br>802.11b, 11Mbps: -84dBm maximum<br>802.11a/g, 6Mbps: -86dBm maximum<br>802.11a/g, 54Mbps: -72dBm maximum<br>802.11n, MCS07: -67dBm maximum<br>802.11n, MCS15: -64dBm maximum<br>802.11ac, MCS0: -84dBm maximum<br>802.11ac, MCS9: -59dBm maximum |
| **Antenna type** | High efficiency antenna with spatial diversity, mounted in the display enclosure<br><br>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)<br>Non-operating –40° to 176° F (–40° to 80° C) |
| **Humidity** | Operating 10% to 90% (non-condensing)<br>Non-operating 5% to 95% (non-condensing) |
| **Altitude** | Operating 0 to 10,000 ft (3,048 m)<br>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)<br>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<br>Legacy : Synchronous Connection Oriented links up to 3, 64 kbps, voice channels<br>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<br>Peak (Rx) 230 mW<br>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<br>ETS 300 328, ETS 300 826<br>Low Voltage Directive IEC950<br>UL, CSA, and CE Mark |
| **Bluetooth Profiles Supported** | BT4.1-ESR 5/6/7 Compliance<br>LE Link Layer Ping<br>LE Dual Mode<br>LE Link Layer<br>LE Low Duty Cycle Directed Advertising<br>LE L2CAP Connection Oriented Channels<br>Train Nudging & Interlaced Scan<br>BT4.2 ESR08 Compliance<br>LE Secure Connection- Basic/Full<br>LE Privacy 1.2 –Link Layer Privacy<br>LE Privacy 1.2 –Extended Scanner Filter Policies<br>LE Data Packet Length Extension<br>FAX Profile (FAX)<br>Basic Imaging Profile (BIP)2<br>Headset Profile (HSP)<br>Hands Free Profile (HFP)<br>Advanced Audio Distribution Profile (A2DP) |

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

| | |
|---|---|
| **Wireless LAN Standards** | IEEE 802.11a<br>IEEE 802.11b<br>IEEE 802.11g<br>IEEE 802.11n<br>IEEE 802.11ac |
| **Interoperability** | Wi-Fi certified |
| **Frequency Band** | 802.11b/g/n<br>• 2.402 – 2.482 GHz<br>802.11a/n<br>• 4.9 – 4.95 GHz (Japan)<br>• 5.15 – 5.25 GHz<br>• 5.25 – 5.35 GHz<br>• 5.47 – 5.725 GHz<br>• 5.825 – 5.850 GHz |
| **Data Rates** | • 802.11b: 1, 2, 5.5, 11 Mbps<br>• 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps<br>• 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps |

| | |
|---|---|
| | • 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)<br>• 802.11ac : MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, and 80MHz) |
| **Modulation** | Direct Sequence Spread Spectrum<br>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<br>• AES-CCMP: 128 bit in hardware<br>• 802.1x authentication<br>• WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES.<br>• WPA2 certification<br>• IEEE 802.11i<br>• Cisco Certified Extensions, all versions through CCX4 and CCX Lite<br>• 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<br>• 802.11g : +12dBm minimum<br>• 802.11a : +12dBm minimum<br>• 802.11n HT20(2.4GHz) : +12dBm minimum<br>• 802.11n HT40(2.4GHz) : +12dBm minimum<br>• 802.11n HT20(5GHz) : +10dBm minimum<br>• 802.11n HT40(5GHz) : +10dBm minimum<br>• 802.11ac VHT80(5GHz) : +10dBm minimum |
| **Power Consumption** | • Transmit mode2.0 W<br>• Receive mode 1.6 W<br>• Idle mode (PSP) 180 mW (WLAN Associated)<br>• Idle mode 50 mW (WLAN unassociated)<br>• Connected Standby 10mW<br>• Radio disabled 8 mW |
| **Power Management** | ACPI and PCI Express compliant power management<br>802.11 compliant power saving mode |
| **Receiver Sensitivity**[3] | 802.11b, 1Mbps : -93.5dBm maximum<br>802.11b, 11Mbps : -84dBm maximum<br>802.11a/g, 6Mbps : -86dBm maximum<br>802.11a/g, 54Mbps : -72dBm maximum<br>802.11n, MCS07 : -67dBm maximum<br>802.11n, MCS15 : -64dBm maximum<br>802.11ac, MCS0 : -84dBm maximum<br>802.11ac, MCS9 : -59dBm maximum |
| **Antenna type** | High efficiency antenna.<br>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)<br>Non-operating –40° to 176° F (–40° to 80° C) |
| **Humidity** | Operating 10% to 90% (non-condensing)<br>Non-operating 5% to 95% (non-condensing) |
| **Altitude** | Operating 0 to 10,000 ft (3,048 m)<br>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.

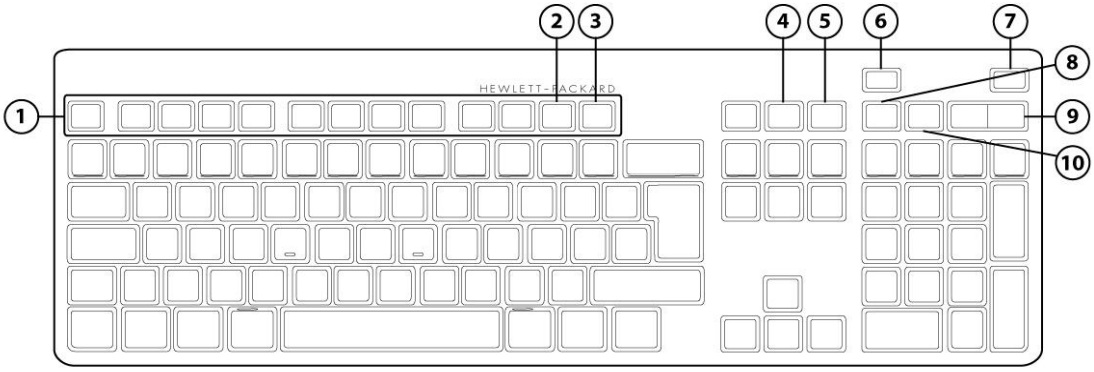
3. Receiver sensitivity is measured at a packet error rate of 8% for 802.11b (CKK modulation) and a packet error rate of 10% for 802.11a/g (OFDM modulation).

**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)<br>BLE : 0~39 (2 MHz/CH) |
| **Data Rates and Throughput** | Legacy : 3 Mbps data rate; throughput up to 2.17 Mbps<br>BLE : 1 Mbps data rate; throughput up to 0.2 Mbps<br>Legacy : Synchronous Connection Oriented links up to 3, 64 kbps, voice channels<br>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<br>Peak (Rx) 230 mW<br>Selective Suspend 17 mW |
| 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<br>Low Voltage Directive IEC950<br>UL, CSA, and CE Mark |
| **Bluetooth Profiles Supported** | BT4.1-ESR 5/6/7 Compliance<br>LE Link Layer Ping<br>LE Dual Mode<br>LE Link Layer<br>LE Low Duty Cycle Directed Advertising<br>LE L2CAP Connection Oriented Channels<br>Train Nudging & Interlaced Scan<br>BT4.2 ESR08 Compliance<br>LE Secure Connection- Basic/Full<br>LE Privacy 1.2 –Link Layer Privacy<br>LE Privacy 1.2 –Extended Scanner Filter Policies<br>LE Data Packet Length Extension<br>FAX Profile (FAX)<br>Basic Imaging Profile (BIP)2<br>Headset Profile (HSP)<br>Hands Free Profile (HFP)<br>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<br>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 |

Technical Specifications

| | | |
|---|---|---|
| **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<br>1 - Headphone port<br>Rear: Line-out<br>Line-in which is retaskable as a Microphone Input<br>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<br>Non-Operating : -40°C ~66°C |
| Relative Humidity | Operating 5% to 90% relative humidity at max inlet temperature<br>Non Operating 5% to 90% relative humidity at max inlet temperature |
| Maximum Altitude (unpressurized) | Operating: 5000m<br>Non-operating: 50,000 ft (15240 m) |
| **80 PLUS Gold** | 500W active PFC / 80 PLUS Gold<br>87/90/87% efficient at 20/50/100% load (115V) |
| **80 PLUS Platinum** | 250W active PFC / 80 PLUS Platinum<br>90/92/89% efficient at 20/50/100% load (115V)<br>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<br>250W≦ 3A |
| **Rated Input Current with Energy Efficient* Power Supply** | 500W ≦ 6A<br>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.<br>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<br>154 x 370 x 365 mm |
| **System Volume** | 1269 cu in<br>20.8 L |
| **System Weight** | 21.74 lb<br>9.86 kg |
| **Max Supported Weight (desktop orientation)** | 77 lb<br>35 kg |
| **Packaging (W x D x H)** | 11.77 x 18.82 x 20.35 in<br>299 x 478 x 517 mm |
| **Shipping Weight** | 24.98 lb<br>11.34 kg |
| **Palletization Profile** | 8 units per layer<br>4 layers ax<br>32 units per pallet<br>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<br>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<br>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<br>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 |