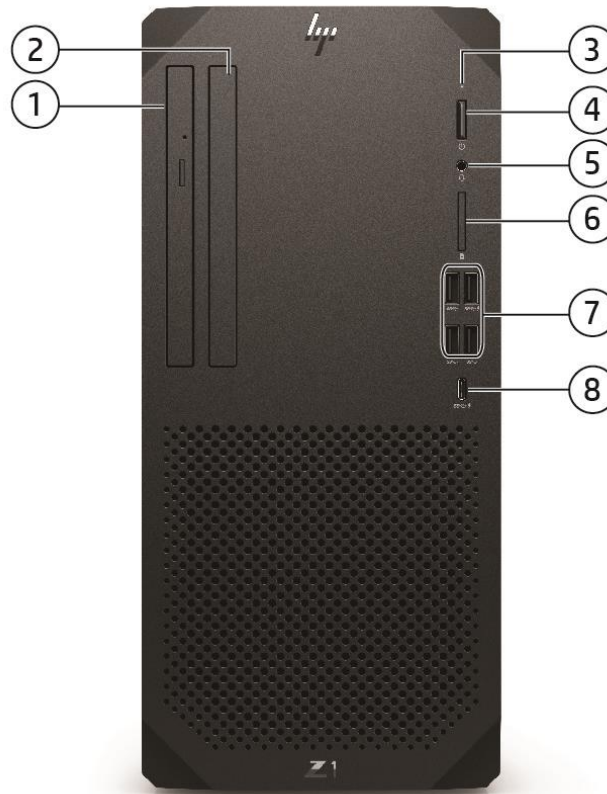


### Overview

#### HP Z1 G9 Tower Desktop PC



1. Slim optical drive bay (optional)
2. Slim optical bay for removable 2.5" HDD or M.2 SSD (optional)
3. Hard drive activity light
4. Dual-state power button
5. Combo Audio Jack with CTIA and OMTP headset support
6. SD card 4.0 reader (optional)
7. (4) Type-A SuperSpeed USB 10Gbps signaling rate port (1 with charge support up to 5V/1.5A)
8. Type-C® SuperSpeed USB 20Gbps signaling rate port (charge support up to 5V/3A)

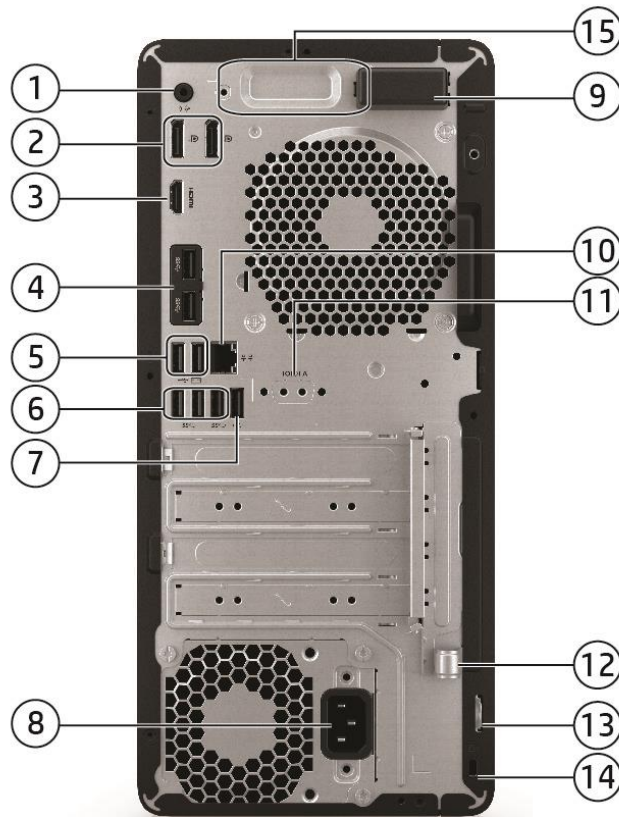
#### **Not Shown**

##### **Slots**

- (1) PCI Express Gen4 x16 (wired as x4)
- (1) PCI Express Gen4 x16
- (2) PCI Express x1
- (3) M.2 (1 as M.2 2230 socket for WLAN/BT and 2 as M.2 2280 socket for storage)

Overview

## HP Z1 G9 Tower Desktop PC



- |   |  |
|---|--|
| <ol style="list-style-type: none"> <li>1. Audio line-out jack connector</li> <li>2. (2) Dual-Mode DisplayPort™ 1.4 (DP++)</li> <li>3. HDMI port 1.4</li> <li>4. Flex port, choice of (shown here HDMI installed):             <ul style="list-style-type: none"> <li>• DisplayPort™ 1.4</li> <li>• HDMI 2.0b</li> <li>• VGA</li> <li>• USB-C® SuperSpeed USB 10Gbps signaling rate port (USB-C® option has alt mode DisplayPort™ 1.4 and 15W output)</li> </ul> </li> <li>5. (2) Type A Hi-Speed USB 480 Mbps signaling rate port with wake from S4/S5</li> </ol> | <ol style="list-style-type: none"> <li>6. (3) Type A SuperSpeed USB 5Gbps signaling rate port</li> <li>7. (1) Type A Hi-Speed USB 480 Mbps signaling rate port</li> <li>8. Power cord connector</li> <li>9. Internal WLAN antenna (optional, shown here installed)</li> <li>10. RJ-45 (network) jack</li> <li>11. Serial port (optional, not shown)</li> <li>12. Integrated keyboard/mouse wire hoop</li> <li>13. Pad Lock Loop</li> <li>14. Standard cable lock slot</li> <li>15. External WLAN antenna (shown here not install)</li> </ol> |
|---|--|

**Not shown**

**Optional ports**

- Thunderbolt™ 3 card<sup>1</sup>
- PS/2 & serial port card (connected to mainboard via a flyer cable)<sup>1</sup>
- Parallel Port<sup>1</sup>

**Bays**

- (2) 3.5" internal storage drive bay
- (2) Slim optical drive bay (optional, ODD and removable storage)

1. Each of the legacy options will occupy one rear slot.

## Features

**AT A GLANCE**

- HP developed and engineered UEFI V2.7 BIOS supporting security, manageability, and software image stability
- Intel® Q670 chipset supporting Intel® 12<sup>th</sup> generation Core™ processors, featuring integrated Intel® UHD Graphics and Intel® vPro® Technology (available with Core i5- and above processors)
- Intel® Ethernet Connection I219LM GbE LOM integrated network connection
- Intel® Wi-Fi 6E + BT5.2 (802.11AX 2x2)<sup>5</sup>
- DDR5 Synchronous Dynamic Random Access Memory (SDRAM) up to 4400 MT/s
- Support for up to 8 monitors via two standard DisplayPort™ 1.4 ports, HDMI 1.4, and a configurable Flex I/O port for video options and a discrete graphics
- Configurable FlexPort which provides the following choices: HDMI 2.0b, Serial, VGA, DisplayPort™ 1.4, or USB Type-C® with DisplayPort™ 1.4 Thunderbolt 3 (PCIe card, Thunderbolt 3 with USB4.0 (and Dual USB Type-A. See Ports section for port availability)
- Configurable, NVIDIA® GeForce® VR ready and NVIDIA® Quadro® discrete graphics <sup>1</sup>
- Can be configured with multiple data drives in a RAID array
- Enhanced Security with HP Security Suite (Refer to Security Section for details)
- ENERGY STAR® certified. EPEAT® registered where applicable. Based on US EPEAT® registration according to IEEE 1680.1-2018 EPEAT®. EPEAT® status varies by country. Visit <http://www.epeat.net> for more information.
- CCC, CECP and SEPA Certified
- TCO Edge for All-in-One TCO
- PC chassis and all internal components and modules are manufactured with low halogen content
- Dust filter available
- Protected by HP Services, including limited warranties of 90/90/90, 1/1/1 and 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
- Compliance with CE (Class B) / FCC (Class B) / UL (UL60950-1 /UL62368-1) / CSA (CSA C22.2 No.60950-1-07 / CSA C22.2 No. 62368-1-14) / ICES-003 / CCC / VCCI (Class B) / KCC (Class B)

1. VR Ready is an optional feature which requires supported discrete graphics.

**NOTE: See important legal disclosures for all listed specs in their respective feature sections**

**PRODUCT NAME**

HP Z1 G9 Tower Desktop PC

**OPERATING SYSTEM****Preinstalled**

Windows 11 Pro<sup>2</sup>  
 Windows 11 Pro Education<sup>2</sup>  
 Windows 11 Home - HP recommends Windows 11 Pro for business<sup>2</sup>  
 Windows 11 Home Single Language - HP recommends Windows 11 Pro for business<sup>2</sup>  
 Windows 11 Pro (preinstalled with Windows 10 Pro Downgrade)<sup>1,2,3</sup>  
 FreeDOS

<sup>1</sup> Device comes with Windows 10 and a free Windows 11 upgrade or may be preloaded with Windows 11. Upgrade timing may vary by device. Features and app availability may vary by region. Certain features require specific hardware (see Windows 11 Specifications).

<sup>2</sup> 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 is automatically updated and enabled. High speed internet and Microsoft account required. ISP fees may apply and additional requirements may apply over time for updates. See <http://www.windows.com>.



## Features

<sup>3</sup>This system is preinstalled with Windows 10 Pro software and also comes with a license for Windows 11 Pro software and provision for recovery software. You may only use one version of the Windows software at a time. Switching between versions will require you to uninstall one version and install the other version. You must back up all data (files, photos, etc.) before uninstalling and installing operating systems to avoid loss of your data.

**NOTE:** Your product does not support Windows 8 or Windows 7. In accordance with Microsoft's support policy, HP does not support the Windows<sup>®</sup> 8 or Windows 7 operating system on products configured with Intel<sup>®</sup> and AMD<sup>®</sup> 7th generation and forward processors or provide any Windows<sup>®</sup> 8 or Windows 7 drivers on <http://www.support.hp.com>. A full list of HP products and the Windows 10 versions tested is available on the HP support website. <https://support.hp.com/us-en/document/c05195282>

## CHIPSET

Intel<sup>®</sup> Q670

## Features

### PROCESSORS

Name	Ghz P-Core Base Frequency	Ghz E-Core Base Frequency	Up to X P-Core Max Turbo Freq	Up to x GHz E-Core Max Turbo Frequency	L3 Cache (MB)	P-Cores	E-Cores	Total Cores	Processor Threads	Memory Speed (MT/s) (DDR5) <sup>4</sup>	ECC Memory Supported <sup>5</sup>	Integrated Graphics	Featuring Intel® vPro® Technology <sup>3</sup>	TDP (W)	Max Turbo Frequency (GHz) <sup>2</sup>
<b>Intel 13<sup>th</sup> Generation Processors</b>															
Intel® Core™ i9-13900	2	1.50	5.2	4.2	36	8	16	24	32	5600	Y	Intel® UHD Graphics 770	Y	65	5.6
Intel® Core™ i7-13700	2.1	1.50	5.1	4.10	30	8	8	16	24	5600	Y	Intel® UHD Graphics 770	Y	65	5.2
Intel® Core™ i5-13600	2.7	2.00	5.0	3.7	24	6	8	14	20	4800	Y	Intel® UHD Graphics 770	Y	65	5.0
Intel® Core™ i5-13500	2.5	1.80	4.8	3.5	24	6	8	14	20	4800	Y	Intel® UHD Graphics 770	Y	65	4.8
Intel® Core™ i5-13400	2.5	1.80	4.6	3.3	20	6	4	10	16	4800	N	Intel® UHD Graphics 730	N/A	65	4.6
Intel® Core™ i3-13100	4.5	N/A	3.4	N/A	12	8	0	8	8	4800	N	Intel® UHD Graphics 730	N/A	60	4.5
<b>Intel 12<sup>th</sup> Generation Processors</b>															
Intel® Core™ i9-12900	5	1.8	5.0	3.8	30	8	8	16	24	4800	Y	Intel® UHD Graphics 770	Y	65	5.1
Intel® Core™ i7-12700	2.1	1.6	4.8	3.6	25	8	4	12	20	4800	Y	Intel® UHD Graphics 770	Y	65	4.9
Intel® Core™ i5-12600	3.3	N/A	4.8	N/A	18	6	0	6	12	4800	Y	Intel® UHD Graphics 770	Y	65	4.8
Intel® Core™ i5-12500	3	N/A	4.6	N/A	18	6	0	6	12	4800	Y	Intel® UHD Graphics 770	Y	65	4.6
Intel® Core™ i5-12400	2.5	N/A	4.4	N/A	18	6	0	6	12	4800	N	Intel® UHD Graphics 730	N/A	65	4.4
Intel® Core™ i3-12300	3.5	N/A	4.4	N/A	12	4	0	4	8	4800	N	Intel® UHD Graphics 730	N/A	60	4.4
Intel® Core™ i3-12100	3.3	N/A	4.3	N/A	12	4	0	4	8	4800	N	Intel® UHD Graphics 730	N/A	60	4.3

## Features

<sup>1</sup> Multicore is designed to improve performance of certain software products. Not all customers or software applications will necessarily benefit from use of this technology. Performance and clock frequency will vary depending on application workload and your hardware and software configurations. Intel's numbering, branding and/or naming is not a measurement of higher performance.

<sup>3</sup> Intel Turbo Boost performance varies depending on hardware, software and overall system configuration. See <http://www.intel.com/technology/turboboost> for more information.

<sup>4</sup> Intel vPro<sup>®</sup> requires Windows 10 Pro 64 bit or higher, a vPro supported processor, vPro enabled chipset, vPro enabled wired LAN and/or Wi-Fi 6E WLAN and TPM 2.0. Some functionality requires additional 3rd party software in order to run. Features of vPro<sup>®</sup> Essentials and Enterprise vary. See <http://intel.com/vpro>

<sup>5</sup> Memory will run at 4400 speed (MT/s) in 2DPC within 1DIMM population; memory will run at 4000 speed (MT/s) in 2DPC within 2DIMM of 1 Rank population and memory will run at 3600 speed (MT/s) in 2DPC within 2DIMM of 2 Rank population

## Features

### GRAPHICS

#### Integrated Intel® Graphics

Intel® UHD Graphics 770 (integrated in 12 <sup>th</sup> gen Core i5-12500T and above)
Intel® UHD Graphics 730 (integrated in 12 <sup>th</sup> gen Core i5-12400(T), and i3)

#### Optional Discrete Graphics Solutions

Intel Arc A380 6 GB FH 3DP+HDMI PCIe x16 Graphics Card
NVIDIA® GeForce® RTX 3070 8GB LHR Graphics Card <sup>1</sup>
NVIDIA® GeForce® RTX 3060 12GB Graphics Card
NVIDIA® GeForce® RTX 3050 8 GB GDDR6 FH PCIe x16 Graphics Card
NVIDIA® T1000 8 GB GDDR6 Graphics Card
NVIDIA® T400 4GB Graphics Card
AMD Radeon RX 6300 2GB GDDR6 Graphics Card
Intel Arc A380 6GB Graphics Card
NVIDIA GeForce RTX 3050 8GB GDDR6 Graphics Card
NVIDIA T1000 8GB 4mDP Graphics Card

1. Requires 550W chassis  
**NOTE:** HP Z1 G9 Tower Desktop PC can support a single discrete graphics card up to 200W with a 550W Power Supply.

#### Adapters and Cables

HP DisplayPort Cable
HP DisplayPort to HDMI True 4K Adapter
HP DisplayPort to VGA Adapter
HP USB to Serial Port Adapter
HP HDMI Standard Cable Kit (HDMI)

## Features

### 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
<b>NOTE:</b> For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 36GB of system disk (for Windows) is reserved for system recovery software.

#### 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*
* Storage DriveLock does not work with Self Encrypting or Optane based storage. ** 2.5 inch SATA Hard Disk Drives are only available with the removable Hard Disk Drive carrier, and as the primary drive only. <b>NOTE:</b> For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 36GB of system disk (for Windows) is reserved for system recovery software.

#### M.2 PCIe NVMe Solid State Drives (SSD)

256GB M.2 2280 PCIe NVMe SSD
512GB M.2 2280 PCIe NVMe SSD
1TB M.2 2280 PCIe NVMe 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
2TB 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**
** Storage DriveLock does not work with Self Encrypting or Optane based storage <b>NOTE:</b> For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 36GB of system disk (for Windows) is reserved for system recovery software.

#### Optical Disc Drives

HP 9.5mm Slim DVD-ROM Drive <sup>1</sup>
HP 9.5mm Slim DVD Writer Drive <sup>1</sup>
1. 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.

#### Media Card Reader

SD 4.0 with 5-in-1 Interface (Supports SD, SDXC, SDHC, UHS-I, UHS-II)
<b>NOTE:</b> For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 36GB of system disk (for Windows) is reserved for system recovery software.

### MEMORY

#### Memory Type



## Features

DDR5-4800 (Transfer rates up to 4400 MT/s), Max 128 GB, 4 U-DIMM

### Memory Configuration

8GB (1 x 8GB)

16GB (2 x 8GB)

32GB (4 x 8GB)

16GB (1 x 16GB)

32GB (2 x 16GB)

64GB (4 x 16GB)

32GB (1 x 32GB)

64GB (2 x 32GB)

128GB (4 x 32GB)

**NOTE:** Memory modules support data transfer rates up to 3600 MT/s(2DPC/2R) or 4400 MT/s (2DPC/1R) and 4400 MT/s; actual data rate is determined by the system configured.

**NOTE:** 2 DIMMs per channel requires platform design with four physical DIMM slots. 2 DIMMS per channel is supported when channel is populated with the same DIMM part number. Symmetric configurations are required for 2 DIMMs per channel physical configuration. Population rule: ensure furthest DIMM from processor is populated.

**NOTE:** All memory slots are customer accessible / upgradeable.

## NETWORKING/COMMUNICATIONS

### Ethernet (RJ-45)

Intel® I219-LM 1 Gigabit Network Connection LOM (vPro®)

Intel® Ethernet Network Adapter I225-T1 (optional)

### Wireless

Intel® Wi-Fi 6E<sup>1</sup> AX211 + BT5.3 wireless card (802.11AX 2x2 vPro®, supporting gigabit data rate<sup>2</sup>)

Intel® Wi-Fi 6E<sup>1</sup> AX211 + BT5.3 wireless card (802.11AX 2x2 non-vPro®, supporting gigabit data rate<sup>2</sup>)

Realtek RTL8852BE 802.11ax<sup>3</sup> 2x2 Wi-Fi® 6<sup>2</sup> + BT5.3 wireless card

1. Wireless access point and Internet service required and not included. Availability of public wireless access points limited. The specifications for the 802.11ax WLAN are draft specifications and are not final. If the final specifications differ from the draft specifications, it may affect the ability of the PC to communicate with 802.11ax WLAN devices. Wi-Fi 6 requires a wireless router, sold separately, that supports 802.11 ax (Wi-Fi 6). Only available in countries where 802.11 ax is supported.

2. Wi-Fi 5 or 6 is designed to support gigabit data rate when transferring files between two devices connected to the same router. Requires a wireless router, sold separately, that supports 80MHz and higher channels.

**NOTE:** Intel Wi-Fi 6E modules are available, but the 6GHz band is not available.

## Features

### KEYBOARDS AND POINTING DEVICES

#### Keyboards

HP Wired Desktop 320K Keyboard
HP USB Business Slim Wired SmartCard CCID Keyboard
HP Business Slim PS/2 Wired Keyboard
HP 125 Wired Keyboard
HP 125 AntiMicrobial Wired Keyboard (China Only)

#### Mouse

HP Wired 320M Mouse
HP PS/2 Mouse
HP Wired 125 Mouse
HP Wired 128 Laser Mouse
HP Wired 125 Antimicrobial Mouse (China only)

#### Keyboard and Mouse Combo

HP 655 Wireless Keyboard and mouse combo
--

## Features

### SECURITY

TPM 2.0 endpoint security controller (Infineon SLB9670) shipped with Windows 10. Common Criteria EAL4+ Certified. FIPS 140-2 Level 2 Certified.
Solenoid Lock & Intrusion Sensor (optional)
Support for chassis cable lock devices
Support for chassis padlocks devices
SATA port disablement (via BIOS)
Serial, USB enable / disable (via BIOS)
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)

### PORTS

#### I/O Ports – Internal Ports

PCI Express 4.0 x16	1
PCI Express 3.0 x16 (wired as x4)	1
PCI Express 3.0 x1	2
SATA port	4
M.2 PCIe	(1) M.2 PCIe 3 x1 2230 (for WLAN) (2) M.2 PCIe 4 x4 2280 (for storage)

1. M.2 SSD attached to CPU is PCIe Gen 4, the other two M.2 are PCIe Gen 3 (AIO)

**NOTE:** For Mini with M.2 Storage config, there will be no SATA drive bracket. If you plan to use or upgrade the storage with any 2.5" SATA drive, please select a DM SATA Drive Bracket (available as both factory configured and after-market option).

#### Standard User Accessible Ports

Type-A Hi-Speed USB 480Mbps signaling rate port	3(rear)
Type-A SuperSpeed USB 5 Gbps signaling rate port	3 (rear)
Type-A SuperSpeed USB 10 Gbps signaling rate port	4 (front)
Type-C® SuperSpeed USB 20Gbps signaling rate port	1 (front)
Video	2 DisplayPort™ 1.4a 1 HDMI 1.4
Audio	1 Universal Audio Jack with CTIA and OMPT headset support (front); 1 Audio-Line-in/Line out (rear)

#### (1) Flexible Port 1, choice of one of the following...

Dual Type-A SuperSpeed USB 5 Gbps signaling rate port	1
Type-C® SuperSpeed USB 10Gbps signaling rate port	1

### Features

Thunderbolt™ 3.0 with USB 4.0 <sup>2</sup>	1
Video	1 DisplayPort™ 1.4a <u>or</u> HDMI 2.0b <u>or</u> VGA
Serial*	1
<p>2. Occupies a PCIe slot. Available in Q3, 2021. 3. Sold separately or as an optional feature.</p>	

### Bays

(2) Slim Optical Disc Drive (ODD or removable storage)
(1) SD Card Reader
(2) 3.5" Internal Storage Drive
4. SATA 2.5" internal storage drive cannot be selected if discrete graphic card is selected.

## Features

### USB SPECIFICATION AND MARKETING NAME MAPPING TABLE

<b>Marketing Name</b>	<b>Technical Terminology</b>
Hi-Speed USB 480Mbps signaling rate	USB 2.0
SuperSpeed USB 5Gbps signaling rate	USB 3.2 Gen 1
SuperSpeed USB 10Gbps signaling rate	USB 3.2 Gen 2
SuperSpeed USB 20Gbps signaling rate	USB 3.2 Gen 2x2

## Features

### SOFTWARE COMPONENTS AND APPLICATIONS WITH WINDOWS

#### Software

HP Easy Clean<sup>20</sup>  
HP PC Hardware Diagnostics UEFI  
HP Desktop Support Utilities  
HP Privacy Settings  
HP Setup Integrated OOBE  
HP Support Assistant<sup>2</sup>  
HSA Fusion for Commercial  
HSA Telemetry for Commercial  
Touchpoint Customizer for Commercial  
myHP  
HP Notifications  
HP Connection Optimizer  
HP Smart Support<sup>3</sup>  
Buy Microsoft Office (sold separately)

#### Manageability Features

HP Connect for Microsoft Endpoint Manager<sup>4</sup>  
HP Image Assistant Gen5 (download)  
HP Manageability Integration Kit (download)<sup>5</sup>  
HP Client Management Script Library (download)  
HP Patch Assistant (download)<sup>6</sup>  
HP Driver Packs (download)<sup>19</sup>  
HP Cloud Recovery<sup>7</sup>  
HP Client Catalog (download)

#### Security Management

HP Wolf Security for Business<sup>8</sup> includes:  
HP Sure Click<sup>9</sup>  
HP Sure Sense 2<sup>10</sup>  
HP Sure Run Gen5<sup>11</sup>  
HP Sure Recover Gen5<sup>12</sup>  
HP Sure Start Gen7<sup>13</sup>  
HP Tamper Lock  
HP Sure Admin<sup>14</sup>  
HP Client Security Manager Gen7<sup>15</sup>

#### BIOS

HP BIOSphere Gen6<sup>16</sup>  
HP Secure Erase<sup>17</sup>  
HP DriveLock & Automatic DriveLock  
BIOS Update via Network  
Absolute Persistence Module<sup>18</sup>  
TPM 2.0 Embedded Security Chip (Common Criteria EAL4+ Certified) (FIPS 140-2 Level 2 Certified)

2. HP Support Assistant requires Windows and Internet Access

3. HP Smart Support automatically collects the telemetry necessary upon initial boot of the product to deliver device-level configuration data and health insights and is available preinstalled on select products, thru HP Factory Configuration Services; or it can be downloaded. For more information about how to enable HP Smart Support or for download, please visit <http://www.hp.com/smart-support>.

4. HP Connect for Microsoft Endpoint Manager is available from the Azure Market Place for HP Pro, Elite, Z and Point-of-Sale PCs managed with Microsoft Endpoint Manager. Subscription to Microsoft Endpoint Manager required and sold separately. Network connection required.

5. HP Manageability Integration Kit can be downloaded from <http://www.hp.com/go/clientmanagement>.

6. HP Patch Assistant available on select HP PCs with the HP Manageability Kit that are managed through Microsoft System Center Configuration Manager. HP Manageability Integration Kit can be downloaded from <http://www8.hp.com/us/en/ads/clientmanagement/overview.html>.

### Features

7. HP Cloud Recovery is available for Z by HP, HP Elite and Pro desktops and laptops PCs with Intel® or AMD processors and requires an open, wired network connection. **NOTE:** You must back up important files, data, photos, videos, etc. before use to avoid loss of data. Detail, please refer to: <https://support.hp.com/us-en/document/c05115630>.
8. HP Wolf Security for Business requires Windows 10 or higher, includes various HP security features and is available on HP Pro, Elite, RPOS and Workstation products. See product details for included security features and OS requirement.
9. HP Sure Click requires Windows 10 Pro or higher or Enterprise. See [https://bit.ly/2PrLT6A\\_SureClick](https://bit.ly/2PrLT6A_SureClick) for complete details.
10. HP Sure Sense requires Windows 11 Pro or Enterprise 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.
11. HP Sure Run Gen5 is available on select HP PCs and requires Windows 10 and higher.
12. HP Sure Recover Gen4 is available on select HP PCs and requires an open network connection. Not available on platforms with multiple internal storage drives. You must back up important files, data, photos, videos, etc. before using HP Sure Recover to avoid loss of data.
13. HP Sure Start Gen 7 is available on select HP PCs and workstations. See product specifications for availability.
14. HP Sure Admin requires Windows 11, HP BIOS, HP Manageability Integration Kit from <http://www.hp.com/go/clientmanagement> and HP Sure Admin Local Access Authenticator smartphone app from the Android or Apple store.
15. HP Client Security Manager Gen7 requires Windows and is available on the select HP PCs.
16. HP BIOSphere Gen6 features may vary depending on the platform and configuration.
17. HP Secure Erase 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™.
18. Absolute firmware module is shipped turned off and can only be activated with the purchase a license subscription and full activation of the software agent. License subscriptions can be purchased for terms ranging multiple years. Service is limited, check with Absolute for availability outside the U.S. Certain conditions apply. For full details visit: <https://www.absolute.com/about/legal/agreements/absolute/>.
19. HP Driver Packs: Not preinstalled, however available for download at <http://www.hp.com/go/clientmanagement>.
20. HP Easy Clean requires Windows 10 RS3 and higher and will disable the keyboard, touchscreen, and clickpad only. Ports are not disabled. See user guide for cleaning instructions.

## Features

**ENVIRONMENTAL & INDUSTRY****ENERGY STAR® certified models available**

ENERGY STAR® certified. EPEAT® registered where applicable. Based on US EPEAT® registration according to IEEE 1680.1-2018 EPEAT®. EPEAT® status varies by country. Visit <http://www.epeat.net> for more information.

Low halogen (chassis, all internal components and modules)<sup>1</sup>

TAA compliant models available

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) <sup>1</sup> Non-operating: -22° to 149° F (-30° to 65° C)
Relative Humidity	Operating: 10% to 90% (non-condensing at ambient) Non-operating: 5% to 95% (non-condensing at ambient)
Maximum Altitude (unpressurized)	Operating: 5000m Non-operating: 50000ft (15240 m)

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



### Features

#### HP Z1 G9 Tower Desktop PC

<b>Eco-Label Certifications &amp; declarations</b>	<p>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:</p> <ul style="list-style-type: none"> <li>• IT ECO declaration</li> <li>• US ENERGY STAR®</li> <li>• ENERGY STAR® certified. EPEAT® registered where applicable. Based on US EPEAT® registration according to IEEE 1680.1-2018 EPEAT®. EPEAT® status varies by country. Visit <a href="http://www.epeat.net">http://www.epeat.net</a> for more information.</li> </ul>		
<b>Sustainable Impact Specifications</b>	<ul style="list-style-type: none"> <li>• 45% post-consumer recycled plastic</li> <li>• 5% ITE-derived closed loop plastic</li> <li>• Bulk packaging available</li> <li>• 80 Plus® Platinum power supplies available</li> <li>• Molded paper pulp cushion inside box is 100% sustainably sourced and recyclable</li> <li>• Ocean-bound plastic in speaker enclosure and system fan</li> <li>• Contains recycled metal</li> </ul>		
<b>System Configuration</b>	<p>The configuration used for the Energy Consumption and Declared Noise Emissions data for the Desktop model is based on a Typically Configured Desktop.</p>		
<b>Energy Consumption (in accordance with US ENERGY STAR® test method)</b>	<b>115VAC, 60Hz</b>	<b>230VAC, 50Hz</b>	<b>100VAC, 50Hz</b>
Normal Operation (Short idle)	27.15 W	27.45 W	27.2 W
Normal Operation (Long idle)	26.07 W	25.96 W	25.45 W
Sleep	1.36 W	1.34 W	1.32 W
Off	0.76 W	0.72 W	0.71 W
	<p><b>NOTE:</b> 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.</p>		
<b>Heat Dissipation*</b>	<b>115VAC, 60Hz</b>	<b>230VAC, 50Hz</b>	<b>100VAC, 50Hz</b>
Normal Operation (Short idle)	92.9 BTU/hr	93.9 BTU/hr	93 BTU/hr
Normal Operation (Long idle)	89.2 BTU/hr	88.8 BTU/hr	87 BTU/hr
Sleep	4.7 BTU/hr	4.6 BTU/hr	4.5 BTU/hr
Off	2.6 BTU/hr	2.5 BTU/hr	2.4 BTU/hr
	<p><b>NOTE:</b> Heat dissipation is calculated based on the measured watts, assuming the service level is attained for one hour.</p>		
<b>Declared Noise Emissions (in accordance with ISO 7779 and ISO 9296)</b>	Sound Power (L <sub>WAd</sub> , bels)		Sound Pressure (L <sub>pAm</sub> , decibels)
Typically Configured – Idle	3.1		19
Fixed Disk – Random writes	3.3		20
Optical Drive – Sequential reads	4.5		23

## Features

<p>Longevity and Upgrading</p>	<p>This product can be upgraded, possibly extending its useful life by several years. Upgradeable features and/or components contained in the product may include:</p> <p>Spare parts are available throughout the warranty period and or for up to “5” years after the end of production.</p>		
<p>Batteries</p>	<p>This battery(s) in this product comply with EU Directive 2006/66/EC</p> <p>Batteries used in the product do not contain:                  Mercury greater the 1ppm by weight                  Cadmium greater than 20ppm by weight</p> <p>Battery size: CR2032 (coin cell)                  Battery type: Lithium</p>		
<p><b>Additional Information</b></p>	<ul style="list-style-type: none"> <li>• This product is in compliance with the Restrictions of Hazardous Substances (RoHS) directive - 2011/65/EC.</li> <li>• This HP product is designed to comply with the Waste Electrical and Electronic Equipment (WEEE) Directive – 2002/96/EC.</li> <li>• This product is in compliance with California Proposition 65 (State of California; Safe Drinking Water and Toxic Enforcement Act of 1986).</li> <li>• ENERGY STAR® certified. EPEAT® 2019 registered where applicable. Based on US EPEAT® registration according to IEEE 1680.1-2018 EPEAT®. Status varies by country. Visit <a href="http://www.epeat.net">http://www.epeat.net</a> for more information.</li> <li>• Plastics parts weighing over 25 grams used in the product are marked per ISO11469 and ISO1043.</li> <li>• This product contains a minimum of 35% post-consumer recycled plastic (by wt.); Including 10% ITE-derived post-consumer recycled plastic*</li> <li>• This product is 93.5% recycle-able when properly disposed of at end of life.</li> </ul> <p><b>*NOTE:</b> Recycled plastic content percentage is based on the definition set in the IEEE 1680.1-2018 standard.</p>		
<p><b>Packaging Materials</b></p>	<p><b>External:</b></p>	<p>PAPER/Corrugated</p> <p>PAPER/Molded Pulp</p>	<p>1106 g</p> <p>666 g</p>
<p><b>Material Usage</b></p>	<p><b>Internal:</b></p>	<p>PLASTIC/Polyethylene low density - LDPE</p>	<p>40 g</p>
<p>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 <a href="http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/gse.pdf">http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/gse.pdf</a>):</p> <ul style="list-style-type: none"> <li>• Asbestos</li> <li>• Certain Azo Colorants</li> <li>• Certain Brominated Flame Retardants – may not be used as flame retardants in plastics</li> <li>• Cadmium</li> <li>• Chlorinated Hydrocarbons</li> <li>• Chlorinated Paraffins</li> <li>• Formaldehyde</li> <li>• Halogenated Diphenyl Methanes</li> <li>• Lead carbonates and sulfates</li> <li>• Lead and Lead compounds</li> <li>• Mercuric Oxide Batteries</li> <li>• Nickel – finishes must not be used on the external surface designed to be frequently handled or carried by the user.</li> <li>• Ozone Depleting Substances</li> <li>• Polybrominated Biphenyls (PBBs)</li> <li>• Polybrominated Biphenyl Ethers (PBBEs)</li> <li>• Polybrominated Biphenyl Oxides (PBBOs)</li> <li>• Polychlorinated Biphenyl (PCB)</li> <li>• Polychlorinated Terphenyls (PCT)</li> <li>• Polyvinyl Chloride (PVC) – except for wires and cables, and certain retail packaging has been voluntarily removed from most applications.</li> </ul>			

## Features

	<ul style="list-style-type: none"> <li>• Radioactive Substances</li> <li>• Tributyl Tin (TBT), Triphenyl Tin (TPT), Tributyl Tin Oxide (TBTO)</li> </ul>
<b>Packaging Usage</b>	<p>HP follows these guidelines to decrease the environmental impact of product packaging:</p> <ul style="list-style-type: none"> <li>• Eliminate the use of heavy metals such as lead, chromium, mercury and cadmium in packaging materials.</li> <li>• Eliminate the use of ozone-depleting substances (ODS) in packaging materials.</li> <li>• Design packaging materials for ease of disassembly.</li> <li>• Maximize the use of post-consumer recycled content materials in packaging materials.</li> <li>• Use readily recyclable packaging materials such as paper and corrugated materials.</li> <li>• Reduce size and weight of packages to improve transportation fuel efficiency.</li> <li>• Plastic packaging materials are marked according to ISO 11469 and DIN 6120 standards.</li> </ul>
<b>End-of-life Management and Recycling</b>	<p>HP Inc. offers end-of-life HP product return and recycling programs in many geographic areas. To recycle your product, please go to: <a href="http://www.hp.com/go/reuse-recycle">http://www.hp.com/go/reuse-recycle</a> or contact your nearest HP sales office. Products returned to HP will be recycled, recovered or disposed of in a responsible manner.</p> <p>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: <a href="http://www.hp.com/go/recyclers">http://www.hp.com/go/recyclers</a>. 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.</p> <p>Global Citizenship Report  <a href="http://www.hp.com/hpinfo/globalcitizenship/gcreport/index.html">http://www.hp.com/hpinfo/globalcitizenship/gcreport/index.html</a>  Eco-label certifications  <a href="http://www8.hp.com/us/en/hp-information/environment/ecolabels.html">http://www8.hp.com/us/en/hp-information/environment/ecolabels.html</a>  ISO 14001 certificates:  <a href="http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/PC_GBU_Product_Design_ISO_14K_Certificate.pdf">http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/PC_GBU_Product_Design_ISO_14K_Certificate.pdf</a>  and  <a href="http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/cert.pdf">http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/cert.pdf</a></p>
<b>Footnotes</b>	<p><sup>1</sup>ITE Derived Closed Loop Plastic percentage is based on the definition set in the IEEE 1680.1-2018 standard.</p> <p><sup>2</sup>Percentage of ocean-bound plastic contained in each component varies by product</p> <p><sup>4</sup>Recycled plastic content percentage is based on the definition set in the IEEE 1680.1-2018 standard.</p> <p><sup>5</sup>Molded pulp cushions are made from 100% recycled wood fiber and organic materials.</p>

## Features

### SERVICE AND SUPPORT

On-site Warranty<sup>1</sup>: One-year (1-1-1) limited warranty delivers one years of on-site, next business day<sup>2</sup> service for parts and labor and includes free support 24 x 7<sup>3</sup>. 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>.<sup>4</sup>

1. Terms and conditions may vary by country. Certain restrictions and exclusions apply. Other warranty variations may be offered in your region.
2. 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.
3. 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.
4. 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](http://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

#### Certification and Compliance

Environmental Sustainability questions concerning:

- This product is low halogen except for power cords, cables, and peripherals. Service parts obtained after purchase may not be Low Halogen.
- Ecolabels (EPEAT, TCO, etc.)
- ENERGY STAR, California Energy Commission (CEC)
- Compliance with Environmental legislation (EU ErP, China CECP, EU RoHS and other countries)
- Supply Chain Social Environmental Responsibility (SER) (conflict minerals; human rights, etc.)
- Product specific environmental features (material content, packaging content, recycled content, etc.)
- China Energy Label (CEL)
- 

Please contact [sustainability@hp.com](mailto:sustainability@hp.com)

For country specific Regulatory Compliance approval documents or Regulatory and Safety questions concerning:

- Declarations of Conformity (for self-service, go to [https://www.hp.com/uk-en/certifications/technical/regulations-certificates.html?jumpid=ex\\_r135\\_uk/en/any/corp/hpuk-mu\\_chev/certificates](https://www.hp.com/uk-en/certifications/technical/regulations-certificates.html?jumpid=ex_r135_uk/en/any/corp/hpuk-mu_chev/certificates))
- GS Certificates
- Product Safety Certificates (UL, CB, BIS, etc.)
- EMC Certificates, Declarations of Conformity, or Certificates of Conformity (CE, FCC, ICES, etc.)
- CCC Certificates
- Ergonomics
- 

Please contact [techregshelp@hp.com](mailto:techregshelp@hp.com)

#### Energy Efficiency Compliance

ENERGY STAR® certified. EPEAT® registered where applicable. EPEAT® registration varies by country. See <http://www.epeat.net> for registration status by country. According to IEEE 1680.1-2018.

## PROCESSORS

### 12<sup>th</sup> and 13<sup>th</sup> Generation Intel® Core™ Processors

All HP Z1 G9 Tower PC models featuring this technology include processors that are part of the Intel® Stable Image Platform Program (SIPP) designed to ensure the stability promise inherent in the value proposition of the HP Z1 series G9 Desktop Business PC.

Intel® Management Engine (ME) v16 – An advanced set of remote management features and functionality which provides network administrators the latest and most effective tools to remotely discover, heal, and protect networked client systems regardless of the system's health or power state. AMT 16 includes the following advanced management functions:

- Support for configuration of Intel ME 16.0 capabilities
- No reset after provisioning
- Support for Intel Enterprise Digital Fence
- The Platform Discovery Utility can now discover these additional Intel products:
  - Public Key Infrastructure
- Profile Editor and Profile Editor Plugin Interface
- Required Permissions for Solutions Framework

## Technical Specifications – Graphics

### GRAPHICS

#### Intel® UHD Graphics (integrated)

<b>VGA Controller</b>	Integrated
<b>DisplayPort™</b>	Multimode capable; supports HDCP, Display Port Audio (2 streams), Onboard support HBR2 link rates/option DP support to HBR3 and Multi-Stream Technology for a maximum of 4 displays connected to any output controlled by Intel® Graphics
<b>HDMI (onboard / optional)</b>	Supports HDMI 2.0b features (onboard HDMI support HDMI1.4; Option HDMI support HDMI2.0b) Supports HDCP 2.3 (Support HDCP 1.4/2.3) Supports audio over HDMI
<b>VGA (optional)</b>	VGA output
<b>USB-C® DP Alt Mode (optional)</b>	DisplayPort™ over the optional USB-C® module (Support DP1.4 HBR2)
<b>Memory</b>	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.
<b>Maximum Color Depth</b>	up to 16 bits/color
<b>Graphics/Video API Support</b>	HEVC 10b Enc/12b Dec HW  VP9 12b Dec HW à AV1 decode support 8/10b, 4:2:0 HDR Rec. 2020 DX12
<b>Max. Resolution (VGA Option)</b>	2048 x 1536@60Hz
<b>Max. Resolution (Onboard HDMI)</b>	1920 x 1080@60Hz
<b>Max. Resolution (Option HDMI)</b>	3840 x 2160@60Hz
<b>Max. Resolution (On board DP)</b>	3840 x 2160@60Hz
<b>Max. Resolution (Option DP)</b>	5120 x 2280@60Hz

#### NVIDIA® GeForce® RTX 3050 8GB GDDR6 Graphics Card

<b>Engine Clock</b>	Base: 1515 Mhz Boost: 1755 Mhz
<b>Frame Buffer Size / Width</b>	8GB/128bit
<b>Graphic Memory Type / Clock</b>	512Mx32 GDDR6 @ 4 pcs/14Gbps
<b>Max. Resolution (HDMI)</b>	7680x4320@60Hz
<b>Max. Resolution (DP)</b>	7680x4320@60Hz
<b>Multi Display Support</b>	4 displays
<b>HDCP Compliance</b>	Yes
<b>Rear I/O connectors (bracket)</b>	HDMIx1+ DPx3
<b>Cooling (active/passive)</b>	Active fansink with 4 pin fan control
<b>Total power consumption (W)</b>	120W
<b>Form-factor</b>	ATX (X:144.7mm/Y:111.15mm/Z: 36.70mm) PCB with ATX dual slot bracket

#### NVIDIA® GeForce® RTX 3060 LHR Graphics Card

<b>Engine Clock</b>	1320 MHz
<b>Memory Clock</b>	1875 MHz
<b>Memory Size(width)</b>	12 GB (256-bit)
<b>Memory Type</b>	256M x 32 GDDR6

## Technical Specifications – Graphics

<b>Max. Resolution (HDMI)</b>	7680x4320@60Hz
<b>Max. Resolution (DP)</b>	7680x4320@60Hz
<b>Multi Display Support</b>	4 displays
<b>HDCP Compliance</b>	Yes
<b>Rear I/O connectors (bracket)</b>	HDMIx1+ DPx3
<b>Cooling (active/passive)</b>	Active fan-sink (Active cooling with dynamic speed)
<b>Total power consumption (W)</b>	170W
<b>PCB form-factor with bracket</b>	ATX (Full height) PCB with ATX dual slot bracket

**NVIDIA® GeForce® RTX 3070 LHR Graphics Card**

<b>Engine Clock</b>	1730 MHz
<b>Memory Clock</b>	8000 MHz
<b>Memory Size(width)</b>	8 GB (256-bit)
<b>Memory Type</b>	256M x 32 GDDR6
<b>Max. Resolution (HDMI)</b>	7680x4320@60Hz
<b>Max. Resolution (DP)</b>	7680x4320@60Hz
<b>Multi Display Support</b>	4 displays
<b>HDCP Compliance</b>	Yes
<b>Rear I/O connectors (bracket)</b>	HDMIx1+ DPx3
<b>Cooling (active/passive)</b>	Active fan-sink (Active cooling with dynamic speed)
<b>Total power consumption (W)</b>	<220W
<b>PCB form-factor with bracket</b>	ATX (Full height) PCB with ATX dual slot bracket

**NVIDIA® T400 2GB Graphics Card**

<b>Engine Clock</b>	2100 MHz
<b>Memory Clock</b>	5001 MHz
<b>Memory Size (width)</b>	2GB (64-bit)
<b>Memory Type</b>	256M x 16 GDDR6
<b>Max. Resolution (DP)</b>	7680x4320@120Hz
<b>Multi Display Support</b>	4 displays
<b>HDCP Compliance</b>	Yes
<b>Rear I/O connectors (bracket)</b>	mDPx3
<b>Cooling (active/passive)</b>	Active fan-sink (Active cooling with dynamic speed)
<b>Total power consumption (W)</b>	30W

**NVIDIA® T400 4GB Graphics Card**

<b>Engine Clock</b>	2100 MHz
<b>Memory Clock</b>	5001 MHz
<b>Memory Size (width)</b>	4GB (64-bit)
<b>Memory Type</b>	512M x 16 GDDR6
<b>Max. Resolution (DP)</b>	7680x4320@120Hz
<b>Multi Display Support</b>	4 displays
<b>HDCP Compliance</b>	Yes

## Technical Specifications – Graphics

<b>Rear I/O connectors (bracket)</b>	mDPx3
<b>Cooling (active/passive)</b>	Active fan-sink (Active cooling with dynamic speed)
<b>Total power consumption (W)</b>	30W
<b>PCB form-factor with bracket</b>	LP PCB with LP bracket

### **NVIDIA® T1000 8GB GDDR6 Graphics card**

<b>Engine Clock</b>	Base: 1065 Mhz Boost: 1395 Mhz
<b>Frame Buffer Size / Width</b>	8GB/128bit
<b>Graphic Memory Type / Clock</b>	4 pcs 2Ch x 256M x 16 GDDR6/Max 5001 Mhz
<b>Max. Resolution (DP)</b>	7680x4320@60Hz
<b>Multi Display Support</b>	4 displays
<b>HDCP Compliance</b>	Yes
<b>Rear I/O connectors (bracket)</b>	mDPx4
<b>Cooling (active/passive)</b>	Active
<b>Total power consumption (W)</b>	50W
<b>Form-factor</b>	X: 155.88mm/Y: 68.91mm, single slot

### **Intel® Arc™ A380 6GB GDDR6 Graphics card**

<b>Engine Clock</b>	2150Mhz
<b>Frame Buffer Size / Width</b>	6GB/96bit
<b>Graphic Memory Type / Clock</b>	GDDR6 ,3 pcs/15.5Gbps
<b>Max. Resolution (HDMI)</b>	4096 x2160@60Hz
<b>Max. Resolution (DP)</b>	7680x4320@60Hz
<b>Multi Display Support</b>	4 displays
<b>HDCP Compliance</b>	Yes
<b>Rear I/O connectors (bracket)</b>	DP x3 + HDMI x1
<b>Cooling (active/passive)</b>	Active
<b>Total power consumption (W)</b>	75W



## Technical Specifications – Storage

**STORAGE****500 GB 7200RPM 3.5in SATA HDD**

<b>Capacity</b>	500 GB
<b>Rotational Speed</b>	7,200 rpm
<b>Interface</b>	SATA 6.0 Gb/s
<b>Buffer Size</b>	32 MB
<b>Logical Blocks</b>	976,773,168
<b>Seek Time</b>	11 ms (Average)
<b>Height</b>	1 in/2.54 cm
<b>Width</b>	Media diameter: 3.5 in/8.89 cm Physical size: 4 in/10.2 cm
<b>Operating Temperature</b>	41° to 131° F (5° to 55° C)

**NOTE:** For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 36GB of system disk (for Windows) is reserved for system recovery software.

**1 TB 7200RPM 3.5in SATA HDD**

<b>Capacity</b>	1 TB
<b>Rotational Speed</b>	7,200 rpm
<b>Interface</b>	SATA 6 Gb/s
<b>Buffer Size</b>	64 MB
<b>Logical Blocks</b>	1,953,525,168
<b>Seek Time</b>	11 ms (Average)
<b>Height</b>	1 in/2.54 cm
<b>Width (nominal)</b>	Media diameter: 3.5 in/8.89 cm Physical size: 4 in/10.2 cm
<b>Operating Temperature</b>	41° to 131° F (5° to 55° C)

**NOTE:** For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 36GB of system disk (for Windows) is reserved for system recovery software.

**2 TB 7200RPM 3.5in SATA HDD**

<b>Capacity</b>	2 TB
<b>Rotational Speed</b>	7,200 rpm
<b>Interface</b>	SATA 6 Gb/s
<b>Buffer Size</b>	128 MB
<b>Logical Blocks</b>	3,907,050,336
<b>Seek Time</b>	11 ms (Average)
<b>Height</b>	1.028 in/26.11 mm
<b>Width (nominal)</b>	Media diameter: 3.5 in/88.9 mm Physical size: 4 in/102 mm
<b>Operating Temperature</b>	41° to 131° F (5° to 55° C)

**NOTE:** For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 36GB of system disk (for Windows) is reserved for system recovery software.

## Technical Specifications – Storage

### 500 GB 7200RPM 2.5in SATA HDD

<b>Capacity</b>	500 GB
<b>Rotational Speed</b>	7,200 rpm
<b>Interface</b>	SATA 6 Gb/s
<b>Buffer Size</b>	Up to 128 MB
<b>Logical Blocks</b>	976,773,168
<b>Seek Time</b>	12 ms (Average)
<b>Height</b>	0.283 in/7.2 mm (Max.)
<b>Width (nominal)</b>	2.75 in/70 mm (nominal)
<b>Operating Temperature</b>	41° to 131° F (5° to 55° C)

**NOTE:** For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 36GB of system disk (for Windows) is reserved for system recovery software.

### 1 TB 7200RPM 2.5in SATA HDD

<b>Capacity</b>	1 TB
<b>Rotational Speed</b>	7,200 rpm
<b>Interface</b>	SATA 6 Gb/s
<b>Buffer Size</b>	Up to 128 MB
<b>Logical Blocks</b>	1,953,525,168
<b>Seek Time</b>	12 ms (Average)
<b>Height</b>	0.283 in/7.2 mm (Max.)
<b>Width (nominal)</b>	2.75 in/70 mm (nominal)
<b>Operating Temperature</b>	41° to 131° F (5° to 55° C)

**NOTE:** For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 36GB of system disk (for Windows) is reserved for system recovery software.

### 2 TB 5400RPM 2.5in SATA HDD

<b>Capacity</b>	2 TB
<b>Rotational Speed</b>	5,400 rpm
<b>Interface</b>	SATA 6 Gb/s
<b>Buffer Size</b>	128 MB
<b>Logical Blocks</b>	3,907,050,336
<b>Seek Time</b>	12 ms (Average)
<b>Height</b>	0.374 in/9.5 mm (nominal)
<b>Width (nominal)</b>	2.75 in/70 mm (nominal)
<b>Operating Temperature</b>	41° to 131° F (5° to 55° C)

**NOTE:** For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 36GB of system disk (for Windows) is reserved for system recovery software.

## Technical Specifications – Storage

### 500 GB 7200RPM 2.5in Self Encrypted OPAL2 SATA HDD

<b>Capacity</b>	500 GB
<b>Architecture</b>	Self-Encrypting (SED) Solid State Drive with SATA interface
<b>Interface</b>	SATA 6 Gb/s
<b>Buffer Size</b>	128 MB
<b>Logical Blocks</b>	976,773,168
<b>Seek Time</b>	12 ms (Average)
<b>Height</b>	0.283 in/7.2 mm (Max.)
<b>Width</b>	2.75 in/70 mm (nominal)
<b>Operating Temperature</b>	41° to 131° F (5° to 55° C)

**NOTE:** For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 36GB of system disk (for Windows) is reserved for system recovery software.

### 256 GB M.2 2280 PCIe NVMe SSD

<b>Drive Weight</b>	< 10g
<b>Capacity</b>	256 GB
<b>Height</b>	2.3 mm
<b>Length</b>	80 mm
<b>Width</b>	22 mm
<b>Interface</b>	PCIe NVMe
<b>Maximum Sequential Read</b>	2000 MB/s +/- 20%
<b>Maximum Sequential Write</b>	900 MB/s +/- 20%
<b>Logical Blocks</b>	500,118,192
<b>Operating Temperature</b>	0° to 70°C (32° to 158°F) [ambient temp]
<b>Features</b>	TRIM; L1.2

**NOTE:** For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 36GB of system disk (for Windows) is reserved for system recovery software.

## Technical Specifications – Storage

**512 GB M.2 2280 PCIe NVMe SSD**

<b>Drive Weight</b>	< 10g
<b>Capacity</b>	512 GB
<b>Height</b>	2.3 mm
<b>Length</b>	80 mm
<b>Width</b>	22 mm
<b>Interface</b>	PCIe NVMe
<b>Maximum Sequential Read</b>	2000 MB/s +/- 20%
<b>Maximum Sequential Write</b>	1000 MB/s +/- 20%
<b>Logical Blocks</b>	1,000,215,216
<b>Operating Temperature</b>	0° to 70°C (32° to 158°F) [ambient temp]
<b>Features</b>	TRIM; L1.2

**NOTE:** For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 36GB of system disk (for Windows) is reserved for system recovery software.

**1 TB M.2 2280 PCIe NVMe SSD**

<b>Drive Weight</b>	< 10g
<b>Capacity</b>	1 TB
<b>Height</b>	2.3 mm
<b>Length</b>	80 mm
<b>Width</b>	22 mm
<b>Interface</b>	PCIe NVMe
<b>Maximum Sequential Read</b>	2200 MB/s +/- 20%
<b>Maximum Sequential Write</b>	1200 MB/s +/- 20%
<b>Logical Blocks</b>	2,000,409,264
<b>Operating Temperature</b>	0° to 70°C (32° to 158°F) [ambient temp]
<b>Features</b>	TRIM; L1.2

**NOTE:** For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 36GB of system disk (for Windows) is reserved for system recovery software.

**256GB M.2 2280 PCIe NVMe Self Encrypted OPAL2 Value SSD**

<b>Capacity</b>	256 GB
<b>Interface</b>	PCIe NVMe
<b>Maximum Sequential Read</b>	2000 MB/s ±20%
<b>Maximum Sequential Write</b>	900 MB/s ±20%
<b>Logical Blocks</b>	500,118,192
<b>Features</b>	Pyrite 2.0; TRIM; L1.2

**NOTE:** For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 36GB of system disk (for Windows) is reserved for system recovery software.

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

<b>Drive Weight</b>	< 10g
<b>Capacity</b>	256 GB
<b>Height</b>	2.3 mm
<b>Length</b>	80 mm

## Technical Specifications – Storage

<b>Width</b>	22 mm
<b>Interface</b>	PCIe Gen4x4
<b>Maximum Sequential Read</b>	4000 MB/s $\pm$ 20%
<b>Maximum Sequential Write</b>	2000 MB/s $\pm$ 20%
<b>Logical Blocks</b>	500,118,192
<b>Operating Temperature</b>	0° to 70°C (32° to 158°F) [ambient temp]
<b>Features</b>	TRIM; L1.2; Pyrite 2.0

**NOTE:** For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 36GB of system disk (for Windows) is reserved for system recovery software.

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

<b>Drive Weight</b>	< 10g
<b>Capacity</b>	512 GB
<b>Height</b>	2.3 mm
<b>Length</b>	80 mm
<b>Width</b>	22 mm
<b>Interface</b>	PCIe Gen4x4
<b>Maximum Sequential Read</b>	6400 MB/s $\pm$ 20%
<b>Maximum Sequential Write</b>	3500 MB/s $\pm$ 20%
<b>Logical Blocks</b>	1,000,215,216
<b>Operating Temperature</b>	0° to 70°C (32° to 158°F) [ambient temp]
<b>Features</b>	TRIM; L1.2; Pyrite 2.0

**NOTE:** For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 36GB of system disk (for Windows) is reserved for system recovery software.

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

<b>Drive Weight</b>	< 10g
<b>Capacity</b>	1 TB
<b>Height</b>	2.3 mm
<b>Length</b>	80 mm
<b>Width</b>	22 mm
<b>Interface</b>	PCIe Gen4x4
<b>Maximum Sequential Read</b>	6400 MB/s $\pm$ 20%
<b>Maximum Sequential Write</b>	5000 MB/s $\pm$ 20%
<b>Logical Blocks</b>	2,000,409,264
<b>Operating Temperature</b>	0° to 70°C (32° to 158°F) [ambient temp]
<b>Features</b>	TRIM; L1.2; Pyrite 2.0

**NOTE:** For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 36GB of system disk (for Windows) is reserved for system recovery software.

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

<b>Drive Weight</b>	< 10g
<b>Capacity</b>	2 TB
<b>Height</b>	2.3 mm

## Technical Specifications – Storage

<b>Length</b>	80 mm
<b>Width</b>	22 mm
<b>Interface</b>	PCIe Gen4x4
<b>Maximum Sequential Read</b>	6400 MB/s $\pm$ 20%
<b>Maximum Sequential Write</b>	5000 MB/s $\pm$ 20%
<b>Logical Blocks</b>	4,000,797,360
<b>Operating Temperature</b>	0° to 70°C (32° to 158°F) [ambient temp]
<b>Features</b>	TRIM; L1.2; Pyrite 2.0

**NOTE:** For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 36GB of system disk (for Windows) is reserved for system recovery software.

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

<b>Drive Weight</b>	< 10g
<b>Capacity</b>	256 GB
<b>Height</b>	2.3 mm
<b>Length</b>	80 mm
<b>Width</b>	22 mm
<b>Interface</b>	PCIe Gen4x4
<b>Maximum Sequential Read</b>	4000 MB/s $\pm$ 20%
<b>Maximum Sequential Write</b>	2000 MB/s $\pm$ 20%
<b>Logical Blocks</b>	500,118,192
<b>Operating Temperature</b>	0° to 70°C (32° to 158°F) [ambient temp]
<b>Features</b>	TRIM; L1.2; TCG Opal 2.0

**NOTE:** For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 36GB of system disk (for Windows) is reserved for system recovery software.

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

<b>Drive Weight</b>	< 10g
<b>Capacity</b>	512 GB
<b>Height</b>	2.3 mm
<b>Length</b>	80 mm
<b>Width</b>	22 mm
<b>Interface</b>	PCIe Gen4x4
<b>Maximum Sequential Read</b>	6400 MB/s $\pm$ 20%
<b>Maximum Sequential Write</b>	3500 MB/s $\pm$ 20%
<b>Logical Blocks</b>	1,000,215,216
<b>Operating Temperature</b>	0° to 70°C (32° to 158°F) [ambient temp]
<b>Features</b>	TRIM; L1.2; TCG Opal 2.0

**NOTE:** For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 36GB of system disk (for Windows) is reserved for system recovery software.

**OPTICAL DISC DRIVES****HP 9.5mm Slim DVD-ROM Drive**

## Technical Specifications – Storage

<b>Height</b>	9.5 mm height
<b>Orientation</b>	Either horizontal or vertical
<b>Interface type</b>	SATA/ATAPI
<b>Dimensions (W x H x D)</b>	5.04 x 0.37 x 5.0 in (128 x 9.5 x 127 mm) without bezel
<b>Weight (max)</b>	Up to 0.31 lb (140g) without bezel
<b>Read Speeds</b>	DVD+R/-R/+RW/ -RW/+R DL /-R DL Up to 8X DVD-ROM Up to 8X CD-ROM, CD-R Up to 24X CD-RW Up to 24X
<b>Access time (typical reads, including settling)</b>	Random: DVD-ROM: 170 ms (typical), CD-ROM: 170 ms (typical) Full stroke: DVD-ROM: 320 ms (typical), CD-ROM: 320 ms (typical)
<b>Power</b>	Source Slimline SATA DC power receptacle DC Power Requirement 5 VDC ± 5%-100 mV ripple p-p DC Current 5 VDC (< 1000 mA typical, 1600 mA maximum)
<b>Environmental conditions (operating - non-condensing)</b>	Temperature 41° to 122° F (5° to 50° C) Relative Humidity 10% to 80% Maximum Wet Bulb Temperature 84° F (29° C)

### HP 9.5mm Slim DVD Writer Drive

<b>Height</b>	9.5 mm height
<b>Orientation</b>	Either horizontal or vertical
<b>Interface type</b>	SATA/ATAPI
<b>Disc recording capacity</b>	Up to 8.5 GB DL or 4.7 GB standard
<b>Dimensions (W x H x D)</b>	5.04 x 0.37 x 5.0 in (128 x 9.5 x 127 mm) without bezel
<b>Weight (max)</b>	0.31 lb (140 g)
<b>Write Speeds</b>	DVD-R DL - Up to 6X DVD+R - Up to 8X DVD+RW - Up to 8X DVD+R DL - Up to 6X DVD-R - Up to 8X DVD-RW - Up to 6X CD-R - Up to 24X CD-RW - Up to 10X DVD-RW, DVD+RW - Up to 8X
<b>Read Speeds</b>	DVD-R DL, DVD+R DL - Up to 8X DVD+R, DVD-R - Up to 8X DVD-ROM DL, DVD-ROM - Up to 8X CD-ROM, CD-R - Up to 24X CD-RW - Up to 24X
<b>Access time (typical reads, including settling)</b>	Random DVD-ROM: 170 ms (typical), CD-ROM: 170 ms (typical) Full Stroke DVD-ROM: 320 ms (typical), CD-ROM: 320 ms (typical) Stop Time 6 seconds (typical)
<b>Power</b>	Source Slimline SATA DC power receptacle DC Power Requirement 5 VDC ± 5%-100 mV ripple p-p DC Current 5 VDC (< 1000 mA typical, 1600 mA maximum)
<b>Environmental conditions (operating - non-condensing)</b>	Temperature 41° to 122° F (5° to 50° C) Relative Humidity 10% to 80% Maximum Wet Bulb Temperature 84° F (29° C)





## Technical Specifications – Networking and Communications

### NETWORKING AND COMMUNICATIONS

<b>Intel® I219-LM 1 Gigabit Network Connection LOM (vPro®)</b>	
<b>Connector</b>	RJ-45
<b>System Interface</b>	PCI (Intel proprietary) + SMBus
<b>Data rates supported</b>	10 Mbit/s operation (10BASE-T; IEEE 802.3i; IEEE 802.3 clauses 13-14) 100 Mbit/s operation (100BASE-TX; IEEE 802.3u; IEEE 802.3 clauses 21-30) 1000 Mbit/s operation (1000BASE-T; IEEE 802.3ab; IEEE 802.3 clauses 40) Auto-Negotiation (Automatic Speed Selection) Full Duplex Operation at all Speeds, Half Duplex operation at 10 and 100 Mbit/s
<b>IEEE Compliance</b>	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)
<b>Performance</b>	TCP/IP/UDP Checksum Offload (configurable) Protocol Offload (ARP & NS) Large send offload and Giant send offload Receiving Side Scaling (Hash Mode Only) Jumbo Frame 9K
<b>Power consumption</b>	Cable Disconnection: 25mW 100Mbps Full Run: 450mW 1000bp Full Run: 1000mW WoL Enable(S3/S4/S5): 50mW WoL Disable(S3/S4/S5): 25mW
<b>Power Management</b>	ACPI compliant – multiple power modes Situation-sensitive features reduce power consumption Advanced link down power saving for reducing link down power consumption
<b>Management Interface</b>	Auto MDI/MDIX Crossover cable detection
<b>IT Manageability</b>	Wake-on-LAN from modern standby or sleep state (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
<b>Security &amp; Manageability</b>	Intel® vPro® support with appropriate Intel® chipset components

<b>Intel® I225-LM 2.5 Gigabit Network Connection LOM (non-vPro®)</b>	
<b>Connector</b>	RJ-45
<b>System Interface</b>	PCI (Intel proprietary) + SMBus
<b>Data rates supported</b>	1. 10 Mbit/s operation (10BASE-T; IEEE 802.3i; IEEE 802.3 clauses 13-14) 2. 100 Mbit/s operation (100BASE-TX; IEEE 802.3u; IEEE 802.3 clauses 21-30) 3. 1000 Mbit/s operation (1000BASE-T; IEEE 802.3ab; IEEE 802.3 clauses 40) 4. 2.5 Gbit/s operation(2.5GBASE-T; IEEE 802.3bz Clause 126) 5. Auto-Negotiation (Automatic Speed Selection) Full Duplex Operation at all Speeds, Half Duplex operation at 10, 100 & 1000 Mbit/s
<b>IEEE Compliance</b>	IEEE 802.1p QoS (Quality of Service) Support IEEE 802.1q VLAN support IEEE 802.3x Flow Control (IEEE 802.3 clauses 31-32; configurable) IEEE 802.3az EEE (Energy Efficient Ethernet) IEEE 802.3i 10BASE-T IEEE 802.3u 100BASE-TX IEEE 802.3ab 1000BAE-T IEEE 802.3bz 2.5GBASE-T

## Technical Specifications – Networking and Communications

<b>Performance</b>	TCP/IP/UDP Checksum Offload (configurable) Protocol Offload (ARP & NS) Large send offload and Giant send offload Receiving Side Scaling (Hash Mode Only) Jumbo Frame 9K
<b>Power consumption</b>	Cable Disconnection: 25mW 100Mbps Full Run: 450mW 1000bp Full Run: 1000mW WoL Enable(S3/S4/S5): 50mW WoL Disable(S3/S4/S5): 25mW
<b>Power Management</b>	ACPI compliant – multiple power modes Situation-sensitive features reduce power consumption Advanced link down power saving for reducing link down power consumption
<b>Management Interface</b>	Auto MDI/MDIX Crossover cable detection
<b>IT Manageability</b>	Wake-on-LAN from modern standby or sleep state (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
<b>Security &amp; Manageability</b>	Intel® non-vPro® support with appropriate Intel® chipset components

<b>Realtek RTL8852BE 802.11ax 2x2 Wi-Fi + BT5.3 (802.11ax 2x2, supporting gigabit data rate)<sup>1</sup></b>	
<b>Wireless LAN Standards</b>	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n IEEE 802.11ac IEEE 802.11ax IEEE 802.11d IEEE 802.11e IEEE 802.11h IEEE 802.11i IEEE 802.11k IEEE 802.11r IEEE 802.11v
<b>Interoperability</b>	Wi-Fi certified modules
<b>Frequency Band</b>	802.11b/g/n/ax • 2.402 – 2.482 GHz 802.11a/n/ac/ax • 4.9 – 4.95 GHz (Japan) • 5.15 – 5.25 GHz • 5.25 – 5.35 GHz • 5.47 – 5.725 GHz • 5.825 – 5.850 GHz
<b>Data Rates</b>	• 802.11b: 1, 2, 5.5, 11 Mbps • 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps • 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps • 802.11n: max 300Mbps • 802.11ac: max 866.7Mbps • 802.11ax: max 1201Mbps
<b>Modulation</b>	Direct Sequence Spread Spectrum BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM, 1024QAM
<b>Security<sup>2</sup></b>	• IEEE and WiFi certified 64 / 128 bit WEP encryption for a/b/g mode only • AES-CCMP: 128 bit in hardware

## Technical Specifications – Networking and Communications

	<ul style="list-style-type: none"> <li>• 802.1x authentication</li> <li>• WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES.</li> <li>• WPA2 certification</li> <li>• WPA3 certification</li> <li>• IEEE 802.11i</li> <li>• WAPI</li> </ul>
<b>Network Architecture Models</b>	<p>Ad-hoc (Peer to Peer)</p> <p>Infrastructure (Access Point Required)</p>
<b>Roaming</b>	IEEE 802.11 compliant roaming between access points
<b>Output Power<sup>3</sup></b>	<ul style="list-style-type: none"> <li>• 802.11b : +18.5dBm minimum</li> <li>• 802.11g : +17.5dBm minimum</li> <li>• 802.11a : +18.5dBm minimum</li> <li>• 802.11n HT20(2.4GHz) : +15.5dBm minimum</li> <li>• 802.11n HT40(2.4GHz) : +14.5dBm minimum</li> <li>• 802.11n HT20(5GHz) : +15.5dBm minimum</li> <li>• 802.11n HT40(5GHz) : +14.5dBm minimum</li> <li>• 802.11ac VHT80(5GHz) : +11.5dBm minimum</li> <li>• 802.11ax HE40(2.4GHz) : +10dBm minimum</li> <li>• 802.11ax HE80(5GHz) : +10dBm minimum</li> </ul>
<b>Power Consumption</b>	<ul style="list-style-type: none"> <li>• Transmit mode :2.5 W</li> <li>• Receive mode :2 W</li> <li>• Idle mode (PSP) 180 mW (WLAN Associated)</li> <li>• Idle mode :50 mW (WLAN unassociated)</li> <li>• Connected Standby/Modern Standby: 10mW</li> <li>• Radio disabled: 8 mW</li> </ul>
<b>Power Management</b>	<p>ACPI and PCI Express compliant power management</p> <p>802.11 compliant power saving mode</p>
<b>Receiver Sensitivity<sup>4</sup></b>	<p>802.11b, 1Mbps : -93.5dBm maximum</p> <p>802.11b, 11Mbps : -84dBm maximum</p> <p>802.11a/g, 6Mbps : -86dBm maximum</p> <p>802.11a/g, 54Mbps : -72dBm maximum</p> <p>802.11n, MCS07 : -67dBm maximum</p> <p>802.11n, MCS15 : -64dBm maximum</p> <p>802.11ac, MCS0 : -84dBm maximum</p> <p>802.11ac, MCS9 : -59dBm maximum</p> <ul style="list-style-type: none"> <li>•802.11ax, MCS11(HE40): -57dBm maximum</li> <li>•802.11ax, MCS11(HE80): -54dBm maximum</li> </ul>
<b>Antenna type</b>	<p>High efficiency antenna with spatial diversity, mounted in the display enclosure</p> <p>Two embedded dual band 2.4/5 GHz antennas are provided to the card to support WLAN MIMO communications and Bluetooth communications</p>
<b>Form Factor</b>	PCI-Express M.2 MiniCard
<b>Dimensions</b>	<p>1. Type 2230: 2.3 x 22.0 x 30.0 mm</p> <p>2. Type 1216: 1.67 x 12.0 x 16.0 mm</p>
<b>Weight</b>	<p>1. Type 2230: 2.8g</p> <p>2. Type 126: 1.3g</p>
<b>Operating Voltage</b>	3.3v +/- 9%
<b>Temperature</b>	<p>Operating: 14° to 158° F (-10° to 70° C)</p> <p>Non-operating: -40° to 176° F (-40° to 80° C)</p>
<b>Humidity</b>	<p>Operating: 10% to 90% (non-condensing)</p> <p>Non-operating: 5% to 95% (non-condensing)</p>
<b>Altitude</b>	<p>Operating: 0 to 10,000 ft (3,048 m)</p> <p>Non-operating: 0 to 50,000 ft (15,240 m)</p>

## Technical Specifications – Networking and Communications

<b>LED Activity</b>	LED Amber – Radio OFF; LED OFF – Radio ON
<b>HP Integrated Module with Bluetooth 4.0/4.1/4.2/5.0/5.1/5.2/5.3 Wireless Technology</b>	
<b>Frequency Band</b>	2402 to 2480 MHz
<b>Number of Available Channels</b>	Legacy: 0~79 (1 MHz/CH) BLE: 0~39 (2 MHz/CH)
<b>Data Rates and Throughput</b>	Legacy: 3 Mbps data rate; throughput up to 2.17 Mbps BLE: 1 Mbps data rate; throughput up to 0.2 Mbps Legacy : Synchronous Connection Oriented links up to 3, 64 kbps, voice channels Legacy : Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric (3-DH5) or 864 kbps symmetric (3-EV5)
<b>Transmit Power</b>	The Bluetooth component shall operate as a Class II Bluetooth device with a maximum transmit power of + 4 dBm for BR and EDR.
<b>Power Consumption</b>	Peak (Tx): 330 mW  Peak (Rx): 230 mW  Selective Suspend: 17 mW
<b>Electrical Interface</b>	Microsoft Windows Bluetooth Software
<b>Bluetooth® Software Supported Link Topology</b>	Microsoft Windows ACPI, and USB Bus Support
<b>Power Management</b>	FCC (47 CFR) Part 15C, Section 15.247 & 15.249
<b>Certifications</b>	ETS 300 328, ETS 300 826  Low Voltage Directive IEC950  UL, CSA, and CE Mark Peak (Tx): 330 mW  Peak (Rx): 230 mW  Selective Suspend: 17 mW
<b>Power Management</b>	Microsoft Windows Bluetooth Software
<b>Certifications</b>	
<b>Bluetooth Profiles Supported</b>	BT4.1-ESR 5/6/7 Compliance LE Link Layer Ping LE Dual Mode LE Link Layer LE Low Duty Cycle Directed Advertising LE L2CAP Connection Oriented Channels Train Nudging & Interlaced Scan BT4.2 ESR08 Compliance LE Secure Connection- Basic/Full LE Privacy 1.2 –Link Layer Privacy LE Privacy 1.2 –Extended Scanner Filter Policies LE Data Packet Length Extension FAX Profile (FAX) Basic Imaging Profile (BIP)2 Headset Profile (HSP) Hands Free Profile (HFP) Advanced Audio Distribution Profile (A2DP) BT5.1

## Technical Specifications – Networking and Communications

	<p>ESR9/10 Compliance          LE Advertisement Extensions          Channel Selection Algo          Limited High Duty Cycle Non-Connectable Advertising          2Mbps LE          LE Long Range</p>
<p>1. Wi-Fi 6 is designed to support gigabit data rate when transferring files between two devices connected to the same router. Requires a wireless router, sold separately, that supports 80MHz and higher channels. Wireless access point and Internet service required and sold separately. Availability of public wireless access points limited. Wi-Fi 6 (802.11ax) is backwards compatible with prior 802.11 specs.          2. Check latest software/driver release for updates on supported security features.          3. The FCC has declared as of September 1, 2014 products that utilize passive scanning on channel 12/13 and are capable of transmitting must fully comply with requirements of 15.247 or otherwise disable those channels.          4. 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).</p>	

<b>Intel AX211 Wi-Fi 6E +BT 5.3 M.2 160MHz CNVi WW WLAN<sup>1</sup></b>	
<b>Wireless LAN Standards</b>	<p>IEEE 802.11a            IEEE 802.11b            IEEE 802.11g            IEEE 802.11n            IEEE 802.11ac            IEEE 802.11ax            IEEE 802.11d            IEEE 802.11e            IEEE 802.11h            IEEE 802.11i            IEEE 802.11k            IEEE 802.11r            IEEE 802.11v</p>
<b>Interoperability</b>	Wi-Fi certified
<b>Frequency Band</b>	<p>802.11b/g/n/ax            • 2.402 – 2.482 GHz            802.11a/n/ac/ax            • 4.9 – 4.95 GHz (Japan)            • 5.15 – 5.25 GHz            • 5.25 – 5.35 GHz            • 5.47 – 5.725 GHz            • 5.825 – 5.850 GHz            • 5.955 – 6.415 GHz            • 6.435 – 6.515 GHz            • 6.535 – 6.875 GHz            • 6.895 – 7.115 GHz</p>
<b>Data Rates</b>	<p>• 802.11b: 1, 2, 5.5, 11 Mbps            • 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps            • 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps            • 802.11n: max 300Mbps            • 802.11ac: 1733Mbps            • 802.11ax : max 2.4Gbps</p>
<b>Modulation</b>	<p>Direct Sequence Spread Spectrum</p> <p>OFDM, BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM, 1024QAM</p>
<b>Security<sup>2</sup></b>	<p>• IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only            • AES-CCMP: 128 bit in hardware            • 802.1x authentication</p>

## Technical Specifications – Networking and Communications

	<ul style="list-style-type: none"> <li>• WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES.</li> <li>• WPA2 certification</li> <li>• WPA3 certification</li> <li>• IEEE 802.11i</li> <li>• WAPI</li> </ul>
<b>Network Architecture Models</b>	<p>Ad-hoc (Peer to Peer)</p> <p>Infrastructure (Access Point Required)</p>
<b>Roaming</b>	IEEE 802.11 compliant roaming between access points
<b>Output Power<sup>3</sup></b>	<ul style="list-style-type: none"> <li>• 802.11b: +17dBm minimum</li> <li>• 802.11g: +16dBm minimum</li> <li>• 802.11a: +17dBm minimum</li> <li>• 802.11n HT20(2.4GHz) : +14dBm minimum</li> <li>• 802.11n HT40(2.4GHz) : +13dBm minimum</li> <li>• 802.11n HT20(5GHz) : +14dBm minimum</li> <li>• 802.11n HT40(5GHz) : +13dBm minimum</li> <li>• 802.11ac VHT80(5GHz) : +10dBm minimum</li> <li>• 802.11ac VHT160(5GHz) : +10dBm minimum</li> <li>• 802.11ax HE40(2.4GHz) : +12dBm minimum</li> <li>• 802.11ax HE80(5GHz) : +10dBm minimum</li> <li>• 802.11ax HE160(5GHz) : +10dBm minimum</li> </ul>
<b>Power Consumption</b>	<ul style="list-style-type: none"> <li>• Transmit mode 2.0 W</li> <li>• Receive mode 1.6 W</li> <li>• Idle mode (PSP) 180 mW (WLAN Associated)</li> <li>• Idle mode 50 mW (WLAN unassociated)</li> <li>• Connected Standby 10mW</li> <li>• Radio disabled 8 mW</li> </ul>
<b>Power Management</b>	<p>ACPI and PCI Express compliant power management</p> <p>802.11 compliant power saving mode</p>
<b>Receiver Sensitivity<sup>4</sup></b>	<ul style="list-style-type: none"> <li>• 802.11b, 1Mbps : -93.5dBm maximum</li> <li>• 802.11b, 11Mbps : -84dBm maximum</li> <li>• 802.11a/g, 6Mbps : -86dBm maximum</li> <li>• 802.11a/g, 54Mbps : -72dBm maximum</li> <li>• 802.11n, MCS07 : -67dBm maximum</li> <li>• 802.11n, MCS15 : -64dBm maximum</li> <li>• 802.11ac, MCS0(VHT80) : -84dBm maximum</li> <li>• 802.11ac, MCS9(VHT80) : -59dBm maximum</li> <li>• 802.11ac, MCS9(VHT160) : -58.5dBm maximum</li> <li>• 802.11ax, MCS11(HE40): -57dBm maximum</li> <li>• 802.11ax, MCS11(HE80): -54dBm maximum</li> <li>• 802.11ax, MCS11(HE160): -53.5dBm maximum</li> </ul>
<b>Antenna type</b>	<p>High efficiency antenna with spatial diversity, mounted in the display enclosure</p> <p>Two embedded dual band 2.4/5 GHz antennas are provided to the card to support WLAN MIMO communications and Bluetooth communications</p>
<b>Form Factor</b>	PCI-Express M.2 MiniCard
<b>Dimensions</b>	<p>1. Type 2230: 2.3 x 22.0 x 30.0 mm</p> <p>2. Type 1216: 1.67 x 12.0 x 16.0 mm</p>
<b>Weight</b>	<p>1. Type 2230: 2.8g</p> <p>2. Type 1216: 1.3g</p>

## Technical Specifications – Networking and Communications

<b>Operating Voltage</b>	3.3v +/- 9%
<b>Temperature</b>	Operating: 14° to 158° F (-10° to 70° C) Non-operating: -40° to 176° F (-40° to 80° C)
<b>Humidity</b>	Operating: 10% to 90% (non-condensing) Non-operating: 5% to 95% (non-condensing)
<b>Altitude</b>	Operating: 0 to 10,000 ft (3,048 m) Non-operating: 0 to 50,000 ft (15,240 m)
<b>LED Activity</b>	LED Amber – Radio OFF; LED OFF – Radio ON
<b>HP Integrated Module with Bluetooth 4.0/4.1/4.2/5.0/5.1/5.2/5.3 Wireless Technology</b>	
<b>Frequency Band</b>	2402 to 2480 MHz
<b>Number of Available Channels</b>	Legacy: 0~79 (1 MHz/CH) BLE: 0~39 (2 MHz/CH)
<b>Data Rates and Throughput</b>	Legacy: 3 Mbps data rate; throughput up to 2.17 Mbps BLE: 1 Mbps data rate; throughput up to 0.2 Mbps Legacy: Synchronous Connection Oriented links up to 3, 64 kbps, voice channels Legacy: Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric (3-DH5) or 864 kbps symmetric (3-EV5)
<b>Transmit Power</b>	The Bluetooth component shall operate as a Class II Bluetooth device with a maximum transmit power of + 9.5 dBm for BR and EDR.
<b>Power Consumption</b>	Peak (Tx): 330 mW  Peak (Rx): 230 mW  Selective Suspend: 17 mW
<b>Bluetooth® Software Supported Link Topology</b>	Microsoft Windows Bluetooth Software
<b>Power Management</b>	Microsoft Windows ACPI, and USB Bus Support
<b>Certifications</b>	FCC (47 CFR) Part 15C, Section 15.247 & 15.249
<b>Power Management Certifications</b>	ETS 300 328, ETS 300 826  Low Voltage Directive IEC950  UL, CSA, and CE Mark
<b>Bluetooth Profiles Supported</b>	BT4.1-ESR 5/6/7 Compliance LE Link Layer Ping LE Dual Mode LE Link Layer LE Low Duty Cycle Directed Advertising LE L2CAP Connection Oriented Channels Train Nudging & Interlaced Scan BT4.2 ESR08 Compliance LE Secure Connection- Basic/Full LE Privacy 1.2 –Link Layer Privacy LE Privacy 1.2 –Extended Scanner Filter Policies LE Data Packet Length Extension FAX Profile (FAX) Basic Imaging Profile (BIP)2 Headset Profile (HSP) Hands Free Profile (HFP) Advanced Audio Distribution Profile (A2DP) BT5.2 ESR9/10 Compliance LE Advertisement Extensions

## Technical Specifications – Networking and Communications

	Channel Selection Algo Limited High Duty Cycle Non-Connectable Advertising 2Mbps LE LE Long Range
<p>1. Wi-Fi 6 is designed to support gigabit data rate when transferring files between two devices connected to the same router. Requires a wireless router, sold separately, that supports 80MHz and higher channels. Wireless access point and Internet service required and sold separately. Availability of public wireless access points limited. Wi-Fi 6 (802.11ax) is backwards compatible with prior 802.11 specs.</p> <p>2. Check latest software/driver release for updates on supported security features.</p> <p>3. The FCC has declared as of September 1, 2014 products that utilize passive scanning on channel 12/13 and are capable of transmitting must fully comply with requirements of 15.247 or otherwise disable those channels.</p> <p>4. 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).</p>	



## Technical Specifications – Networking and Communications

<b>Intel AX211 Wi-Fi 6E +BT 5.3 M.2 vPro® 160MHz CNVi WW WLAN<sup>1</sup></b>	
<b>Wireless LAN Standards</b>	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n IEEE 802.11ac IEEE 802.11ax IEEE 802.11d IEEE 802.11e IEEE 802.11h IEEE 802.11i IEEE 802.11k IEEE 802.11r IEEE 802.11v
<b>Interoperability</b>	Wi-Fi certified
<b>Frequency Band</b>	802.11b/g/n/ax • 2.402 – 2.482 GHz 802.11a/n/ac/ax • 4.9 – 4.95 GHz (Japan) • 5.15 – 5.25 GHz • 5.25 – 5.35 GHz • 5.47 – 5.725 GHz • 5.825 – 5.850 GHz • 5.955 – 6.415 GHz • 6.435 – 6.515 GHz • 6.535 – 6.875 GHz • 6.895 – 7.115 GHz
<b>Data Rates</b>	• 802.11b: 1, 2, 5.5, 11 Mbps • 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps • 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps • 802.11n: max 300Mbps • 802.11ac: 1733Mbps • 802.11ax: max 2.4Gbps
<b>Modulation</b>	Direct Sequence Spread Spectrum  OFDM, BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM, 1024QAM
<b>Security<sup>2</sup></b>	• IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only • AES-CCMP: 128 bit in hardware • 802.1x authentication • WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES. • WPA2 certification • WPA3 certification • IEEE 802.11i • WAPI
<b>Network Architecture Models</b>	Ad-hoc (Peer to Peer)  Infrastructure (Access Point Required)
<b>Roaming</b>	IEEE 802.11 compliant roaming between access points
<b>Output Power<sup>3</sup></b>	• 802.11b : +17dBm minimum • 802.11g : +16dBm minimum • 802.11a : +17dBm minimum • 802.11n HT20(2.4GHz) : +14dBm minimum • 802.11n HT40(2.4GHz) : +13dBm minimum • 802.11n HT20(5GHz) : +14dBm minimum

## Technical Specifications – Networking and Communications

	<ul style="list-style-type: none"> <li>• 802.11n HT40(5GHz) : +13dBm minimum</li> <li>• 802.11ac VHT80(5GHz) : +10dBm minimum</li> <li>• 802.11ac VHT160(5GHz) : +10dBm minimum</li> <li>• 802.11ax HE40(2.4GHz) : +12dBm minimum</li> <li>• 802.11ax HE80(5GHz) : +10dBm minimum</li> <li>• 802.11ax HE160(5GHz) : +10dBm minimum</li> </ul>
<b>Power Consumption</b>	<ul style="list-style-type: none"> <li>• Transmit mode 2.0 W</li> <li>• Receive mode 1.6 W</li> <li>• Idle mode (PSP) 180 mW (WLAN Associated)</li> <li>• Idle mode 50 mW (WLAN unassociated)</li> <li>• Connected Standby 10mW</li> <li>• Radio disabled 8 mW</li> </ul>
<b>Power Management</b>	ACPI and PCI Express compliant power management 802.11 compliant power saving mode
<b>Receiver Sensitivity<sup>4</sup></b>	<ul style="list-style-type: none"> <li>•802.11b, 1Mbps : -93.5dBm maximum</li> <li>•802.11b, 11Mbps : -84dBm maximum</li> <li>• 802.11a/g, 6Mbps : -86dBm maximum</li> <li>• 802.11a/g, 54Mbps : -72dBm maximum</li> <li>• 802.11n, MCS07 : -67dBm maximum</li> <li>• 802.11n, MCS15 : -64dBm maximum</li> <li>• 802.11ac, MCS0(VHT80) : -84dBm maximum</li> <li>• 802.11ac, MCS9(VHT80) : -59dBm maximum</li> <li>• 802.11ac, MCS9(VHT160) : -58.5dBm maximum</li> <li>•802.11ax, MCS11(HE40): -57dBm maximum</li> <li>•802.11ax, MCS11(HE80): -54dBm maximum</li> <li>•802.11ax, MCS11(HE160): -53.5dBm maximum</li> </ul>
<b>Antenna type</b>	High efficiency antenna with spatial diversity, mounted in the display enclosure  Two embedded dual band 2.4/5 GHz antennas are provided to the card to support WLAN MIMO communications and Bluetooth communications
<b>Form Factor</b>	PCI-Express M.2 MiniCard
<b>Dimensions</b>	1. Type 2230: 2.3 x 22.0 x 30.0 mm 2. Type 1216: 1.67 x 12.0 x 16.0 mm
<b>Weight</b>	1. Type 2230: 2.8g 2. Type 1216: 1.3g
<b>Operating Voltage</b>	3.3v +/- 9%
<b>Temperature</b>	Operating: 14° to 158° F (-10° to 70° C) Non-operating: -40° to 176° F (-40° to 80° C)
<b>Humidity</b>	Operating: 10% to 90% (non-condensing) Non-operating: 5% to 95% (non-condensing)
<b>Altitude</b>	Operating: 0 to 10,000 ft (3,048 m) Non-operating: 0 to 50,000 ft (15,240 m)
<b>LED Activity</b>	LED Amber – Radio OFF; LED OFF – Radio ON
<b>HP Integrated Module with Bluetooth 4.0/4.1/4.2/5.0/5.1/5.2/5.3 Wireless Technology</b>	
<b>Frequency Band</b>	2402 to 2480 MHz
<b>Number of Available Channels</b>	Legacy: 0~79 (1 MHz/CH) BLE : 0~39 (2 MHz/CH)
<b>Data Rates and Throughput</b>	Legacy: 3 Mbps data rate; throughput up to 2.17 Mbps BLE : 1 Mbps data rate; throughput up to 0.2 Mbps

## Technical Specifications – Networking and Communications

	Legacy : Synchronous Connection Oriented links up to 3, 64 kbps, voice channels Legacy : Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric (3-DH5) or 864 kbps symmetric (3-EV5)
<b>Transmit Power</b>	The Bluetooth component shall operate as a Class II Bluetooth device with a maximum transmit power of + 9.5 dBm for BR and EDR.
<b>Power Consumption</b>	Peak (Tx): 330 mW  Peak (Rx): 230 mW  Selective Suspend: 17 mW
<b>Bluetooth® Software Supported Link Topology</b>	Microsoft Windows Bluetooth Software
<b>Power Management</b>	Microsoft Windows ACPI, and USB Bus Support
<b>Certifications</b>	FCC (47 CFR) Part 15C, Section 15.247 & 15.249
<b>Power Management Certifications</b>	ETS 300 328, ETS 300 826  Low Voltage Directive IEC950  UL, CSA, and CE Mark
<b>Bluetooth Profiles Supported</b>	BT4.1-ESR 5/6/7 Compliance LE Link Layer Ping LE Dual Mode LE Link Layer LE Low Duty Cycle Directed Advertising LE L2CAP Connection Oriented Channels Train Nudging & Interlaced Scan BT4.2 ESR08 Compliance LE Secure Connection- Basic/Full LE Privacy 1.2 –Link Layer Privacy LE Privacy 1.2 –Extended Scanner Filter Policies LE Data Packet Length Extension FAX Profile (FAX) Basic Imaging Profile (BIP)2 Headset Profile (HSP) Hands Free Profile (HFP) Advanced Audio Distribution Profile (A2DP) BT5.2 ESR9/10 Compliance LE Advertisement Extensions Channel Selection Algo Limited High Duty Cycle Non-Connectable Advertising 2Mbps LE LE Long Range

1. Wi-Fi 6 is designed to support gigabit data rate when transferring files between two devices connected to the same router. Requires a wireless router, sold separately, that supports 80MHz and higher channels. Wireless access point and Internet service required and sold separately. Availability of public wireless access points limited. Wi-Fi 6 (802.11ax) is backwards compatible with prior 802.11 specs.
2. Check latest software/driver release for updates on supported security features.
3. The FCC has declared as of September 1, 2014 products that utilize passive scanning on channel 12/13 and are capable of transmitting must fully comply with requirements of 15.247 or otherwise disable those channels.
4. 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).

## Technical Specifications – Input/Output Devices

### I/O DEVICES

<b>HP Business Slim Standalone USB/PS2 Wired Keyboard</b>		
<b>Physical Characteristics</b>	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)
<b>Electrical</b>	Operating voltage	4.4-5.25VDC
	Power consumption	50-mA maximum (with 5 VDC power supplied and three LEDs ON)/
	System interface	USB or PS/2
	ESD	Contact Discharge: 2, 4,6,8KV Air Discharge: 2, 4, 8,10,12.5KV
	EMI - RFI	Conforms to FCC rules for a Class B computing device
<b>Mechanical</b>	Keycaps	Low-profile design
	Switch actuation	60±12.5g 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)
<b>Environmental</b>	Acoustics	43-dBA maximum sound pressure level
	Operating temperature	50° to 122° F (10° to 50° C)
	Non-operating temperature	Minus 30 degrees to 60 degrees 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
<b>Approvals</b>	UL, FCC, CE Mark, TUV GS, VCCI, BSMI, RCM, KCC	
<b>Ergonomic compliance</b>	ANSI HFS 100, ISO 9241-4, and TUVGS	

<b>HP USB Business Slim Wired SmartCard CCID Keyboard</b>		
<b>Physical Characteristics</b>	Keys	104, 105, 109 layout (depending upon country)

## Technical Specifications – Input/Output Devices

	Dimensions (L x W x H)	17.34 x 5.68 x 0.78in (440.6 x 144.5 x 1.98 cm)
	Weight	1.32 lb (598g)
<b>Electrical</b>	Operating voltage	5 VDC, +/-5%
	Power consumption	100mA (All LED on)
	System interface	USB Type A plug connector
	ESD	Contact Discharge: 8 KV Air Discharge: 12.5 KV
	EMI - RFI	Conforms to FCC rules for a Class B computing device
<b>Mechanical</b>	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)
<b>Environmental</b>	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
<b>Approvals</b>	CE Marking, TUV, EAC, FCC, cULus/CSAus, ICES, RCM, VCCI, KCC, BSMI	
<b>Ergonomic compliance</b>	ISO 9241-4, TUVGS	

<b>HP 125 (AntiMicrobial) Wired Keyboard (China only)</b>		
<b>Physical Characteristics</b>	Keys	104/105/107/109layout (depending upon country)
	Dimensions (L x W x H)	436 x 138 x 24.7 mm
	Weight	471g
<b>Electrical</b>	Operating voltage	5V +- 5%
	Power consumption	50mA
	System interface	USB Type A plug connector

### Technical Specifications – Input/Output Devices

	ESD	Contact Discharge: 8 KV Air Discharge: 12.5 KV
	EMI - RFI	Conforms to FCC rules for a Class B computing device
<b>Mechanical</b>	Keycaps	Low-profile design
	Switch actuation	55±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	1.8 m
<b>Environmental</b>	Acoustics	43-dBA maximum sound pressure level
	Operating temperature	50° to 122° F (10° to 50° C)
	Non-operating temperature	-4° to 149° F (-20° to 65° C)
	Operating humidity	10% to 95% (non-condensing at ambient)
	Non-operating humidity	0% to 95% (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
<b>Approvals</b>	UL, cUL, FCC, CE, TUV GS, VCCI, BSMI, RCM, KCC, USB-IF, WHQL, EN/IEC 60601-1	
<b>Ergonomic compliance</b>	ANSI HFS 100, ISO 9241-4, and TUVGS	

### HP 655 wireless Keyboard

<b>Physical Characteristics</b>	Keys	104, 105, 107, 109 layouts
	Dimensions (L x W x H)	16.86 x 4.55 x 0.71 in (428.22 x 115.47 x 18.06 mm)
	Weight	0.96 lb (435g)
<b>Electrical</b>	Operating voltage	3 VDC, +/-5%
	Power consumption	20 mA Max (All LED on)
	System interface	2.4GHz Wireless
	ESD	Contact Discharge: 8 KV Air Discharge: 15 KV
	EMI - RFI	Conforms to FCC rules for a Class B computing device
<b>Mechanical</b>	Keycaps	Plunger, 2.0 mm key travel
	Key actuation	60±10g nominal peak force with tactile feedback
	Key life	10 million keystrokes (Life tester)
	Key structure type	Rubber dome & Membrane

## Technical Specifications – Input/Output Devices

	Key-leveling mechanisms	For all double-wide and greater-length keys
<b>Environmental</b>	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
<b>Approvals</b>	CB, CE, FCC, cULus, ICES, IC, I TRC, TRA, CASA, UA, EAC, CNC, ANATEL, NOM-NYCE SCT, IFETEL, MPTC, RCM, BIS, PosTel, VCCI, TELEC, KC, MCMC, IDA, BSMI, NCC, DWLF&M, TP-BY, MOC	
<b>Ergonomic compliance</b>	TUVGS	

### HP Wired Desktop 320K Keyboard

<b>Physical Characteristics</b>	Keys	104, 105, 107, 109 layouts
	Dimensions (L x W x H)	18.86*4.55*0.66 in (426.2 x 110.9 x 16.7 mm)
	Weight	1.00 lb(452g)
<b>Electrical</b>	Operating voltage	5 VDC, +/-5%
	Power consumption	50 mA Max (All LED on)
	System interface	USB Port
	ESD	Contact Discharge: 8 KV Air Discharge: 15 KV (Class B)
	EMI - RFI	European Standard EN 55022: 2006+A1: 2007, Class B. FCC/CFR 47: Part 15 Class B
<b>Mechanical</b>	Keycaps	2.0mm +/-0.2mm at 120gf Key travel
<b>Environmental</b>	Operating temperature	10° C to 90° C
	Non-operating temperature	-30° C to 95° C
	Operating humidity	N/A
	Non-operating humidity	10% to 90% (non-condensing at ambient)
	Operating shock	N/A

## Technical Specifications – Input/Output Devices

Non-operating shock	<p>i. Half-Sine Shock – End-Use Handling, Non-Operational                  Sample size: 5pcs.                  Condition: Sample power off.                  Axis: X, Y, Z axis (all 6 faces) – sample normal mode of operation.                  Number of shocks: 1 shock/face.                  Pulse duration: &lt; 3 ms                  Velocity change: 50lps (inch-per-second)- 65lps desired.</p> <p>ii. Trapezoidal Shock- Transportation Environment, Non-Operational                  Sample size: 5pcs.                  Condition: Sample power off.                  Orientation: All six faces: Front, Rear, Left, Right, Bottom, and Top.                  Configuration: As intended for shipment                  Number of shocks: 1 shock/face.                  Minimum faired acceleration: 30G's. Test also at 40 and 50G's to find margin.                  Velocity change: 266lps (inch-per-second) for product mass (m)                  20&lt;m&lt;40lbs.</p>		
	Operating vibration	<b>Frequency (Hz)</b>	<b>Slope (dB/oct)</b>
5-350		0	0.0001
350-500		-6	-
500		-	0.00005
(~0.21G <sub>rms</sub> ) Total Test time: 10 minutes			
Non-operating vibration	<b>Frequency (Hz)</b>	<b>Slope (dB/oct)</b>	<b>PSD (g<sup>2</sup>/Hz)</b>
	5.100	0	0.015
	100-137	-6	-
	137-350	0	0.008
	350-500	-6	-
500	-	0.0039	
Drop (out of box)	76cm on carpet, six-drop sequence		
Drop (in box)	10 times drop including 6 faces, one corner and 3 edges on rigid surface. Drop Height: 91cm		
<b>Approvals</b>	CB, CE, FCC, ICES, EAC, NOM-NYCE SCT, RCM, BIS, VCCI, KC, BSMI		
<b>Ergonomic compliance</b>	TUVGS		

<b>HP Wired Desktop 320M Mouse</b>		
<b>Physical Characteristics</b>	Keys	Left/right key
	Dimensions (L x W x H)	4.09 x 2.50 x 1.40 in (103.8x 63.4 x 35.5 mm)
	Weight	0.16 lb(72g)
<b>Electrical</b>	Operating voltage	5 VDC, +/-0.25V
	Power consumption	100 mA Max
	System interface	USB Port
	ESD	Contact Discharge: 8 KV Air Discharge: 15 KV (Class B)
	EMI - RFI	European Standard EN 55022: 2006+A1: 2007, Class B. FCC/CFR 47: Part 15 Class B



## Technical Specifications – Input/Output Devices

<b>Mechanical</b>	Keycaps	0.3mm key travel			
	Key actuation	75±20g			
	Key life	1million cycles			
	Key structure type	Tact Switch			
	Key-leveling mechanisms	N/A			
<b>Environmental</b>	Operating temperature	10° to 90° C			
	Non-operating temperature	-30° C to 95° C			
	Operating humidity	N/A			
	Non-operating humidity	10% to 90% (non-condensing at ambient)			
	Operating shock	N/A			
	Non-operating shock	i. Half-Sine Shock – End-Use Handling, Non-Operational Sample size: 5pcs. Condition: Sample power off. Axis: X, Y, Z axis (all 6 faces) – sample normal mode of operation. Number of shocks: 1 shock/face. Pulse duration: < 3 ms Velocity change: 50lps (inch-per-second)- 65lps desired.			
		ii. Trapezoidal Shock- Transportation Environment, Non-Operational Sample size: 5pcs. Condition: Sample power off. Orientation: All six faces: Front, Rear, Left, Right, Bottom, and Top. Configuration: As intended for shipment Number of shocks: 1 shock/face. Minimum faired acceleration: 30G's. Test also at 40 and 50G's to find margin. Velocity change: 266lps (inch-per-second) for product mass (m) 20<m<40lbs.			
	Operating vibration	<b>Frequency (Hz)</b>	<b>Slope (dB/oct)</b>	<b>PSD (g<sup>2</sup>/Hz)</b>	
		5-350	0	0.0001	
		350-500	-6	-	
		500	-	0.00005	
		(~0.21G <sub>rms</sub> ) Total Test time: 10 minutes			
	Non-operating vibration	<b>Frequency (Hz)</b>	<b>Slope (dB/oct)</b>	<b>PSD (g<sup>2</sup>/Hz)</b>	
5.100		0	0.015		
100-137		-6	-		
137-350		0	0.008		
350-500		-6	-		
500	-	0.0039			
Drop (out of box)	76cm on carpet, six-drop sequence				
Drop (in box)	N/A				
<b>Approvals</b>	CB, CE, FCC, cULus, ICES, EAC, NOM-NYCE SCT, RCM, VCCI, KC, BSMI				
<b>Ergonomic compliance</b>	TUVGS				

### Technical Specifications – Input/Output Devices

<b>HP 655 wireless Mouse</b>		
<b>Dimensions (H x L x W)</b>	4.74 x 2.75 x 1.63 in (120.29 x 69.97 x 41.39 mm)	
<b>Weight</b>	0.194lb (88g)	
<b>Environmental</b>	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
<b>Electrical</b>	Operating voltage	3 VDC, +/-5%
	Power consumption (typical)	10 mA Max
	Resolution	1,200 DPI (Default)
	Sensor	Pixart PAW3222DB-TJDS
	Tracking speed	10G(max), 1G=9.8m/s <sup>2</sup>
	Tracking acceleration	2.4GHz Wireless
<b>Mechanical</b>	Color	Jack Black
<b>Regulatory approvals</b>	Compliant	CB, CE, FCC, cULus, ICES, IC, TRC, TRA, ICASA, UA, EAC, CNC, ANATEL, NOM-NYCE SCT, IFETEL, MPTC, RCM, PosTel, VCCI, TELECOM, KC, MCMC, IDA, BSMI, NCC, DWLF&M, TP-BY, MOC
<b>Ergonomic compliance</b>	Compliant	TUVGS

<b>HP PS/2 Mouse</b>		
<b>Dimensions (H x L x W)</b>	4.53 x 2.48 x 1.46 in (115.2x 63 x 37 mm)	
<b>Weight</b>	0.22lb (101.6g)	
<b>Environmental</b>	Operating temperature	41° to 122° F (5° to 50° C)
	Non-operating temperature	(-4° to 140° F) (-20° to 60° C)
	Operating humidity	10% to 85% (non-condensing at ambient)
	Non-operating humidity	5% to 95% (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
<b>Electrical</b>	Tracking speed	30 inch/sec (max)
	Tracking acceleration	8G(max), 1G=9.8m/s <sup>2</sup>
	System interface	PS/2
<b>Mechanical</b>	Switch actuation	60±15g nominal peak force with tactile feedback
	Switch life	3 million keystrokes (Life tester)
	Switch type	Contamination-resistant switch membrane

## Technical Specifications – Input/Output Devices

	Key-leveling mechanisms	For all double-wide and greater-length keys
	Cable length	6 ft (1.8 m)
	Color	Jack Black
<b>Regulatory approvals</b>	Compliant	UL, FCC, CE Mark, TUV GS, VCCI, BSMI, RCM, KCC

<b>HP USB 125 (Antimicrobial)/128 Laser Mouse (China only)</b>		
<b>Dimensions (H x L x W)</b>	112 x 63 x 36.2 mm (L x W x H)	
<b>Weight</b>	85 g	
<b>Environmental</b>	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
<b>Electrical</b>	Operating voltage	5 VDC, +/-5%
	Power consumption (typical)	100mA
	Resolution	1,200 DPI
	Sensor	Optical/ Laser USB mouse sensor
	Tracking speed	30 inch/sec (max)
	Tracking acceleration	8G(max), 1G=9.8m/s <sup>2</sup>
<b>Mechanical</b>	Connector	USB
	Cable length	6 ft (1.8 m)
	Color	Jack Black
<b>Regulatory approvals</b>	Compliant	UL, FCC, CE Mark, TUV GS, VCCI, BSMI, RCM, KCC, EAC

## Technical Specifications – Audio/Multimedia

### AUDIO/MULTIMEDIA

Type	Integrated
HD Stereo Codec	Realtek ALC 3252
Audio I/O Ports	Front: Headset connector supports a CTIA and OMTP style headset and is re-taskable as a Line-in, Line-out, Microphone-in or Headphone-out port Rear: Line-out, Line-in*, 3.5mm and support stereo and retasking
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 192 kHz for ADC
Wavetable Syntheses	Yes - Uses OS soft wavetable
Analog Audio	Yes
# of Channels on Line-Out	Stereo (Left & Right channels)

## Technical Specifications – Integrated Webcam and Microphone

### INTEGRATED WEBCAM AND MICROPHONE

#### Integrated Webcam and Microphone

Optional integrated 5 MP Swivel Webcam with integrated dual array digital microphones

Optional integrated 5 MP Swivel Webcam + IR Sensor + Color Light Sensor with integrated dual array digital microphones (Supports Windows Hello)

Optional integrated 16MP binned Swivel Webcam + IR Sensor + Color Light Sensor + Time of Flight Sensor (TOF) (Supports Windows Hello)

**NOTE:** All HP devices which carry the Bang & Olufsen brand are custom-tuned with Bang & Olufsen's acoustical engineers for precise sound experience in business use.

### INTEGRATED FINGERPRINT SENSOR

**Sensor type:** Touch

**Fingerprint matching:** Performed on device

**Anti-Spoofing:** Yes

**Windows Hello Support:** Yes

**Encryption:** On sensor

**FIPS Compliant:** No

## Technical Specifications – Power

**POWER****HP Z1 G9 Tower Desktop PC****Unit Environment and Operating Conditions**

<b>Temperature Range</b>	Operating: 5°C ~35°C Non-Operating: -30°C ~65°C
<b>Relative Humidity</b>	Operating 5% to 90% relative humidity at max inlet temperature Non-Operating 5% to 90% relative humidity at max inlet temperature
<b>Maximum Altitude (unpressurized)</b>	Operating: 5000m Non-operating: 50,000 ft. (15240 m)
<b>80 PLUS Platinum</b>	550W active PFC / 80 PLUS Platinum 260W active PFC / 80 PLUS Platinum 400W active PFC / 80 PLUS Platinum 90/92/89% efficient at 20/50/100% load (115V) 91/93/90% efficient at 20/50/100% load (230V)
<b>Operating Voltage Range</b>	90Vac~264Vac
<b>Rated Voltage Range</b>	100Vac~240Vac
<b>Rated Line Frequency</b>	50HZ~60HZ
<b>Operating Line Frequency</b>	47HZ~63HZ
<b>Rated Input Current with Energy Efficient* Power Supply</b>	260W Platinum $\leq$ 3.1A 400W Platinum $\leq$ 5.2A 550W Platinum $\leq$ 6.6A
<b>DC Output</b>	+12V
	1. Service parts obtained after purchase may not be low halogen.
<b>Current Leakage (NFPA 99: 2102)</b>	Less than 500 microamps of leakage current at 264 Vac with the ground wire disconnected, as required for Non-patient Electrical Appliances and Equipment used in a patient care facility or that contact patients in normal use. Per section 10.3.5.1. Less than 100 microamps of leakage current at 264 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.
<b>Power Supply Fan</b>	70mm variable speed
<b>Power cord length</b>	6.0 ft. (1.83 m) <sup>2</sup>
<b>External Power Adapter</b>	Internal power supply
<b>Dimensions</b>	165mm x 95mm x 73mm
<b>Total Cord Length</b>	6.0 ft. (1.83 m)

1. Power cord length will be varied from different type of cords start from 1.8m.

2. The length of India power cord is 2.0m

## Technical Specifications – Power

Condition	90/92/89%	Input Voltage
10% of Rated Load	86%	115Vac/60HZ
20% of Rated Load	90%	115Vac/60HZ
50% of Rated Load	92%	115Vac/60HZ
	PF>0.95	
100% of Rated Load	89%	115Vac/60HZ
	PF>0.9	230Vac/50HZ

Technical Specifications – Miscellaneous Features

## WEIGHTS & DIMENSIONS

<b>Chassis (W x D x H)</b>	6.1 x 12.13 x 13.27 in 155 x 308 x 337 mm
<b>System Volume</b>	981.9 cu in 16.1 L
<b>System Weight</b>	13.56 lb 6.15 kg
<b>Max Supported Weight (desktop orientation)</b>	77.16 lb 35 kg
<b>Stand Dimensions</b>	N/A
<b>Packaging (W x D x H)</b>	15.75 x 19.65 x 11.30 in (400 x 499 x 287 mm) <b>MPP:</b> 15.75 x 19.65 x 11.30 in (400 x 499 x 287 mm)
<b>Shipping Weight</b>	19.54 lbs (8.87 kg) <b>MPP:</b> 20.35 lbs (9.24kg)
<b>Multipack Packaging (10 units)</b>	6-units per layer 8 layer max 48 per pallet 47.24 x 39.37 x 95.12 in, 1200 x 1000 x 2416 mm (including pallet)
<b>Palletization Profile</b>	6-units per layer 8 layer max 48 per pallet 47.24 x 39.37 x 95.12 in, 1200 x 1000 x 2416 mm (including 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
- 1 Aux Power LED on System PCA
- Processor ZIF Socket for easy Upgrade
- Over-Temp Warning on Screen (Requires IM Agents)
- 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
- Tool-less Hard Drive, CD & Diskette Removal (For MT, SFF, and DM only)
- Green Pull Tabs, and Quick Release Latches for easy Identification

## Technical Specifications – Miscellaneous Features

### Additional Features

#### Tower Orientation

#### Description

Product can be oriented as either a desktop (horizontal) or a 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 (for SATA hard drive only)

A diagnostic hard drive self- test. It scans critical physical components and every sector of the hard drive for physical faults and then reports any faults to the user

Running independently of the operating system, it can be accessed through a Windows-based diagnostics utility or through the computer's setup procedure. It produces an evaluation on whether the hard drive is the source of the problem and needs to be replaced

The system expands on the Self-Monitoring, Analysis, and Reporting Technology (SMART), a continuously running systems diagnostic that alerts the user to certain types of failures

#### SMART Technology (Self-Monitoring, Analysis and Reporting Technology)

Allows hard drives to monitor their own health and to raise flags if imminent failures were predicted

#### SMART I - Drive Failure Prediction

Predicts failures before they occur. Tracks fault prediction and failure indication parameters such as re-allocated sector count, spin retry count, calibration retry count

#### SMART II - Off-Line Data Collection

By avoiding actual hard drive failures, SMART hard drives act as "insurance" against unplanned user downtime and potential data loss from hard drive failure

#### SMART III - Off-Line Read Scanning with Defect Reallocation

IOEDC: I/O Error Detection Circuitry

#### SMART IV - End-to-End CRC for hard drives

Detects errors in Read/Write buffers on HDD cache RAM

## AFTER MARKET OPTIONS

<b>Graphics Solutions</b>	<b><u>Part Number</u></b>
NVIDIA® T400 2GB GDDR6 3mDP	340K8AA
NVIDIA® T400 4GB GDDR6 3mDP	5Z7E0AA
HP DisplayPort to HDMI True 4k Adapter	2JA63AA
HP DVI Cable Kit	DC198A
HP HDMI Standard Cable Kit	T6F94AA
HP DisplayPort to VGA Adapter	AS615AA
HP DisplayPort to DVI-D Adapter	FH973AA
HP USB-C To DisplayPort Adapter	N9K78AA
<b>Data Storage Drives</b>	
HP PCIe NVME TLC M.2 256GB SSD	1CA51AA
HP PCIe NVME TLC M.2 512GB SSD	X8U75AA
HP PCIe Gen 4 NVME TLC M.2 512GB SSD	406L8AA
HP PCIe Gen 4 NVME TLC M.2 1TB SSD	406L7AA
HP 500GB 7200PRM SATA 3.5" Hard Drive	QK554AA
HP 1TB 7200rpm SATA 3.5" Hard Drive	QK555AA
<b>Input Devices</b>	
HP 125 Wired Keyboard	266C9AA
HP 225 Antimicrobial Wired Mouse and Keyboard Combo (China only)	286K3AA
HP 225 Wired Mouse and Keyboard Combo	286J4AA
HP 125 Wired Mouse	265A9AA
HP 128 Laser Wired Mouse	265D9AA
HP Wired Desktop 320K Keyboard	9SR37AA
HP Wired Desktop 320M Mouse	9VA80AA
HP Wired Desktop 320MK Mouse and Keyboard	9SR36AA
HP USB Business Slim CCID SmartCard Keyboard	Z9H48AA
HP 655 Wireless Keyboard and Mouse Combo	4R009AA
HP 455 Programmable Wireless Keyboard	4R177AA
HP USB Keyboard and Mouse Healthcare Edition <sup>1</sup>	1VD81AA
1. Only available in NA/EMEA regions	
<b>System Memory</b>	<b><u>Part Number</u></b>
HP 8GB DDR5-4800 UDIMM	4M9X9AA
HP 16GB DDR5-4800 UDIMM	4M9Y0AA
HP 32GB DDR5-4800 UDIMM	4M9Y2AA
<b>Multimedia Devices</b>	<b><u>Part Number</u></b>

### Technical Specifications – After Market Options

HP S101 Speaker Bar	5UU40AA
HP Stereo 3.5mm Headset G2	428K7AA
HP Stereo USB Headset G2	428K6AA
HyperX Cloud MIX – Gaming Headset (Black-Gunmetal)	4P5K9AA
HyperX Cloud Flight – Wireless Gaming Headset (Black-Red)	4P5L4AA
HyperX Cloud Stinger Core – Gaming Headset (Black)	4P4F4AA
HyperX Cloud Core + 7.1 Gaming Headset (Black)	4P4F2AA
HyperX SoloCast USB WHT Microphone (Black)	4P5P8AA
<b>Security Devices</b>	<b><u>Part Number</u></b>
HP Business PC Security Lock v3 Kit	3XJ17AA
HP Keyed Cable Lock 10mm	T1A62AA
HP Master Keyed Cable Lock 10mm	T1A63AA
HP Sure Key Cable Lock	6UW42AA
<b>I/O Devices</b>	<b><u>Part Number</u></b>
HP DisplayPort Port Flex IO v2	13L54AA
HP Type-C® USB 3.1 Gen2 Port Flex IO v2	13L59AA
HP USB 3.1 Gen1 x2 Module Flex IO v2	13L58AA
HP VGA Port Flex IO v2	13L53AA
HP Serial Port Flex IO v2	13L56AA
HP Internal Serial Port (in rear wall)	3TK82AA
HP PCIe x1 Parallel Port Card	N1M40AA
HP Serial/PS/2 Adapter Kit (in PCIe slot)	1VD82AA
HP USB to Serial Port Adapter	J7B60AA
HP USB-C to Display Port Adapter	N9K78AA
HP USB Type-C Extension Cable Kit (5M)	<u>9JH45AA</u>
HP Serial Port v3 Flex IO	<u>5B895AA</u>
HP HDMI Port Flex IO v2	<u>13L55AA</u>
HP Parallel Port Adapter	KD061AA
<b>NOTE:</b> For more detail on HP I/O Devices please refer to the <a href="http://h20195.www2.hp.com/v2/GetDocument.aspx?docname=c06042607">HP FLEX IO Option Cards QuickSpecs</a> . URL is: <a href="http://h20195.www2.hp.com/v2/GetDocument.aspx?docname=c06042607">http://h20195.www2.hp.com/v2/GetDocument.aspx?docname=c06042607</a>	
<b>Communication Devices</b>	<b><u>Part Number</u></b>
Intel® Ethernet I225-T1 GbE NIC	<u>406L9AA</u>

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Date	Version History	Action	Description of Change
March 16, 2022	From v1 to v2	Changed	Social and Environmental Responsibility section
June 1, 2022	From v2 to v3	Changed	Graphics section
July 1, 2022	From v3 to v4	Changed	Graphics and AFTER MARKET OPTIONS sections
October 1, 2022	From v4 to v5	Changed	AFTER MARKET OPTIONS section
December 7, 2022	From v5 to v6	Changed	Format
December 15, 2022	From v6 to v7	Changed	GRAPHICS section
March 1, 2023	From v7 to v8	Changed	Manageability section
March 30, 2023	From v8 to v9	Changed	Processors section
April 25, 2023	From v9 to v10	Changed	STORAGE, POWER, CERTIFICATION AND COMPLIANCE sections
May 1, 2023	From v10 to v11	Changed	AFTER MARKET OPTIONS section
May 22, 2023	From v11 to v12	Changed	GRAPHICS section
June 1, 2023	From v12 to v13	Changed	Image page 2, GRAPHICS, PROCESSORS sections