

**ANNEX 4b. PROPOSICIÓ TÈCNICA – Lot 2**

El senyor Carlos Torruella García amb DNI 39683651A com a apoderat declara sota la seva responsabilitat, com a licitador/a de l'Acord marc de subministrament d'equips informàtics i determinades llicències de programari amb destinació a les entitats locals de Catalunya (expedient 2018.09) que l'empresa ICOT, Informàtica i Comunicacions de Tarragona, S.A. amb CIF A43132422, fa la següent proposta tècnica, d'acord amb les característiques tècniques que es detallen seguidament,

**LOT 1 - PORTÀTILS**
**Sublot 2.1**
**Estàndard i3 – Portàtil HP ProBook 450 G7**

Portàtil resolució 1366 x 768, antirreflectant amb retro il·luminació WLED de 15,6" (SI)

Windows 10 Pro (64 bits) (SI)

**Intel Core i3-10110U (2.1 / 4.1Ghz, 4Mb, 2Cores)**

Memòria DDR4 de 4GB

Disc dur 128Gb SSD

T. Gràfica Intel UHD (SI)

**Realtek 802.11ac, 2x2 + BT5**

Bateria integrada (fins 13h 30m autonomia)

Adaptador de CA 45Watt

Càmera inclosa 720p

Energy Star 7.1

Garantia 48 mesos fabricant

**Sublot 2.2**
**Avançat i5 – Portàtil HP ProBook 650 G5**

Ordinador Portàtil resolució FHD 1920 x 1080, antirreflectant amb retro il·luminació WLED de 15,6" (SI)

Windows 10 Pro (64 bits) (SI)

**Intel Core i5-8265U (1.6 / 3.9Ghz, 6Mb, 4Cores)**

Memòria DDR4 de 8GB

Sense DVD (SI)

T. Gràfica Intel UHD 620 (SI)

**Intel 9560 ac, 2x2 + BT5**

Disc dur 256Gb SSD

Bateria integrada (fins a 15h autonomia)

Adaptador de CA 45Watt

Càmera inclosa 720p

Energy Star 7.1

Garantia 48 mesos fabricant

Exp. 2018.09

Sublot 2.3
<b>Ultra Book i7 - Portàtil HP ProBook 640 G5</b>
Ordinador Portàtil LCD WLED Full HD (1920 x 1080) antirreflectant No tàctil de 14,0" amb càmera i micròfon, compatible amb WLAN + WWAN (SI)
Windows 10 Pro (64 bits) (SI)
<b>Core i7-8565U</b> , targeta gràfica Intel® UHD 620, lector de targetes intel·ligents
Memòria DDR4 de <b>8GB</b>
Disc dur <b>256Gb</b> SSD
<b>Intel 9560 ac, 2x2 + BT5 + Intel 7360 LTE</b>
Bateria integrada (fins a 15h autonomia)
Adaptador de CA <b>45Watt</b>
Energy Star <b>7.1</b>
Garantia <b>48</b> mesos fabricant

Aquest document degudament complimentat haurà d'adjuntar les fitxes tècniques o catàleg de cadascun dels elements objecte de la unitat de licitació.

I per què consti, signo aquesta declaració responsable.

A Tarragona, 07 de juliol de 2020  
 Sig. Carlos Torruella García

Estàndar i3 – Portàtil HP ProBook 450 G7	
Processador	Intel Core i3-10110U (2.1Ghz / 4.1Ghz, 4Mb, 2Cores)
Memòria	4GB (1x4GB) DDR4 2666; ampliació màxima 32Gb
Disc dur	128GB Solid State M2 SATA-3 Three Layer Cell Drive
Gràfics	Intel UHD Graphics
Pantalla	15.6 inch HD (1366x768) Anti-Glare LED SVA for HD Webcam with 2 Antennas Slim + Webcam 720p
Ports	(1) USB Type-C; (2) USB 3.1; (1) USB USB 2.0, (1) HDMI, (1) RJ45 Gigabit; (1) auriculars/micro
Pes	2kgs
Comunicacions	Wifi ac 2x2 +Bluetooth 5 WW
Bateria	Autonomia fins 13h i 30 minuts
Certificacions mediambientals	ENERGY STAR 7.1; IT ECO Declaration, TCO 5.0
Sistema operatiu	Windows 10 Pro 64
Garantia	48 mesos de fabricant

Avançat i5 – Portàtil HP ProBook 650 G5	
Processador	Intel Core i5-8265U (1.6Ghz / 3.9Ghz, 6Mb, 4Cores)
Memòria	8GB (1x8GB) DDR4 2400; ampliació màxima 64Gb
Disc dur	256GB PCIe NVMe Value Solid State Drive
Gràfics	Intel UHD Graphics 620
Pantalla	15.6 inch FHD (1920x1080) Anti-Glare LED UWVA 250 for WWAN for HD Webcam slim
Ports	(1) USB Type-C; (2) USB 3.1; (1) HDMI, (1) VGA; (1) RJ45 Gigabit; (1) auriculars/micro
Pes	2.18kgs
Comunicacions	Wifi ac 2x2 +Bluetooth 5 WW
Bateria	Autonomia fins 15h
Certificacions mediambientals	ENERGY STAR 7.1; IT ECO Declaration, TCO 5.0
Sistema operatiu	Windows 10 Pro 64
Garantia	48 mesos de fabricant

UltraBook i7 – Portàtil HP ProBook 640 G5	
Processador	Intel Core i7-8565U (1.8Ghz / 4.6Ghz, 8Mb, 4Cores)
Memòria	8GB (1x4GB) DDR4 2666; ampliació màxima 32Gb
Disc dur	256GB PCIe NVMe Value Solid State Drive
Gràfics	Intel UHD Graphics
Pantalla	14.0 inch FHD (1920x1080) Anti-Glare LED UWVA 250 for WWAN for HD Webcam slim
Ports	(1) USB Type-C; (3) USB 3.1; (1)HDMI, (1) VGA; (1) RJ45 Gigabit; (1) auriculars/micro
Pes	1.7kgs
Comunicacions	Intel 9560 ac 2x2 MU-MIMO nvP160MHz+BT5WW + Intel 7360 LTE-Advanced (Cat 9)
Bateria	Autonomia fins 15h i 30 minuts
Certificacions mediambientals	ENERGY STAR 7.1; IT ECO Declaration, TCO 5.0
Sistema operatiu	Windows 10 Pro 64
Garantia	48 mesos de fabricant

### Overview

### HP ProBook 450 G7 Notebook PC



#### Left

- |   |  |
|---|--|
| 1. Internal Microphones (2)                     | 7. SD Card Reader                                      |
| 2. Webcam (Optional)                            | 8. Thermal Vent  |
| 3. Privacy Shutter (Only available with webcam) | 9. USB 2.0 Port  |
| 4. Webcam LED                                   | 10. Standard Security Lock Slot (Lock sold separately) |
| 5. Clickpad                                     | 11. Power Button                                       |
| 6. Hard Drive LED                               |  |

### Overview



#### Right

- |                                   |  |
|-----------------------------------|--|
| 1. Power Connector                | 5. USB 3.1 Gen 1 Port                    |
| 2. USB Type-C™ 3.1 Gen 1 Port     | 6. USB 3.1 Gen 1 Port                    |
| 3. Ethernet Port (RJ-45)          | 7. Headphone/Microphone Combo Jack       |
| 4. HDMI Port (Cable not included) | 8. HP Fingerprint Sensor (select models) |

### Overview

#### At a Glance

- Preinstall Windows 10 or FreeDOS
- Choice of 10th Generation Intel® Core™ i7, i5, i3 processors
- Display include your choice of 39.62 cm (15.6") diagonal HD, Ultra Wide Viewing Angle FHD, Touch or Non-Touch screen, and Privacy Panel option
- Optional Nvidia GeForce MX250 and MX130 with 2 GB GDDR5 dedicated video memory or integrated Intel® UHD Graphics, Premium
- Enhanced security features including TPM 2.0, HP Sure Sense, HP Sure Start Gen5, HP BIOSphere, Hardware enforced Firmware Protection, optional Fingerprint Sensor<sup>4</sup> (select models), optional IR camera, and optional Privacy Panel
- Passed 19 MIL-STD 810 G testing<sup>1</sup>
- Weight starting at 4.41 lbs (2.0 kgs)<sup>3</sup>
- HP Long-Life Rechargeable battery, with HP Fast Charge Technology recharges 50% in 30 minutes<sup>2</sup>
- Supports wireless LAN and wireless WAN options for connectivity on the go
- Up to 512 GB Solid State Drives and 1 TB Hard Drive
- Up to 32 GB total system memory
- 720p HD webcam, IR camera for face authentication with Windows Hello
- Spill-resistant and optional backlit Keyboard, and Clickpad with multi-touch gestures enabled, taps enabled as default

1. MIL STD 810G testing is not intended to demonstrate fitness for U.S. Department of Defense contract requirements or for military use. Test results are not a guarantee of future performance under these test conditions. Damage under the MIL STD test conditions or any accidental damage requires an optional HP Accidental Damage Protection Care Pack
2. Recharges the battery up to 50% within 30 minutes when the system is off or in standby mode when used with the power adapter provided with the notebook. After charging has reached 50% capacity, charging speed will return to normal. Charging time may vary +/-10% due to System tolerance.
3. Does not include power adapter.
4. HP Fingerprint Sensor is an optional feature and requires configuration at purchase.

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

---

### Technical Specifications

## PRODUCT NAME

HP ProBook 450 G7 Notebook PC

---

## OPERATING SYSTEMS

<b>Preinstalled</b>	Windows 10 Pro 64 <sup>1</sup> Windows 10 Pro 64 (National Academic only) <sup>2</sup> Windows 10 Home 64 <sup>1</sup> Windows 10 Home Single Language 64 <sup>1</sup> Windows 10 Pro (Windows 10 Enterprise available with a Volume Licensing Agreement) <sup>1</sup> FreeDOS
---------------------	---

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

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

---

## PROCESSORS

Intel® Core™ i7-10510U processor with Intel® UHD Graphics, Premium (1.8 GHz base frequency, up to 4.9 GHz with Intel® Turbo Boost Technology, 8 MB L3 cache, 4 cores)<sup>3,4,5,6,7</sup>

Intel® Core™ i5-10210U processor with Intel® UHD Graphics, Premium (1.6 GHz base frequency, up to 4.2 GHz with Intel® Turbo Boost Technology, 6 MB L3 cache, 4 cores)<sup>3,4,5,6,7</sup>

Intel® Core™ i3-10110U processor with Intel® UHD Graphics, Premium (2.1 GHz base frequency, up to 4.1 GHz with Intel® Turbo Boost Technology, 4 MB L3 cache, 2 cores)<sup>3,4,5,6,7</sup>

### Processors Family

10th Generation Intel® Core™ i7 processor (i7-1050U)<sup>7</sup>

10th Generation Intel® Core™ i5 processor (i5-10210U)<sup>7</sup>

10th Generation Intel® Core™ i3 processor (i3-10110U)<sup>7</sup>

3. 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 at your hardware and software configurations. Intel's numbering, branding and/or naming is not a measurement of higher performance.

4. Processor speed denotes maximum performance mode; processors will run at lower speeds in battery optimization mode.

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

6. Max Boost clock frequency performance varies depending on hardware, software and overall system configuration.

7. In accordance with Microsoft's support policy, HP does not support the Windows 8 or Windows 7 operating system on products configured with Intel and AMD 7th generation and forward processors or provide any Windows 8 or Windows 7 drivers on <http://www.support.hp.com>.

---



### Technical Specifications

---

## CHIPSET

Integrated with processor

---

## GRAPHICS

### Integrated

Intel® UHD Graphics, Premium<sup>8</sup>

### Discrete

NVIDIA® GeForce® MX130 (2 GB DDR5 dedicated)<sup>9</sup>

NVIDIA® GeForce® MX250 (2 GB DDR5 dedicated)<sup>9</sup>

### Supports

Support HD decode, DX12, HDMI 1.4b up to 4K 30Hz

Support CUDA, Optimus, PhysX, GPU Boost 2.0

8. HD content required to view HD images.

9. Integrated graphics depends on processor. NVIDIA® Optimus™ technology requires an Intel processor, plus an NVIDIA® GeForce® discrete graphics configuration and is available on Windows 10 Pro OS. With NVIDIA® Optimus™ technology, full enablement of a discrete graphics video and display features may not be supported on all systems (e.g. OpenGL applications will run on the integrated GPU or the APU as the case may be).

---

## DISPLAYS

### Technical Specifications

#### Non-Touch

39.6 cm (15.6") diagonal HD SVA eDP anti-glare slim, 220 nits, 45% NTSC two WLAN antennas (1366 x 768)<sup>8,11</sup>

39.6 cm (15.6") diagonal HD SVA eDP anti-glare slim, 220 nits, 45% NTSC for HD camera and two WLAN antennas (1366 x 768)<sup>8,11</sup>

39.6 cm (15.6") diagonal HD SVA eDP anti-glare slim, 220 nits, 45% NTSC for HD+IR camera and two WLAN antennas (1366 x 768)<sup>8,11</sup>

39.6 cm (15.6") diagonal HD SVA eDP anti-glare slim, 220 nits, 45% NTSC for HD camera, WWAN and two WLAN antennas (1366 x 768)<sup>8,11</sup>

39.6 cm (15.6") diagonal FHD IPS eDP anti-glare slim, 250 nits, 45% NTSC and two WLAN antennas (1920 x 1080)<sup>8,11</sup>

39.6 cm (15.6") diagonal FHD IPS eDP anti-glare slim, 250 nits, 45% NTSC fro HD camera and two WLAN antennas (1920 x 1080)<sup>8,11</sup>

39.6 cm (15.6") diagonal FHD IPS eDP anti-glare slim, 250 nits, 45% NTSC fro HD+IR camera and two WLAN antennas (1920 x 1080)<sup>8,11</sup>

39.6 cm (15.6") diagonal FHD IPS eDP anti-glare slim, 250 nits, 45% NTSC fro HD camera, WWAN and two WLAN antennas (1920 x 1080)<sup>8,11</sup>

39.6 cm (15.6") diagonal FHD IPS eDP + PSR anti-glare flat with HP Sure View Integrated Privacy Screen, 1000 nits, 72% NTSC for HD camera and two WLAN antennas (1920 x 1080)<sup>8,11,12\*</sup>

39.6 cm (15.6") diagonal FHD IPS eDP + PSR anti-glare flat with HP Sure View Integrated Privacy Screen, 1000 nits, 72% NTSC for HD+IR camera and two WLAN antennas (1920 x 1080)<sup>8,11,12\*</sup>

#### Touch

39.6 cm (15.6") diagonal FHD IPS eDP On-Cell slim touch screen, 250 nits, 45% NTSC for HD camera and two WLAN antennas (1920 x 1080)<sup>8,10,11</sup>

39.6 cm (15.6") diagonal FHD IPS eDP On-Cell slim touch screen, 250 nits, 45% NTSC for HD camera, WWAN and two WLAN antennas (1920 x 1080)<sup>8,10,11</sup>

#### HDMI

Supports resolutions up to 4K 30Hz

#### Display Size

15.6"

39.6 cm (15.6")

8. HD content required to view HD images.

10. Sold separately or as an optional feature.

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

12. HP Sure View integrated privacy screen is an optional feature that must be configured at purchase and is designed to function in landscape orientation.

\*Touch-enabled display and Sure View privacy panel will lower actual brightness

### Technical Specifications

Docking station model	Total number of supported displays (incl. the notebook display)	Max. resolutions supported	Dock Connectors	Technical limitations
HP Thunderbolt Dock 120W G2	3	Dual 4k @60Hz	2xDP, 1xVGA, 1xTB,1xUSB-C alt-mode	Dual 4k only with one display in to DP and + TB port or USB-C alt mode + TB port
HP USB-C Dock G4	3	Dual 2K @ 60Hz Single 4K @ 60Hz (3840 x 1440)	1xHDMI, 2xDP	
HP USB-C Universal Dock	3	Dual 4K @ 60Hz Single 5K @ 60Hz	2xDP	
HP USB-C Travel Dock	2	Single 2K @ 60Hz	1xHDMI, 1xVGA	Single external display Only HDMI or VGA at the time
HP USB-C Mini Dock	2	Single 4K @ 30Hz	1xHDMI, 1xVGA	Single external display Only HDMI or VGA at the time
HP USB-C/A Universal Dock G2	3	Dual 2.5K @ 60Hz	2xDP, 1xHDMI	
HP USB-C Dock G5	3	Dual 2.5K @ 60Hz or 4K @ 60Hz + FHD @ 60Hz	2xDP, 1xHDMI	

## STORAGE AND DRIVES

### Primary Storage

500 GB 7200 rpm SATA<sup>13</sup>

1 TB 5400 rpm SATA<sup>13</sup>

### Primary M.2 Storage

128 GB M.2 SATA TLC Solid State Drive<sup>13</sup>

256 GB PCIe® NVMe™ M.2 Value Solid State Drive<sup>13</sup>

256 GB Intel® PCIe® NVMe™ QLC M.2 SSD with 16 GB Intel® Optane™ memory H10<sup>13,14,15</sup>

512 GB PCIe® NVMe™ M.2 TLC Solid State Drive<sup>13</sup>

512 GB PCIe® NVMe™ M.2 Value Solid State Drive<sup>13</sup>

512 GB Intel® PCIe® NVMe™ QLC M.2 SSD with 32 GB Intel® Optane™ memory H10<sup>13,14,15</sup>

13. For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 30 GB (for Windows 10) reserved for system recovery software.

14. Intel® Optane™ memory system acceleration does not replace or increase the DRAM in your system. Requires 8th Gen or higher Intel® Core™ processor, BIOS version with Intel® Optane™ supported, Windows 10 64-bit, and an Intel® Rapid Storage Technology (Intel® RST) driver.

15. Intel® Optane™ memory H10 only for Intel® PCIe® NVMe™ QLC M.2 SSD.

## MEMORY

### Technical Specifications

#### Maximum Memory

32 GB DDR4-2666 SDRAM<sup>16</sup>

#### Memory

32 GB DDR4-2666 SDRAM (2 x 16 GB)<sup>16</sup>

16 GB DDR4-2666 SDRAM (1 x 16 GB)<sup>16</sup>

12 GB DDR4- 2666 SDRAM (4 GB and 8 GB (1 x 8 GB))<sup>16</sup>

8 GB DDR4-2666 SDRAM (1 x 8 GB)<sup>16</sup>

8 GB DDR4-2666 SDRAM (2 x 4 GB)<sup>16</sup>

4 GB DDR4-2666 SDRAM (1 x 4 GB)<sup>16</sup>

#### Memory Slots

2 SODIMM

Both slots are customer accessible / upgradeable

DDR4 PC4 SODIMMS (Comet Lake runs at 2666)

Supports Dual Channel Memory

16. Due to the non-industry standard nature of some third-party memory modules, we recommend HP branded memory to ensure compatibility. If you mix memory speeds, the system will perform at the lower memory speed.

## NETWORKING/COMMUNICATIONS

#### WLAN

Realtek 802.11ac (2x2) WLAN and Bluetooth® 5 Combo<sup>17</sup>

Intel® Dual Band Wireless-AC 9560 802.11a/b/g/n/ac (2x2) WLAN and Bluetooth® 5 Combo, non-vPro<sup>TM17</sup>

Intel® Dual Band Wi-Fi 6 AX201 802.11a/b/g/n/ac (2x2) WLAN and Bluetooth® 5 Combo, non-vPro<sup>TM17</sup>

#### WWAN

Intel® XMM<sup>TM</sup> 7360 LTE-Advanced (Cat9)<sup>18</sup>

#### Ethernet

Realtek 10/100/1000 GbE NIC<sup>19</sup>

17. Wireless access point and Internet service required and sold separately. Availability of public wireless access points limited. The specifications for the 802.11ac WLAN are draft specifications and are not final. If the final specifications differ from the draft specifications, it may affect the ability of the notebook to communicate with other 802.11ac WLAN devices.

18. WWAN module is optional, must be configured at the factory and requires separately purchased service contract. Check with service provider for coverage and availability in your area. Connection speeds will vary due to location, environment, network conditions, and other factors. 4G LTE not available on all products, in all regions.

19. The term "10/100/1000" or "Gigabit" Ethernet indicates compatibility with IEEE standard 802.3ab for Gigabit Ethernet, and does not connote actual operating speed of 1 Gb/s. For high-speed transmission, connection to a Gigabit Ethernet server and network infrastructure is required.

## AUDIO/MULTIMEDIA

### Technical Specifications

**Audio**

2 Integrated Stereo Speakers  
Integrated microphone (Mono or Dual Array)

**Speaker Power**

2W/4ohm Per speaker

**Camera**

720p HD Camera<sup>8</sup>  
720p HD Camera+IR Camera<sup>8,10</sup>

8. HD content required to view HD images.  
10. Sold separately or as an optional feature.

---

## KEYBOARDS/POINTING DEVICES/BUTTONS & FUNCTION KEYS

**Keyboard**

HP Premium Keyboard, spill resistant with optional backlit function

**Pointing Device**

Clickpad with multi-touch gesture support

**Function Keys**

F1 - Display Switching  
F2 - Blank or SureView On/Off  
F3 - Brightness Down  
F4 - Brightness Up  
F5 - Audio Mute  
F6 - Volume Down  
F7 - Volume Up  
F8 - Mic Mute  
F9 - Blank or Backlit Toggle  
F10 - NumLk  
F11 - Wireless  
F12 - Sleep

**Hidden Functions**

Fn+R - Break  
Fn+S - Sys Rq  
Fn+C - Scroll Lock

---

## SOFTWARE AND SECURITY

**BIOS**

HP BIOSphere Gen5<sup>20</sup>  
HP Drive Lock & Automatic Drive Lock<sup>21</sup>  
BIOS Update via Network  
Master Boot Record Security  
Power On Authentication

---

### Technical Specifications

Secure Erase<sup>22</sup>

Absolute Persistence Module<sup>23</sup>

Pre-boot Authentication

#### Software

HP Connection Optimizer

HP Image Assistant

HP Hotkey Support

HP JumpStart

HP Support Assistant<sup>24</sup>

HP Noise Cancellation Software

Buy Office (Sold separately)

#### Manageability Features

HP Driver Packs<sup>25</sup>

HP System Software Manager (SSM)

HP BIOS Config Utility (BCU)

HP Client Catalog

HP Manageability Integration Kit Gen3<sup>26</sup>

#### Client Security Software

HP Client Security Manager Gen5<sup>27</sup>

HP Fingerprint Sensor (select models)<sup>28</sup>

Windows Defender<sup>29</sup>

#### Security Management

Pre-boot Authentication

TPM 2.0 Embedded Security Chip shipped with Windows 10 (Common Criteria EAL4+ Certified)

USB Enable/Disable (via BIOS)

Power-On Password (via BIOS)

Setup Password (via BIOS)

Support for chassis padlocks and cable lock devices

HP Sure Click<sup>30</sup>

HP Sure Start Gen5<sup>31</sup>

HP Sure Sense<sup>32</sup>

20. HP BIOSphere Gen5 is available on select HP Pro and Elite PCs. See product specifications for details. Features may vary depending on the platform and configurations.

21. HP Drive Lock & Automatic Drive Lock is not supported on NVMe drives

22. 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™.

23. Absolute agent is shipped turned off, and will be activated when customers activate a purchased subscription. Subscriptions can be purchased for terms ranging multiple years. Service is limited, check with Absolute for availability outside the U.S. The Absolute Recovery Guarantee is a limited warranty. Certain conditions apply. For full details visit:

<http://www.absolute.com/company/legal/agreements/> computrace-agreement. Data Delete is an optional service provided by Absolute Software. If utilized, the Recovery Guarantee is null and void. In order to use the Data Delete service, customers must first sign a Pre-Authorization Agreement and either obtain a PIN or purchase one or more RSA SecurID tokens from Absolute Software.

24. HP Support Assistant requires Windows and Internet access.

### Technical Specifications

25. HP Driver Packs not preinstalled, however available for download at <http://www.hp.com/go/clientmanagement>.
26. HP Manageability Integration Kit can be downloaded from <http://www.hp.com/go/clientmanagement>.
27. HP Client Security Manager Gen5 requires Windows and is available on the select HP Pro and Elite PCs. See product specifications for details.
28. HP Fingerprint Sensor is an optional feature and requires configuration at purchase.
29. Windows Defender Opt in and internet connection required for updates.
30. HP Sure Click is available on select HP platforms and supports Microsoft® Internet Explorer, Google Chrome, and Chromium™. Supported attachments include Microsoft Office (Word, Excel, PowerPoint) and PDF files in read only mode. Check <http://h20195.www2.hp.com/v2/GetDocument.aspx?docname=4AA7-0922ENW> for all compatible platforms as they become available.
31. HP Sure Start Gen5 is available on select HP PCs with Intel processors. See product specifications for availability.
32. HP Sure Sense requires Windows 10. See product specifications for availability.

---

## POWER

### Power Supply

- HP Smart 65 W External AC power adapter<sup>33</sup>
- HP Smart 65 W EM External AC power adapter<sup>33</sup>
- HP Smart 65 W USB Type-C™ adapter<sup>33</sup>
- HP Smart 45 W External AC power adapter<sup>33</sup>
- HP Smart 45 W USB Type-C™ adapter<sup>33</sup>

### Primary Battery

3-cell, 45 Wh Long Life Li-ion<sup>34</sup>

### Battery Life

Up to 13 hours and 30 minutes<sup>35</sup>

### Power Cord

- 3-Wire Plug - 1m<sup>33</sup>
- 3-Wire Plug - 1.8m<sup>33</sup>
- 2-Wire Plug - 1m<sup>33</sup>
- Duckhead Power Cord- 1m<sup>33</sup>
- Duckhead Power cord- 1.8m<sup>33</sup>

### Battery Weight

- 0.49 lb
- 0.22 kg

33. Availability may vary by country.

34. Battery is internal and not replaceable by customer. Serviceable by warranty.

35. Windows 10 MM14 battery life will vary depending on various factors including product model, configuration, loaded applications, features, use, wireless functionality, and power management settings. The maximum capacity of the battery will naturally decrease with time and usage. See <http://www.bapco.com> for additional details.

## WEIGHTS & DIMENSIONS

### Technical Specifications

#### Weight

Starting at 4.41 lbs (Non-touch); Starting at 4.48 lbs (Touch)<sup>36</sup>

Starting at 2 kgs (Non-touch); Starting at 2.03 kgs (Touch)<sup>36</sup>

Does not include power adapter.

#### Dimensions (w x d x h)

14.37 x 10.11 x 0.75 in

36.49 x 25.69 x 1.9 cm

36. Weight will vary by configuration.

---

## PORTS/SLOTS

1 USB 3.1 Type-C™ Gen 1 (Power delivery, DisplayPort™)

2 USB 3.1 Gen 1

1 USB 2.0 (Powered port)

1 HDMI 1.4b<sup>37</sup>

1 RJ-45

1 AC power

1 Headphone/Microphone Combo Jack

1 Standard Security Lock

#### Expansion Slots

1 SD

Supports SD, SDHC, SDXC

37. HDMI cable sold separately.

---

## SERVICE AND SUPPORT

HP Services offers 3-year and 1-year limited warranties and 90 day software limited warranty options depending on country. Batteries have a default one year limited warranty except for Long Life Batteries which will have same 1-year or 3-year limited warranty as the platform. On-site service and extended coverage is also available. HP Care Pack Services are optional extended service contracts that go beyond the standard limited warranties. To choose the right level of service for your HP product, use HP Care Pack Services Lookup Tool at: <http://www.hp.com/go/cpc>.<sup>38</sup>

38. HP Care Packs are sold separately. 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 <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.

---

## COMPATIBILITY

---



### Technical Specifications

HP TB Dock 120W w/Audio	3YE87AA
HP USB-C Mini Dock	1PM64AA
HP E243d Docking Monitor	1TJ76AA

## CERTIFICATION AND COMPLIANCE

ENERGY STAR® certified  
EPEAT® 2019 Gold<sup>39</sup>  
Low halogen<sup>40</sup>  
TCO NB 5.0 Certification

39. Based on US EPEAT® registration according to IEEE 1680.1-2018 EPEAT®. Status varies by country. Visit <http://www.epeat.net> for more information.

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

## FACETS

<b>Maximum Resolution</b>	1920 x 1080
<b>Screen Size, imperial</b>	15.6 (diagonal)
<b>Weight, Metric</b>	2
<b>Weight, Imperial</b>	4.41

## ENVIRONMENTAL & INDUSTRY

<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>• EPEAT® 2019 Gold in U.S. 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><li>• TCO 8.0</li></ul>
<b>System Configuration</b>	<p>The configuration used for the Energy Consumption and Declared Noise Emissions data for the Notebook model is based on a "Typically Configured Notebook"?</p>

### Technical Specifications

Energy Consumption (in accordance with US ENERGY STAR® test method)	115VAC, 60Hz	230VAC, 50Hz	100VAC, 50Hz
Normal Operation (Short idle)	5.77 W	5.61 W	5.92 W
Normal Operation (Long idle)	3.37 W	4.29 W	4.30 W
Sleep	0.57 W	0.61 W	0.56 W
Off	0.24 W	0.28 W	0.24 W
<p>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>			
Heat Dissipation*	115VAC, 60Hz	230VAC, 50Hz	100VAC, 50Hz
Normal Operation (Short idle)	20 BTU/hr	19 BTU/hr	20 BTU/hr
Normal Operation (Long idle)	12 BTU/hr	15 BTU/hr	15 BTU/hr
Sleep	2 BTU/hr	2 BTU/hr	2 BTU/hr
Off	1 BTU/hr	1 BTU/hr	1 BTU/hr
<p>Heat dissipation is calculated based on the measured watts, assuming the service level is attained for one hour.</p>			
Declared Noise Emissions (in accordance with ISO 7779 and ISO 9296)	Sound Power (L <sub>WAd</sub> , bels)		Sound Pressure (L <sub>pAm</sub> , decibels)
Typically Configured - Idle	2.5		14
Fixed Disk - Random writes	3.1		25
Longevity and Upgrading	<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> <ul style="list-style-type: none"> <li>• 3 USB ports</li> <li>• 1 PC card slot (type I/II)</li> <li>• 1 ExpressCard/54 slot</li> <li>• 1 IEEE 1394 Port</li> <li>• 2 SODIMM memory slots</li> <li>• Optional expansion base docking station</li> <li>• 1 multi-bay II storage port</li> <li>• Interchangeable HDD</li> </ul> <p>Spare parts are available throughout the warranty period and or for up to "5"? years after the end of production.</p>		
Batteries	<p>This battery(s) in this product comply with EU Directive 2006/66/EC</p> <p>Batteries used in the product do not contain:</p> <p>Mercury greater the1ppm by weight</p> <p>Cadmium greater than 20ppm by weight</p> <p>Battery size: CR2016 (coin cell)</p>		

### Technical Specifications

<b>Additional Information</b>	<p><b>Battery type:</b> Lithium</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>This product is in compliance with the IEEE 1680.1 (EPEAT) standard at the &lt;Gold&gt; level, see <a href="http://www.epeat.net">www.epeat.net</a></li> <li>Plastics parts weighing over 25 grams used in the product are marked per ISO11469 and ISO1043.</li> <li>This product contains 11.9% post-consumer recycled plastic (by wt.)</li> <li>This product is 95% recycle-able when properly disposed of at end of life.</li> </ul>		
<b>Packaging Materials</b>	<b>External:</b>	PAPER/Corrugated	295 g
	<b>Internal:</b>	PLASTIC/Polyethylene Expanded - EPE	68 g
		PLASTIC/Polyethylene low density - LDPE	10 g
<b>Material Usage</b>	<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> <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</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.</p>		

### Technical Specifications

<b>Recycling</b>	<p>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>
<b>HP Inc. Corporate Environmental Information</b>	<p>For more information about HP's commitment to the environment:</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></p> <p>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></p> <p>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>

## SYSTEM UNIT

### Stand-Alone Power Requirements (AC Power)

Nominal Operating Voltage	19 V
Average Operating Power	Win 10
Integrated graphics	Yes
Discrete Graphics	N17S-G2: 25 W N16S-GTR: 19 W
Max Operating Power	Discrete < 65 W UMA < 45 W

### Temperature

Operating	32° to 95° F (0° to 35° C) (Not writing optical)
Non-operating	41° to 95° F (5° to 35° C) (Writing optical)

### Relative Humidity

Operating	10% to 90%, non-condensing
Non-operating	5% to 95%, 101.6° F (38.7° C) Maximum wet bulb temperature

### Shock

Operating	40 G, 2 ms, half-sine
Non-operating	200 G, 2 ms, half-sine

### Random Vibration

Operating	0.75 grms
Non-operating	1.50 grms

### Altitude (unpressurized)

Operating	-50 to 10,000 ft (-15.24 to 3,048 m)
Non-operating	-50 to 40,000 ft (-15.24 to 12,192 m)

### Planned Industry Standard Certifications

UL	Yes
CSA	Yes
FCC Compliance	Yes
ENERGY STAR®	Selected models <sup>41</sup>
EPEAT®	EPEAT® 2019 Gold in U.S. <sup>42</sup>

### Technical Specifications

ICES	Yes
Australia	Yes
NZ A-Tick Compliance	Yes
CCC	Yes
Japan VCCI Compliance	Yes
KC	Yes
BSMI	Yes
CE Marking Compliance	Yes
BNCI or BELUS	Yes
CIT	Yes
GOST	Yes
Saudi Arabian Compliance (ICCP)	Yes
SABS	Yes

41. Based on US EPEAT® registration according to IEEE 1680.1-2018 EPEAT®. Status varies by country. Visit <http://www.epeat.net> for more information.

42. Configurations of the HP ProBook 450 G7 is ENERGY STAR® certified are identified as HP ProBook 450 G7 ENERGY STAR on HP websites and on <http://www.energystar.gov>.

## DISPLAYS

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

<b>Panel LCD 15.6 inch HD (1366 x 768) Anti-Glare WLED SVA 45% NTSC 220nits eDP 1.2 w/o PSR slim NB non-touch</b>	<b>Outline Dimensions (W x H x D)</b>	350.96 x 216.75 (max.)
	<b>Active Area</b>	344.16 x 193.59 (typ.)
	<b>Weight</b>	<370g max.
	<b>Diagonal Size</b>	15.6"
	<b>Thickness</b>	3.2mm max.
	<b>Interface</b>	eDP 1.2
	<b>Surface Treatment</b>	Anti-glare
	<b>Touch Enabled</b>	No
	<b>Contrast Ratio</b>	300:1 (typ)
	<b>Refresh Rate</b>	60 Hz
	<b>Brightness</b>	220 nits typical (Panel Only)
	<b>Pixel Resolution</b>	1366 x 768 (HD)
	<b>Backlight</b>	LED
	<b>Format of LCD Pixel Arrangement</b>	RGB
<b>Color Gamut Coverage</b>	45% of NTSC	
<b>Color Depth</b>	6 bits + Hi FRC	
<b>Viewing Angle</b>	SVA 40/40/15/30	

### Technical Specifications

<b>Panel LCD 15.6 inch FHD (1920 x 1080) Anti-Glare WLED UWVA 45% NTSC 250nits eDP 1.2 w/o PSR slim NWBZ</b>	<b>Outline Dimensions (W x H)</b>	350.96 x 216.65 mm (max)
	<b>Active Area</b>	344.16 x 193.59 mm (typ.)
	<b>Weight</b>	370 g (max)
	<b>Diagonal Size</b>	15.6 inch
	<b>Thickness</b>	3.2 mm (max)
	<b>Interface</b>	eDP 1.2 (2 lane)
	<b>Surface Treatment</b>	Anti-Glare
	<b>Touch Enabled</b>	No
	<b>Contrast Ratio</b>	600:1 (typ.)
	<b>Refresh Rate</b>	60 Hz
	<b>Brightness</b>	250 nits
	<b>Pixel Resolution</b>	1920 x 1080 (FHD)
	<b>Backlight</b>	LED
	<b>Format of LCD Pixel Arrangement</b>	RGB
	<b>Color Gamut Coverage</b>	45% of NTSC
<b>Color Depth</b>	6 bits	
<b>Viewing Angle</b>	UWVA 85/85/85/85	

---

<b>Panel LCD 15.6 inch FHD (1920 x 1080) Anti-Glare WLED UWVA 45% NTSC 250nits eDP slim Touch on Panel NWBZ</b>	<b>Outline Dimensions (W x H)</b>	350.96 x 216.75 mm (max)
	<b>Active Area</b>	344.16 x 193.59 mm (typ.)
	<b>Weight</b>	385 g (max)
	<b>Diagonal Size</b>	15.6 inch
	<b>Thickness</b>	3.2 mm (panel side) / 3.4 mm (PCBA Side) (max)
	<b>Interface</b>	eDP 1.2
	<b>Surface Treatment</b>	Anti-Glare On-cell
	<b>Touch Enabled</b>	Yes
	<b>Contrast Ratio</b>	600:1 (typ.)
	<b>Refresh Rate</b>	60 Hz
	<b>Brightness</b>	250 nits
	<b>Pixel Resolution</b>	1920 x 1080 (FHD)
	<b>Backlight</b>	LED
	<b>Format of LCD Pixel Arrangement</b>	RGB
	<b>Color Gamut Coverage</b>	45% of NTSC
<b>Color Depth</b>	6 bits	
<b>Viewing Angle</b>	UWVA 85/85/85/85	

---

### Technical Specifications

<b>Panel LCD 15.6 inch diagonal FHD (1920 x 1080) Anti-Glare WLED UWVA 72% NTSC 1000nits eDP 1.4+PSR2 flat Privacy</b>	<b>Outline Dimensions (W x H)</b>	349.52 x 204.79 mm (max)
	<b>Active Area</b>	344.16 x 193.59 mm (typ.)
	<b>Weight</b>	350 g (max)
	<b>Diagonal Size</b>	15.6 inch
	<b>Thickness</b>	2.6 mm (max)
	<b>Interface</b>	eDP 1.4 + PSR2 (4 lane)
	<b>Surface Treatment</b>	Anti-Glare
	<b>Touch Enabled</b>	No
	<b>Contrast Ratio</b>	2000:1 (typ.)
	<b>Refresh Rate</b>	60 Hz
	<b>Brightness*</b>	1000 nits
	<b>Pixel Resolution</b>	1920 x 1080 (FHD)
	<b>Backlight</b>	LED
	<b>Format of LCD Pixel Arrangement</b>	RGB
	<b>Color Gamut Coverage</b>	72% of NTSC
	<b>Color Depth</b>	8 bits
	<b>Viewing Angle</b>	UWVA 85/85/85/85

\*Touch-enabled display and Sure View privacy panel will lower actual brightness

### STORAGE AND DRIVES

<b>500 GB 7200 rpm SATA Hard Drive</b>	<b>Drive Weight</b>	0.20 lbs (92 g) ~ 0.21 lbs (95 g)
	<b>Rotation speed</b>	7200 rpm
	<b>Cache Buffer</b>	Up to 32 MB
	<b>Height</b>	0.28 in (7 mm)
	<b>Width</b>	2.75 in (69.85 mm)
	<b>Interface</b>	ATA-8, SATA 3.0
	<b>Transfer Rate</b>	600 MB/s
	<b>Seek Time</b>	Single Track: 2 ~ 1.5 ms; Average: 11 ~ 13 ms; Maximum: 18 ~ 22 ms
	<b>Logical Blocks</b>	976,773,168
	<b>Operating Temperature</b>	32° to 140° F (0° to 60° C) [top cover temp]
	<b>Security Features</b>	ATA Security
	<b>Features</b>	S.M.A.R.T., NCQ, Ultra DMA

### Technical Specifications

<b>1 TB 5400 rpm SATA Hard Drive</b>	<b>Drive Weight</b>	0.21 lbs (94 g)
	<b>Rotation speed</b>	5400 rpm
	<b>Cache Buffer</b>	Up to 32 MB
	<b>Height</b>	0.28 in (7.2 mm)
	<b>Width</b>	2.75 in (69.85 mm)
	<b>Interface</b>	ATA-8, SATA 3.0
	<b>Transfer Rate</b>	600 MB/s
	<b>Seek Time</b>	Single Track 2 ms Average 12 ~ 13 ms Maximum 18 ~ 22 ms
	<b>Logical Blocks</b>	1,953,525,168
	<b>Operating Temperature</b>	32° to 140° F (0° to 60° C) [top cover temp]
	<b>Security Features</b>	ATA Security
	<b>Features</b>	S.M.A.R.T., NCQ, Ultra DMA

<b>SSD 128 GB 2280 M2 SATA-3 TLC</b>	<b>Form Factor</b>	M.2 2280
	<b>Capacity</b>	128GB
	<b>NAND Type</b>	TLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Weight</b>	0.02 lb (10 g)
	<b>Interface</b>	ATA-8, SATA 3.0
	<b>Maximum Sequential Read</b>	Up To 520 MB/s
	<b>Maximum Sequential Write</b>	Up To 450 MB/s
	<b>Logical Blocks</b>	250,069,680
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
	<b>Features</b>	DIPM; TRIM; DEVSLP

<b>256 GB 2280 PCIe NVMe Value Solid State Drive</b>	<b>Form Factor</b>	M.2 2280
	<b>Capacity</b>	256 GB
	<b>NAND Type</b>	TLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Interface</b>	PCIe NVMe Gen3
	<b>Maximum Sequential Read</b>	Up To 1700 MB/s
	<b>Maximum Sequential Write</b>	Up To 1300 MB/s
	<b>Logical Blocks</b>	500,118,192
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
	<b>Features</b>	TRIM; L1.2



### Technical Specifications

<b>512 GB 2280 M2 PCIe NVMe TLC Solid State Drive</b>	<b>Form Factor</b>	M.2 2280
	<b>Capacity</b>	512 GB
	<b>NAND Type</b>	TLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Interface</b>	PCIe NVMe Gen3X4
	<b>Maximum Sequential Read</b>	Up To 2600 MB/s
	<b>Maximum Sequential Write</b>	Up To 1400 MB/s
	<b>Logical Blocks</b>	1,000,215,216
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
	<b>Features</b>	TRIM; L1.2

<b>512 GB 2280 PCIe NVMe Value Solid State Drive</b>	<b>Form Factor</b>	M.2 2280
	<b>Capacity</b>	512 GB
	<b>NAND Type</b>	Value
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Weight</b>	0.02 lb (10 g)
	<b>Interface</b>	PCIe NVMe Gen3X4
	<b>Maximum Sequential Read</b>	Up To 1500 ~ 1700 MB/s
	<b>Maximum Sequential Write</b>	Up To 860 ~ 1500MB/s
	<b>Logical Blocks</b>	1,000,215,216
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
<b>Features</b>	ATA Security, TRIM; L1.2	

### NETWORKING/COMMUNICATIONS

<b>Realtek RTL8822CE 802.11ac 2 x 2 Wi-Fi® and Bluetooth® 5.0</b>	<b>Wireless LAN Standards</b>	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n IEEE 802.11ac 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>	<ul style="list-style-type: none"> <li>802.11b/g/n 2.402 - 2.482 GHz</li> <li>802.11a/n/ac 4.9 - 4.95 GHz (Japan) 5.15 - 5.25 GHz</li> </ul>

### Technical Specifications

	5.25 - 5.35 GHz 5.47 - 5.725 GHz
<b>Data Rates</b>	5.825 - 5.850 GHz <ul style="list-style-type: none"> <li>• 802.11b: 1, 2, 5.5, 11 Mbps</li> <li>• 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li> <li>• 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li> <li>• 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)</li> <li>• 802.11ac: MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz &amp; 80MHz)</li> </ul>
<b>Modulation</b>	Direct Sequence Spread Spectrum BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM
<b>Security<sup>3</sup></b>	<ul style="list-style-type: none"> <li>• IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only</li> <li>• AES-CCMP: 128 bit in hardware</li> <li>• 802.1x authentication</li> <li>• WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES.</li> <li>• WPA2 certification</li> <li>• IEEE 802.11i</li> <li>• WAPI</li> </ul>
<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>2</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>• 802.11ac VHT160(5GHz): +11.5dBm minimum</li> </ul>
<b>Power Consumption</b>	Transmit mode: 2.0 W Receive mode: 1.6 W Idle mode (PSP)180 mW (WLAN Associated) Idle mode: 50 mW (WLAN unassociated) Connected Standby/Modern Standby: 10mW Radio disabled: 8 mW
<b>Power Management</b>	ACPI and PCI Express compliant power management 802.11 compliant power saving mode
<b>Receiver Sensitivity<sup>3</sup></b>	802.11b, 1Mbps: -93.5dBm maximum 802.11b, 11Mbps: -84dBm maximum 802.11a/g, 6Mbps: -86dBm maximum 802.11a/g, 54Mbps: -72dBm maximum 802.11n, MCS07: -67dBm maximum 802.11n, MCS15: -64dBm maximum 802.11ac, MCS0: -84dBm maximum 802.11ac, MCS9: -59dBm maximum
<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 with CNVi Interface

### Technical Specifications

<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: 2.8 g 2. Type 126: 1.3 g
<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

1. Check latest software/driver release for updates on supported security features.
2. Maximum output power may vary by country according to local regulations.
3. Receiver sensitivity is measured at a packet error rate of 8% for 802.11b (CKK modulation) and a packet error rate of 10% for 802.11a/g (OFDM modulation).

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

<b>Bluetooth® Specification</b>	4.0/4.1/4.2/5.0 Compliant
<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>Signaling Data Rate</b>	Legacy: 3 Mbps signaling data rate <sup>1</sup> BLE: 1 Mbps signaling data rate <sup>1</sup> <b>1. Actual throughput may vary.</b>
	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>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

### Technical Specifications

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)

**Intel® 9560  
 802.11a/b/g/n/ac  
 (2 x 2) Wi-Fi® and  
 Bluetooth® 5.0 Combo<sup>1</sup>  
 non-vPro**

**Wireless LAN Standards**

IEEE 802.11a  
 IEEE 802.11b  
 IEEE 802.11g  
 IEEE 802.11n  
 IEEE 802.11ac  
 IEEE 802.11d  
 IEEE 802.11e  
 IEEE 802.11h  
 IEEE 802.11i  
 IEEE 802.11k  
 IEEE 802.11r  
 IEEE 802.11v

**Interoperability**

Wi-Fi® certified

**Frequency Band**

- 802.11b/g/n  
2.402 - 2.482 GHz
- 802.11a/n/ac  
4.9 - 4.95 GHz (Japan)  
5.15 - 5.25 GHz  
5.25 - 5.35 GHz  
5.47 - 5.725 GHz  
5.825 - 5.850 GHz

**Data Rates**

- 802.11b: 1, 2, 5.5, 11 Mbps
- 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps
- 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps
- 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)
- 802.11ac: MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, 80MHz & 160MHz)

**Modulation**

Direct Sequence Spread Spectrum  
 BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM

**Security<sup>3</sup>**

- IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only
- AES-CCMP: 128 bit in hardware
- 802.1x authentication
- WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES.
- WPA2 certification
- IEEE 802.11i
- WAPI

**Network Architecture Models**

Ad-hoc (Peer to Peer)  
 Infrastructure (Access Point Required)

**Roaming**

IEEE 802.11 compliant roaming between access points

### Technical Specifications

<b>Output Power<sup>2</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>• 802.11ac VHT160(5GHz): +11.5dBm 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/Modern 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>3</sup></b>	802.11b, 1Mbps: -93.5dBm maximum 802.11b, 11Mbps: -84dBm maximum 802.11a/g, 6Mbps: -86dBm maximum 802.11a/g, 54Mbps: -72dBm maximum 802.11n, MCS07: -67dBm maximum 802.11n, MCS15: -64dBm maximum 802.11ac, MCS0: -84dBm maximum 802.11ac, MCS9: -59dBm maximum
<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 with CNVi Interface
<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 126: 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

1. Check latest software/driver release for updates on supported security features.
2. Maximum output power may vary by country according to local regulations.
3. Receiver sensitivity is measured at a packet error rate of 8% for 802.11b (CKK modulation) and a packet error rate of 10% for 802.11a/g (OFDM modulation).

### Technical Specifications

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

<b>Bluetooth Specification</b>	4.0/4.1/4.2/5.0 Compliant
<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>Signaling Data Rate</b>	Legacy: 3 Mbps signaling data rate <sup>1</sup> BLE: 1 Mbps signaling data rate <sup>1</sup> <a href="#">1. Actual throughput may vary.</a>
	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>	USB 2.0 compliant
<b>Bluetooth Software Supported</b>	Microsoft Windows Bluetooth Software
<b>Link Topology</b>	
<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 IEC950UL, 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)

**Intel® Wi-Fi 6 AX201 and Bluetooth 5.0 (802.11ax (2 x 2), non-vPro, supporting gigabit file transfer speeds) non-vPro**

<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
-------------------------------	--

### Technical Specifications

	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>	<ul style="list-style-type: none"><li>• 802.11b/g/n/ax 2.402 - 2.482 GHz</li><li>• 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</li></ul>
<b>Data Rates</b>	<ul style="list-style-type: none"><li>• 802.11b: 1, 2, 5.5, 11 Mbps</li><li>• 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li><li>• 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li><li>• 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)</li><li>• 802.11ac: MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, 80MHz &amp; 160MHz)</li><li>• 802.11ax: MCS0 ~ MCS11, (1SS and 2SS) (20MHz, 40MHz, 80MHz &amp; 160MHz)</li></ul>
<b>Modulation</b>	Direct Sequence Spread Spectrum OFDM, BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM, 1024QAM
<b>Security<sup>3</sup></b>	<ul style="list-style-type: none"><li>• IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only</li><li>• AES-CCMP: 128 bit in hardware</li><li>• 802.1x authentication</li><li>• WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES.</li><li>• WPA2 certification</li><li>• IEEE 802.11i</li><li>• WAPI</li></ul>
<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>2</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>• 802.11ac VHT160(5GHz): +11.5dBm minimum</li><li>• 802.11ax HT40(2.4GHz): +10dBm minimum</li><li>• 802.11ax VHT160(5GHz): +10dBm minimum</li></ul>
<b>Power Consumption</b>	Transmit mode 2.0 W Receive mode 1.6 W Idle mode (PSP) 180 mW (WLAN Associated) Idle mode 50 mW (WLAN unassociated) Connected Standby 10 mW Radio disabled 8 mW

### Technical Specifications

<b>Power Management</b>	ACPI and PCI Express compliant power management 802.11 compliant power saving mode
<b>Receiver Sensitivity<sup>3</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: -84dBm maximum</li> <li>• 802.11ac, MCS9: -59dBm maximum</li> <li>• 802.11ax, MCS11(HT40): -59dBm maximum</li> <li>• 802.11ax, MCS11(VHT160): -58.5dBm 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: 2.8 g 2. Type 126: 1.3 g
<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
	<ol style="list-style-type: none"> <li>1. Check latest software/driver release for updates on supported security features.</li> <li>2. Maximum output power may vary by country according to local regulations.</li> <li>3. Receiver sensitivity is measured at a packet error rate of 8% for 802.11b (CKK modulation) and a packet error rate of 10% for 802.11a/g (OFDM modulation).</li> </ol>
<b>HP Integrated Module with Bluetooth 4.0/4.1/4.2/5.0/5.1 Wireless Technology</b>	
<b>Bluetooth Specification</b>	4.0/4.1/4.2/5.0/5.1 Compliant
<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>Signaling Data Rate</b>	Legacy: 3 Mbps data signaling rate up to 2.17 Mbps BLE: 1 Mbps data signaling rate up to 0.2 Mbps <a href="#">1. Actual throughput may vary.</a>
	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.



### Technical Specifications

<b>Power Consumption</b>	Peak (Tx) 330 mW Peak (Rx) 230 mW Selective Suspend 17 mW
<b>Electrical Interface</b>	USB 2.0 compliant
<b>Bluetooth Software Supported</b>	Microsoft Windows Bluetooth Software
<b>Link Topology</b>	
<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)

1. Wireless access point and internet service required and sold separately. Availability of public wireless access points limited. Wi-Fi 6 backwards compatible with prior 802.11 specs. The specifications for Wi-Fi 6 (802.11ax) are draft and are not final. If the final specifications differ from the draft specifications, it may affect the ability of the notebook to communicate with other 802.11ax devices. Only available in countries where 802.11ax is supported. Wi-Fi® supporting gigabit speeds is achievable when transferring files between two devices connected to the same router. Requires a wireless router, sold separately, that supports 160 MHz channels.
2. 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.
3. Check latest software/driver release for updates on supported security features.
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

<b>Intel® XMM™ 7360 LTE-Advanced CAT9<sup>1</sup></b>	<b>Technology/Operating bands</b>	FDD LTE: 2100 (Band 1), 1900 (Band 2), 1800 (Band 3), 1700/2100 (Band 4), 850 (Band 5), 2600 (Band 7), 900 (Band 8), 1400 (Band 11), 700 (Band 12 lower), 700 (Band 13 upper), 700 (Band 17 lower), 850 (Band 18 lower), 850 (Band 19 upper), 800 (Band 20), 1400 (Band 21), 850 (Band 26), 700 (Band 28), 700 (Band 29 RX only), 2300 (Band 30), 1700/2100 (Band 66). TDD LTE: 2600 (Band 38), 1900 (Band 39), 2400 (Band 40), 2500 (Band 41). HSPA+: 2100 (Band 1), 1900 (Band 2), 1700/2100 (Band 4), 850 (Band 5), 900 (Band 8) MHz
	<b>Wireless protocol standards</b>	3GPP Release 11 LTE Specification CAT.9, DL 60MHz BW throughput up to 450Mbps; UL 20MHz throughput up to 50Mbps WCDMA R99, 3GPP Release 5, 6, 7 and 8 UMTS Specification
	<b>GPS</b>	Standalone, A-GPS (MS-A, MS-B)
	<b>GPS bands</b>	1575.42 MHz ± 1.023 MHz, GLONASS 1596-1607MHz, Beidou 1561.098 MHz
	<b>Maximum data rates</b>	LTE: 450 Mbps (Download), 50 Mbps (Upload) DC-HSPA+: 42 Mbps (Download), 5.76 Mbps (Upload) HSPA+: 21Mbps (Download), 5.76 Mbps (Upload)
	<b>Maximum output power</b>	LTE: 23 dBm HSPA+: 23.5 dBm
	<b>Maximum power consumption</b>	LTE: 1,200 mA (peak); 900 mA (average) HSPA+: 1,100 mA (peak); 800 mA (average)
	<b>Form Factor</b>	M.2, 3042-S3 Key B
	<b>Weight</b>	5.8 g
	<b>Dimensions</b> (Length x Width x Thickness)	42 x 30 x 2.3 mm

1. WWAN module is optional, must be configured at the factory and requires separately purchased service contract. Check with service provider for coverage and availability in your area. Connection speeds will vary due to location, environment, network conditions, and other factors. 4G LTE not available on all products, in all regions.

### POWER

<b>HP 45W Smart AC adapter</b>	<b>Dimensions (H x W x D)</b>	3.74 x 1.57 x 1.04 in (9.5 x 4.0 x 2.65 cm)	
	<b>Weight</b>	0.386 lb (175 g) max <a href="#">Not including power cord. Power cord varies by country.</a>	
	<b>Input</b>	90 to 265 VAC	
		<b>Input Efficiency</b>	87.74% at 115Vac and 88.4% at 230Vac
		<b>Input frequency range</b>	47 to 63 Hz
		<b>Input AC current</b>	1.4 A at 90 VAC
	<b>Output</b>	<b>Output power</b> 45 W	
		<b>DC output</b> 19.5 V	
		<b>Hold-up time</b> 5 msec at 115 VAC input	
		<b>Output current limit</b> <8.0A	
	<b>Connector</b>	4.5mm Barrel Type, 3 pin/grounded, mates with interchangeable cords	
	<b>Environmental Design</b>	<b>Operating temperature</b> 32° F to 95° F (0° to 35° C)	
		<b>Non-operating (storage) temperature</b> -4° F to 185°F (-20° to 85° C)	
		<b>Altitude</b> 0 to 16,400 ft (0 to 5,000 m)	

### Technical Specifications

	<b>Humidity</b>	20% to 95%
	<b>Storage Humidity</b>	10% to 95%
<b>EMI and Safety Certifications</b>	<p>*CE Mark - full compliance with LVD and EMC directives</p> <p>* Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, SELV; Agency approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CISPR22 Class B, CCC, NOM-1 NYCE.</p> <p>* MTBF - over 200,000 hours at 25°C ambient condition.</p>	

<b>HP 65W Smart AC adapter</b>	<b>Dimensions</b>	90 x 51 x 28.5 mm	
	<b>Weight</b>	220 g +/- 10 g Not including power cord. Power cord varies by country.	
	<b>Input</b>	<b>Input Efficiency</b>	88% min at 115 VAC and 89% min at 230 VAC
		<b>Input frequency range</b>	47 to 63 Hz
		<b>Input AC current</b>	1.7 A at 90 VAC
	<b>Output</b>	<b>Output power</b>	65 W
		<b>DC output</b>	19.5 V
		<b>Hold-up time</b>	5 msec at 115 VAC input
		<b>Output current limit</b>	<11.0A
		<b>Connector</b>	4.5mm Barrel Type, 3 pin/grounded, mates with interchangeable cords
	<b>Environmental Design</b>	<b>Operating temperature</b>	32° F to 95° F (0° to 35° C)
		<b>Non-operating (storage) temperature</b>	-4° F to 185° F (-20° to 85° C)
		<b>Altitude</b>	0 to 16,400 ft (0 to 5000m)
		<b>Humidity</b>	20% to 95%
		<b>Storage Humidity</b>	10% to 95%
	<b>EMI and Safety Certifications</b>	<p>*CE Mark - full compliance with LVD and EMC directives</p> <p>* Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, SELV; Agency approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CISPR22 Class B, CCC, NOM-1 NYCE.</p> <p>* MTBF - over 200,000 hours at 25°C ambient condition.</p>	

### Technical Specifications

<b>HP 65W EM Smart AC adapter</b>	<b>Dimensions</b>	102 x 55 x 30 mm	
	<b>Weight</b>	270 g +/- 10 g <a href="#">Not including power cord. Power cord varies by country.</a>	
	<b>Input</b>	<b>Input Efficiency</b>	87% min at 115V/230V
		<b>Input frequency range</b>	47 to 63 Hz
		<b>Input AC current</b>	1.7 A at 90 VAC and maximum load
		<b>DC output</b>	65 W(19.5V/3.33A)
		<b>Hold-up time</b>	5 msec at 115 VAC input
		<b>Output current limit</b>	<11A, Over voltage protection- 29V max automatic shutdown
		<b>Connector</b>	4.5mm Barrel Type, 3 pin/grounded, mates with interchangeable cords
	<b>Environmental Design</b>	<b>Operating temperature</b>	32°F to 95°F (0° to 35°C)
		<b>Non-operating (storage) temperature</b>	-4°F to 185°F (-20° to 85°C)
		<b>Altitude</b>	0 to 5,000 m
		<b>Humidity</b>	0% to 95%
<b>EMI and Safety Certifications</b>	<b>Storage Humidity</b>	0% to 95%	
	CE Mark - EMC directives; Worldwide safety standards - IEC60950, EN60950 UL60950, Class1, SELV; Agency approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CISPR22 Class B, CCC, NOM-1 NYCE; Reliability - failure rate of less than 0.1% annually within the first three years of operation.		

---

<b>AC Adapter 65 Watt nPFC USB type C</b>	<b>Dimensions</b>	74 x 74 x 28.5 mm	
	<b>Weight</b>	245 g +/- 10 g <a href="#">Not including power cord. Power cord varies by country.</a>	
	<b>Input</b>	<b>Input Efficiency</b>	81.5% min at 115 Vac/ 230Vac @ 5V/3A 86.7% min at 115 Vac/ 230Vac @ 9V/3A 88% min at 115 Vac/ 230Vac @ 10V/5A 88% min at 115 Vac/ 230Vac @ 12V/5A 89% min at 115 Vac/ 230Vac @ 15V/4.33A 89% min at 115 Vac/ 230Vac @ 20V/3.25A
		<b>Input frequency range</b>	47 to 63 Hz
		<b>Input AC current</b>	1.7 A at 90 VAC and maximum load
		<b>Output power</b>	65 W
		<b>DC output</b>	5V/9V/10V/12V/15V/20V
		<b>Hold-up time</b>	5ms at 115 Vac input
		<b>Output current limit</b>	<8.0A
	<b>Connector</b>	Type C	
	<b>Environmental Design</b>	<b>Operating temperature</b>	32°F to 95°F (0° to 35°C)
		<b>Non-operating (storage) temperature</b>	-4°F to 185°F (-20° to 85°C)
		<b>Altitude</b>	0 to 16,400 ft (0 to 5000 m)
<b>Humidity</b>		5% to 95%	
	<b>Storage Humidity</b>	5% to 95%	

### Technical Specifications

#### EMI and Safety Certifications

\*CE Mark - full compliance with LVD and EMC directives  
 \* Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, SELV;  
 Agency approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CISPR22 Class B, CCC, NOM-1 NYCE.  
 \* MTBF - over 200,000 hours at 25°C ambient condition.

#### AC Adapter 45 Watt nPFC USB type C

#### Dimensions

62.0 x 62.0 x 28.5 mm

#### Weight

220 g +/- 10 g  
 Not including power cord. Power cord varies by country.

#### Input

**Input Efficiency** Average Efficiency of 25%, 50%, 75%, 100% load condition with 115Vac/230Vac Spec:5V: 81.5%9V: 86.7%10V: 87.5%12V: 87.8%15V: 87.8%20V: 87.8%

**Input frequency range** 47 to 63 Hz

**Input AC current** Max. 1.4 A at 90 Vac

**Output power**  
 5V/15W  
 9V/27W  
 10V/37.5W  
 12V/45W  
 15V/45W  
 20V/45W

**DC output** 5V/9V/10V/12V/15V/20V

**Hold-up time** 5ms at 115 Vac input

**Output current limit** <5.0A

#### Connector

Type C

#### Environmental Design

**Operating temperature** 32°F to 95°F (0° to 35°C)

**Non-operating (storage) temperature** -4°F to 185°F (-20° to 85°C)

**Altitude** 0 to 16,400 ft (0 to 5000m)

**Humidity** 20% to 95%

**Storage Humidity** 10% to 95%

#### EMI and Safety Certifications

\*CE Mark - full compliance with LVD and EMC directives  
 \* Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, SELV;  
 Agency approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CISPR22 Class B, CCC, NOM-1 NYCE.  
 \* MTBF - over 200,000 hours at 25°C ambient condition.

### Technical Specifications

<b>3 Cell WHr 45 Long Life - Polymer HP Fast Charge Technology<sup>1</sup></b>	<b>Dimensions (H x W x L)</b>	6.0 x 184.7 x 88.9 mm
	<b>Weight</b>	0.22 kg (0.48 lb)
	<b>Cells/Type</b>	3cell Lithium-Ion
	<b>Energy</b>	
	<b>Voltage</b>	11.55V
	<b>Amp-hour capacity</b>	3.900Ah
	<b>Watt-hour capacity</b>	45Wh
	<b>Temperature</b>	
	<b>Operating (Charging)</b>	32° to 113° F (0° to 45° C)
	<b>Operating (Discharging)</b>	14° to 122° F (-10° to 60° C)
	<b>Optional Travel Battery Available</b>	No

1. Recharges the battery up to 50% within 30 minutes when the system is off or in standby mode when use with the power adapter provided with the notebook. After charging has reached 50% capacity, charging speed will return to normal. Charging time may vary +/-10% due to System tolerance.

### FINGERPRINT READER

<b>Model</b>	Synaptics Validity VFS7604 touch sensor
<b>Mobile Voltage Operation</b>	3.0V to 3.6V
<b>Operating Temperature</b>	0~60°C
<b>Current Consumption Image</b>	100mA Max
<b>Low Latency Wait For Finger</b>	260 uA
<b>ESD Resistance</b>	IEC 61000-4-2 4B (+/-15KV)
<b>Detection Matrix</b>	363 dpi / 7.4 x 6 mm sensor area
<b>FRR (False Reject Rate) / FAR (False Acceptance Rate)</b>	FRR <1% @ 1:50K FAR

### Country of Origin

China

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

Type	Description	Part Number
<b>Cases</b>	HP Essential Top Load Case	H2W17AA
	HP Essential Backpack (up to 15.6")	H1D24AA
	HP Essential Messenger Case (up to 17.3")	H1D25AA
<b>Docking</b>	HP USB-C Mini Dock	1PM64AA
	HP USB-C Universal Dock	1MK33AA
	HP USB-C Dock G4 (Mockingjay 3.0)	3FF69AA
	HP Thunderbolt Dock 120W G2	2UK37AA
	HP TB Dock G2 w/ Combo Cable	3TR87AA
	HP TB Dock 120W G2 w/Audio	3YE87AA
	HP TB Dock 120W G2 Cable	3XB94AA
	HP TB Dock G2 Combo Cable	3XB96AA
	HP TB Dock G2 Audio Module	3AQ21AA
	HP USB-C/A Universal Dock G2	5TW13AA
	HP USB-C Dock G5	5TW10AA
	HP E223d Docking Monitor	5VT82A8 5VT82AA
	HP E243d Docking Monitor	1TJ76AA
	HP E273d Docking Monitor	5WN63A8 5WN63AA
	HP EliteDisplay E244d Monitor	6PA50A8 6PA50AA
HP EliteDisplay E274d Monitor	6PA56A8 6PA56AA	
<b>Input/Output</b>	HP USB Essential Keyboard and Mouse	H6L29AA
	HP Ultra Mobile Wireless Mouse	H6F25AA
	HP Comfort Grip Wireless Mouse	H2L63AA
	HP 3-Button USB Laser Mouse	H4B81AA
	HP USB Travel Mouse	G1K28AA
	HP HDMI to DVI Adapter	F5A28AA
	HP Elite USB-C Hub	4WX89AA
	HP USB-C Travel Hub	Z9G82AA
<b>Memory</b>	4G B 2666MHz DDR4	4VN05AA
	8 GB 2666MHz DDR4	4VN06AA
	16 GB 2666MHz DDR4	4VN07AA
<b>Power</b>	HP 45W Smart AC Adapter 4.5mm	H6Y88AA
	45W Smart Power Adapter 2 prong -4.5mm (Japan only)	L6F60AA
	65W Smart Power Adapter (w/ 4.5mm to 7.5mm DC dongle)	H6Y89AA
	HP 65W Slim AC Adapter	H6Y82AA
	HP 65W USB-C Slim Power Adapter	3PN48AA
	HP 65W USB-C Power Adapter	1HE08AA
	HP 45W USB-C Power Adapter	1HE07AA

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

	HP Power Bank	N9F71AA
	HP USB-C Power Bank	2NA10AA
<b>Storage</b>	HP External USB Optical Drive	F2B56AA
	HP 128 GB M.2 SATA-3	2JB95AA
	1TB 7200rpm 9.5mm SATA HDD	L3M56AA
	HP 500 GB 7200rpm HDD	F3B97AA
	HP 256 GB TLC PCI-e 3x4 NVMe SSD (2280)	1FU87AA
	HP 512 GB TLC PCI-e 3x4 NVMe SSD (2280)	1FU88AA
<b>Security</b>	HP Combination Lock	TOY15AA
	HP Essential Keyed Cable lock 12.3mm	TOY14AA
	HP Keyed Cable Lock 10mm	T1A62AA
<b>UCC</b>	HP Conferencing Keyboard	K8P74AA
	HP UC Speaker Phone	4VW02AA
	HP Wired Headset	K7V17AA



### Summary of Changes

<b>Date of change:</b>	<b>Version History:</b>		<b>Description of change:</b>
October 30, 2019	V1 to V2	Added	Environmental Section and updated Battery life
November 4, 2019	V2 to V3	Updated	UHD Graphics
February 12, 2020	V3 to V4	Added	HP Sure Sense
February 27, 2020	V4 to V5	Updated	Copyright and footnote for fingerprint sensor.
March 2, 2020	V5 to V6	Updated	Call out numbers, Webcam and Privacy Shutter

Copyright © 2020 HP Development Company, L.P. The only warranties for HP products are set forth in the express limited warranty statements accompanying such products. Nothing herein should be construed as constituting an additional warranty. HP shall not be liable for technical or editorial errors or omissions contained herein.

Intel®, Core® and Intel® vPro™ are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries. Bluetooth is a trademark owned by its proprietor and used by HP Inc. under license. DisplayPort™ and the DisplayPort™ logo are trademarks owned by the Video Electronics Standards Association (VESA®) in the United States and other countries. USB Type-C™ and USB-C™ are trademarks of USB Implementers Forum. NVIDIA, the NVIDIA logo are trademarks and/or registered trademarks of NVIDIA Corporation in the U.S. and other countries. Bluetooth is a trademark owned by its proprietor and used by HP Inc. ENERGY STAR is a registered trademark of the U.S. Environmental Protection Agency. All other trademarks are the property of their respective owners.

### Overview

### HP ProBook 650 G5 Notebook PC



#### Left

- |                               |  |
|-------------------------------|--|
| 1. Webcam (select models)     | 6. Smart Card Reader (select models)         |
| 2. Internal microphones (2)   | 7. Optical Drive (select models)             |
| 3. Camera Privacy Shutter     | 8. Security lock slot (Lock sold separately) |
| 4. Webcam LED (select models) | 9. Power button                              |
| 5. Clickpad                   |  |

### Overview



#### Right

- |                                   |  |
|-----------------------------------|--|
| 1. Power connector                | 7. USB 3.1 Gen 1 port                          |
| 2. MicroSD card slot              | 8. USB 3.1 Gen 1 charging port                 |
| 3. Docking connector              | 9. USB Type-C™ charging port (PD+DP 1.2, Gen1) |
| 4. VGA port (or Serial port)      | 10. Audio combo jack                           |
| 5. Ethernet port                  | 11. HDD LED indicator                          |
| 6. HDMI port (Cable not included) | 12. Fingerprint reader (Select models)         |

### Overview

#### AT A GLANCE

- Windows 10 versions and FreeDOS
- Precision-crafted slim design with fingerprint resistant modern, fresh and comfortable natural silver finish
- Choice of 8th Generation Intel® Core™ processors, with integrated graphics or optional AMD Radeon™ 540X 64 bit Discrete Graphics
- HP Advanced keyboard, spill resistant with optional backlit design
- Large Clickpad with gestures support
- Enhanced security features including TPM2.0, HP Privacy Camera, Optional HP Sure View Gen3, Optional Smart Card Reader, Optional Touch FingerPrint Reader<sup>3</sup> (select models), HP Sure Sense<sup>2</sup> and HP Sure Start Gen5.
- LED-backlit display 39.6 cm (15.6"") diagonal HD, FHD, Touch FHD or FHD with HP Sure View Gen3.
- Optional WWAN
- HDMI port for connecting to high-resolution displays
- Optional HD webcam with dual-microphone array for video conferencing
- Optional integrated ODD and Serial Port support
- Flexible wireless connectivity options, including 802.11 AX WLAN module and CAT9 WWAN module
- Battery hours up to 15 hours with fast charging technology
- Dual storage combines SSD fast boot up and app access with cost effective HDD mass storage
- Passed MIL-STD 810G test<sup>1</sup>
- Compliance with FCC (Class B)

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

2. HP Sure Sense requires Windows 10. See product specifications for availability.

3. HP Fingerprint Sensor is an optional feature and requires configuration at purchase.

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

### Technical Specifications

## PRODUCT NAME

HP ProBook 650 G5 Notebook PC

---

## OPERATING SYSTEM

<b>Preinstalled</b>	Windows® 10 Pro 64 <sup>1</sup> Windows® 10 Pro 64 (National Academic License) <sup>2</sup> Windows® 10 Home 64 <sup>1</sup> Windows® 10 Home Single Language 64 <sup>1</sup> Windows® 10 Enterprise 64 (Web Support) <sup>1</sup> FreeDOS
---------------------	---

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

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

---

## PROCESSORS

Intel® Core™ i7-8665U vPro™ with Intel® UHD graphics 620 (1.9 GHz base frequency, up to 4.8 GHz with Intel® Turbo Boost Technology, 4 cores)<sup>3,4,5</sup>

Intel® Core™ i7-8565U with Intel® UHD graphics 620 (1.8 GHz base frequency, up to 4.6 GHz with Intel® Turbo Boost Technology, 4 cores)<sup>3,4,5</sup>

Intel® Core™ i5-8365U vPro™ with Intel® UHD Graphics 620 (1.6 GHz base frequency, up to 4.1 GHz with Intel® Turbo Boost Technology, 4 cores)<sup>3,4,5</sup>

Intel® Core™ i5-8265U with Intel® UHD Graphics 620 (1.6 GHz base frequency, up to 3.9 GHz with Intel® Turbo Boost Technology, 4 cores)<sup>3,4,5</sup>

Intel® Core™ i3-8145U with Intel® UHD Graphics 620 (2.1 GHz base frequency, up to 3.9 GHz with Intel® Turbo Boost Technology, 4 cores)<sup>3,4,5</sup>

### Processor Family

8th Generation Intel® Core™ i7 processor (i7-8665U, i7-8565U models)<sup>5</sup>

8th Generation Intel® Core™ i5 processor (i5-8365U, i5-8265U models)<sup>5</sup>

8th Generation Intel® Core™ i3 processor (i3-8145U model)<sup>5</sup>

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

4. Processor speed denotes maximum performance mode; processors will run at lower speeds in battery optimization mode.

5. In accordance with Microsoft's support policy, HP does not support the Windows 8 or Windows 7 operating system on product models with Intel and AMD 7th generation and forward processors or provide any Windows 8 or Windows 7 drivers on <http://www.support.hp.com>

---

## CHIPSET

### Technical Specifications

Chipset is integrated with processor

---

## GRAPHICS

### Integrated

Intel® UHD Graphics 620<sup>6</sup>

### Discrete

AMD Radeon™ 540X (2 GB GDDR5 dedicated)<sup>7</sup>

### Supports

Support HD decode, DX12, HDMI 1.4

6. HD content required to view HD images.

7. AMD Dynamic Switchable Graphics technology requires an Intel processor, plus an AMD Radeon™ discrete graphics configuration available on FreeDOS and Linux OS. With AMD Dynamic Switchable Graphics technology, full enablement of all discrete graphics features may not be supported on all systems (e.g. OpenGL applications will run on the integrated GPU or the APU as the case may be).

---

## DISPLAY

### Non-Touch HD

39.6 cm (15.6") diagonal HD SVA eDP anti-glare LED-backlit, 220 cd/m<sup>2</sup>, 45% NTSC (1366 x 768)<sup>6,8</sup>

39.6 cm (15.6") diagonal HD SVA eDP anti-glare LED-backlit, 220 cd/m<sup>2</sup>, 45% NTSC, for HD camera (1366 x 768)<sup>6,8</sup>

39.6 cm (15.6") diagonal HD SVA eDP anti-glare LED-backlit, 220 cd/m<sup>2</sup>, 45% NTSC, for WWAN (1366 x 768)<sup>6,8</sup>

39.6 cm (15.6") diagonal HD SVA eDP anti-glare LED-backlit, 220 cd/m<sup>2</sup>, 45% NTSC, for HD camera and WWAN (1366 x 768)<sup>6,8</sup>

### Non-Touch FHD

39.6 cm (15.6") diagonal FHD IPS eDP anti-glare LED-backlit, 250 cd/m<sup>2</sup>, 45% NTSC (1920 x 1080)<sup>6,8</sup>

39.6 cm (15.6") diagonal FHD IPS eDP anti-glare LED-backlit, 250 cd/m<sup>2</sup>, 45% NTSC, for HD camera (1920 x 1080)<sup>6,8</sup>

39.6 cm (15.6") diagonal FHD IPS eDP anti-glare LED-backlit, 250 cd/m<sup>2</sup>, 45% NTSC, for WWAN (1920 x 1080)<sup>6,8</sup>

39.6 cm (15.6") diagonal FHD IPS eDP anti-glare LED-backlit, 250 cd/m<sup>2</sup>, 45% NTSC, for HD camera and WWAN (1920 x 1080)<sup>6,8</sup>

### Touch FHD

39.6 cm (15.6") diagonal FHD IPS eDP LED-backlit touch screen, 250 cd/m<sup>2</sup>, 45% NTSC, for HD camera and WWAN (1920 x 1080)<sup>6,8</sup>

### Non-Touch FHD Privacy Panel

HP Sure View Gen3 Integrated Privacy Screen 39.6 cm (15.6") diagonal FHD IPS eDP anti-glare LED-backlit, 1000 cd/m<sup>2</sup>, 72% NTSC, for HD camera and WWAN (1920 x 1080)\*

6. HD content required to view HD images.

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

\*Touch-enabled display and Sure View privacy panel will lower actual brightness

---

### Technical Specifications

Docking station model	Total number of supported displays (incl. the notebook display)	Max. resolutions supported	Dock Connectors	Technical limitations
HP UltraSlim Docking Station	3	Dual 2.5K @ 60Hz	2xDP, 1xVGA	Dual 2.5k only with both d
HP Thunderbolt Dock G2	3	Single 4K@60Hz (3840 x 2160)	2xDP, 1xVGA, 1xTB,1xUSB-C alt-mode	System will perform at USI when connected to the dock. Thunderbolt port will function with data and power c
HP USB-C Dock G4	3	Dual 2K @ 60Hz Single 4K @ 60Hz (3840 x 1440)	1xHDMI, 2xDP	
HP USB-C Universal Dock	3	Dual 4K @ 60Hz Single 5K @ 60Hz	2xDP	
HP USB-C Travel Dock	2	Single 2K @ 60Hz	1xHDMI, 1xVGA	Single external display Only HDMI or VGA at the til
HP USB-C Mini Dock	2	Single 4K @ 30Hz	1xHDMI, 1xVGA	Single external display Only HDMI or VGA at the til

### STORAGE AND DRIVES

#### Primary Storage

500 GB 7200 rpm SATA<sup>9</sup>

500 GB 7200 rpm SATA FIPS 140-2 SED<sup>9</sup>

1 TB 7200 rpm SATA<sup>9</sup>

#### Primary M.2 Storage

128 GB SATA-3 SS TLC<sup>9</sup>

256 GB PCIe<sup>®</sup> NVMe<sup>™</sup> SS Value<sup>9</sup>

256 GB PCIe<sup>®</sup> Gen3x4 NVMe<sup>™</sup> SS TLC<sup>9</sup>

256 GB SATA-3 TLC FIPS<sup>9</sup>

256 GB SATA-3 SS TLC (Opal 2)<sup>9</sup>

256 GB Intel<sup>®</sup> PCIe<sup>®</sup> NVMe<sup>™</sup> QLC M.2 SSD with 16 GB Intel<sup>®</sup> Optane<sup>™</sup> memory H10(Available Q4 2019)<sup>9,10,11</sup>

512 GB PCIe<sup>®</sup> NVMe<sup>™</sup> Value<sup>9</sup>

512 GB PCIe<sup>®</sup> Gen3x4 NVMe<sup>™</sup> SS TLC<sup>9</sup>

512 GB PCIe<sup>®</sup> Gen3x4 NVMe<sup>™</sup> SS TLC (Opal 2)<sup>9</sup>

512 GB SATA- 3 SS TLC (FIPS)<sup>9</sup>

512 GB Intel<sup>®</sup> PCIe<sup>®</sup> NVMe<sup>™</sup> QLC M.2 SSD with 32 GB Intel<sup>®</sup> Optane<sup>™</sup> memory H10<sup>9,10,11</sup>

1 TB PCIe<sup>®</sup> Gen3x4 NVMe<sup>™</sup> SS TLC<sup>9</sup>

#### Cache Memory

16 GB PCIe<sup>®</sup> NVMe<sup>™</sup> Intel<sup>®</sup> Optane<sup>™</sup> Memory for storage acceleration<sup>9</sup>

9. For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 30 GB (for Windows 10) is recovery software.

10. Intel<sup>®</sup> Optane<sup>™</sup> memory system acceleration does not replace or increase the DRAM in your system. Requires 8th Gen or higher Intel<sup>®</sup> Core<sup>™</sup> processor, BIOS version with Intel<sup>®</sup> Optane<sup>™</sup> supported, Windows 10 64-bit, and an Intel<sup>®</sup> Rapid Storage Technology (Intel<sup>®</sup> RST) driver.

11. Intel<sup>®</sup> Optane<sup>™</sup> memory H10 only for Intel<sup>®</sup> PCIe<sup>®</sup> NVMe<sup>™</sup> QLC M.2 SSD.

### MEMORY



### Technical Specifications

#### Maximum Memory

64 GB DDR4-2400 SDRAM<sup>12</sup>

#### Memory

4 GB Total System Memory (4 GB x 1)<sup>12</sup>

8 GB Total System Memory (4 GB x 2)<sup>12</sup>

8 GB Total System Memory (8 GB x 1)<sup>12</sup>

12 GB Total System Memory (8 GB + 4 GB)<sup>12</sup>

16 GB Total System Memory (16 GB x 1)<sup>12</sup>

16 GB Total System Memory (8 GB x 2)<sup>12</sup>

32 GB Total System Memory (16 GB x 2)<sup>12</sup>

48 GB Total System Memory (32 GB + 16 GB) (available Q4 2019)<sup>12</sup>

64 GB Total System Memory (32 GB x 2) (available Q4 2019)<sup>12</sup>

#### Memory Slots

2 SODIMM

Both slots are customer accessible / upgradeable

DDR4 SODIMMS, System runs at: 2400

Supports Dual Channel Memory

12. Due to the non-industry standard nature of some third-party memory modules, we recommend HP branded memory to ensure you mix memory speeds, the system will perform at the lower memory speed.

## NETWORKING/COMMUNICATIONS

#### WLAN

Intel® Dual Band Wireless-AC 9560 802.11 ac (2x2) Wi-Fi® and Bluetooth® 5 Combo, vPro™<sup>13</sup>

Intel® Dual Band Wireless-AC 9560 802.11 ac (2x2) Wi-Fi® and Bluetooth® 5 Combo, non-vPro™<sup>13</sup>

Intel® Wi-Fi 6\*\* AX200 + Bluetooth® 5 (802.11ax 2x2, vPro, supporting gigabit file transfer speeds)<sup>13</sup>

Intel® Wi-Fi 6\*\* AX200 + Bluetooth® 5 (802.11ax 2x2, non-vPro, supporting gigabit file transfer speeds)<sup>13</sup>

#### WWAN

LTE CAT6: Fibocom Intel® XMM™ 7262 LTE-Advanced, LTE/HSPA+ w/GPS<sup>14</sup>

LTE CAT9: Fibocom Intel® XMM™ 7360 LTE-Advanced, LTE/HSPA+ w/GPS<sup>14</sup>

#### NFC

NXP NPC300 Near Field Communication Module <sup>15</sup>

#### WPAN Bluetooth®

BT 5.0 supported via all supported WLAN modules

#### Ethernet

Intel® Ethernet Connection I219-LM 10/100/1000 (vPro™)<sup>16</sup>

Intel® Ethernet Connection I219-V 10/100/1000 (Non-vPro™)<sup>16</sup>

13. Wireless access point and Internet service required and sold separately. Availability of public wireless access points |

14. WWAN module requires separately purchased service contract. Check with service provider for coverage and availability. Connection speeds will vary due to location, environment, network conditions, and other factors. 4G LTE not available on all regions.

15. Sold separately or as an optional feature.

16. The term "10/100/1000" or "Gigabit" Ethernet indicates compatibility with IEEE standard 802.3ab for Gigabit Ethernet, connote actual operating speed of 1 Gb/s. For high-speed transmission, connection to a Gigabit Ethernet server and network infrastructure is required.

\*\*Wireless access point and internet service required and sold separately. Availability of public wireless access points limited. W



### Technical Specifications

compatible with prior 802.11 specs. The specifications for Wi-Fi 6 (802.11ax) are draft and are not final. If the final specification: specifications, it may affect the ability of the notebook to communicate with other 802.11ax devices. Only available in countries supported.

### AUDIO/MULTIMEDIA

#### Audio

2 Integrated stereo speakers  
Integrated dual array microphone

#### Webcam

720p HD HP Privacy Camera<sup>6,15,17</sup>

#### Optical Drive

DVD-ROM (Defeatured Combo)<sup>18</sup>

DVD Writer SATA Drive<sup>17</sup>

6. HD content required to view HD images.

15. Sold separately or as an optional feature.

17. Internet access required.

18. DVD-Writer does not support DVD RAM. Don't copy copyright protected materials.

---

### KEYBOARDS/POINTING DEVICES/BUTTONS & FUNCTION KEYS

#### Keyboard

HP Advanced Keyboard with Numeric Keypad

#### Pointing Device

ClickPad, Spill-resistant with drain

ClickPad, Spill-resistant with drain, DuraKeys & Backlit

Dual Point, Spill-resistant with drain, DuraKeys & Backlit

Dual Point Spill-resistant with drain, DuraKeys & Backlit Privacy

#### Function Keys

ESC: system information

F1 - Display Switching

F2 - Blank or Privacy

F3 - Brightness Down

F4 - Brightness Up

F5 - Speaker Mute

F6 - Volume Down

F7 - Volume Up

F8 - Mic Mute

F9 - Backlight Toggle (for backlit keyboard) or Blank

F10 - Blank

F11 - Wi-fi Toggle

F12 - Sleep

#### Clickpad requirements:

On/off control by driver

Taps enabled as default

#### Gestures:

(Win 10):

Disabled by default:

3 Finger Flick

2 Finger Rotate

### Technical Specifications

Momentum Motion

1 Finger Vertical Scroll

**Win 10:**

Support PTP with Miniport driver

Settings enabled by default by MSFT:

2 Finger Scrolling

2 Finger Zoom (Pinch)

OSD (enable/disable)

3 finger tap - Cortana

3 finger flick - App switch

4 finger tap - Action Center

---

## SOFTWARE AND SECURITY

### Preinstalled Software

#### BIOS

HP BIOSphere Gen5<sup>19</sup>

HP Drive Lock & Automatic Drive Lock<sup>20</sup>

BIOS Update via Network

Master Boot Record Security

Power On Authentication

Secure Erase<sup>21</sup>

Absolute Persistence Module<sup>22</sup>

Pre-boot Authentication

#### Software

HP Native Miracast Support<sup>23</sup>

HP Connection Optimizer

HP Image Assistant

HP Hotkey Support

HP JumpStart

HP Support Assistant<sup>24</sup>

HP Noise Cancellation Software

Buy Office (sold separately)

#### Manageability Features

HP Driver Packs<sup>25</sup>

HP System Software Manager (SSM)

HP BIOS Config Utility (BCU)

HP Client Catalog

HP Manageability Integration Kit Gen3<sup>26</sup>

HP Cloud Recovery<sup>27</sup>

#### Client Security Software

HP Client Security Manager Gen5<sup>28</sup>

HP Fingerprint Sensor<sup>29</sup> (select models)

HP Power On Authentication

Windows Defender<sup>30</sup>

#### Security Management

Pre-boot Authentication

TPM 2.0 Embedded Security Chip shipped with Windows 10 (Common Criteria EAL4+ Certified)<sup>31</sup>

M2 SSD, SATA 1 port disablement (via BIOS)

Serial, USB enable/disable (via BIOS)

Power-on password (via BIOS)

Setup password (via BIOS)

Support for chassis padlocks and cable lock devices

HP Sure Click<sup>32</sup>

### Technical Specifications

HP Sure Start Gen5<sup>33</sup>

HP Sure Sense<sup>34</sup>

#### Security

##### TPM

Model: Infineon SLB9670

Version: 7.85

Revision: TPM 2.0

FIPS 140-2 Compliant: Yes

##### Smartcard Reader

Model number: Alcor AU9560

FIPS 201 Compliant: Yes

##### IPv6 Compliance:

Yes

##### MD5 Hash: Please follow the instructions below to access MD5 Hash.

Log-on to <http://hp.com/support>, enter your product name, select software and drivers, select OS, select driver. After selecting "Associated files"? and then click on "Download"?. When opening the file, under "Purpose"? you should see the appropriate "SOF

##### Is the BIOS on this notebook ISO/IEC 19678:2015 (formerly NIST 800-147) compliant?:

Yes

UEFI version: 2.6

19. HP BIOSphere Gen5 is available on select HP Pro and Elite PCs. See product specifications for details. Features may vary depending on platform and configurations.

20. HP Drive Lock & Automatic Drive Lock is not supported on NVMe drives

21. For the methods outlined in the National Institute of Standards and Technology Special Publication 800-88 "Clear" sanitization, Erase does not support platforms with Intel® Optane™.

22. Absolute agent is shipped turned off, and will be activated when customers activate a purchased subscription. Subscription is for terms ranging from multiple years. Service is limited, check with Absolute for availability outside the U.S. The Absolute Recovery limited warranty. Certain conditions apply. For full details visit: <http://www.absolute.com/company/legal/agreements/computer>. Data Delete is an optional service provided by Absolute Software. If utilized, the Recovery Guarantee is null and void. In order to use the service, customers must first sign a Pre-Authorization Agreement and either obtain a PIN or purchase one or more RSA SecurID tokens from Absolute Software.

23. Miracast is a wireless technology your PC can use to project your screen to TVs, projectors, and streaming devices.

24. HP Support Assistant requires Windows and Internet access.

25. HP Driver Packs not preinstalled, however available for download at <http://www.hp.com/go/clientmanagement>.

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

27. HP Cloud Recovery is available for HP Elite and Pro desktops and laptops PCs with Intel® or AMD processors and requires an internet 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>

28. HP Client Security Manager Gen5 requires Windows and is available on the select HP Pro and Elite PCs. See product specifications for details.

29. HP Fingerprint Sensor is an optional feature and requires configuration at purchase.

30. Windows Defender Opt in and internet connection required for updates.

31. Firmware TPM is version 2.0. Hardware TPM is v1.2, which is a subset of the TPM 2.0 specification version v0.89 as implemented by Intel Platform Trust Technology (PTT). Software TPM is version 2.0. Hardware TPM is v1.2, which is a subset of the TPM 2.0 specification version v0.89 as implemented by Intel Platform Trust Technology (PTT).

32. HP Sure Click is available on most HP PCs and supports Microsoft® Internet Explorer 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.

33. HP Sure Start Gen5 is available on select HP PCs with Intel processors. See product specifications for availability.

34. HP Sure Sense requires Windows 10. See product specifications for availability.

### POWER

### Technical Specifications

#### Power Supply

HP Smart 45 W right angle 4.5 mm AC Adapter<sup>35</sup>  
HP Smart 45 W right angle 4.5 mm AC Adapter - Argentina<sup>35</sup>  
HP Smart 45 W right angle 4.5 mm AC Adapter 2-prong (Japan only)<sup>35</sup>  
HP Smart 45 W USB Type-C™ adapter<sup>35</sup>  
HP Smart 65 W right angle 4.5 mm AC Adapter<sup>35</sup>  
HP Smart 65 W EM External AC power adapter<sup>35</sup>  
HP Smart 65 W USB Type-C™ adapter<sup>35</sup>

#### Primary Battery

HP Long Life 3-cell, 48 Wh Li-ion<sup>36</sup>  
HP Fast Charge Technology - 90% in 90minutes

#### Battery Life

Up to 15 hours<sup>37</sup>

#### Power Cord

2-wire plug (C7), 1.0m, Conventional  
3-wire plug (C5), 1.0m, Conventional  
3-wire plug (C5), 1.8m, Conventional  
Duckhead power cord, 1.0m, Premium  
Duckhead power cord, 1.8m, Premium

35. Availability may vary by country.

36. Battery is internal and not replaceable by customer. Serviceable by warranty.

37. Windows 10 MM14 battery life will vary depending on various factors including product model, configuration, loaded applications, wireless functionality, and power management settings. The maximum capacity of the battery will naturally decrease with time <http://www.bapco.com> for additional details.

### WEIGHTS & DIMENSIONS

#### Weight

Starting at 4.8 lb (non-touch); Starting at 5.29 lb (touch)<sup>38</sup>  
Starting at 2.18 kg (non-touch); Starting at 2.4 kg (touch)<sup>38</sup>

#### Dimensions (W x D x H)

14.85 x 10.12 x 0.95 in (non-touch); 14.85 x 10.12 x 0.99 in (touch)  
37.7 x 25.7 x 2.39 cm (non-touch); 37.7 x 25.7 x 2.49 cm (touch)

38. Weight will vary by configuration.

### PORTS/SLOTS

### Technical Specifications

#### Ports

- 2 USB 3.1 Gen 1 (1 charging)
- 1 USB 3.1 Type-C™ Gen1 (Power delivery, DisplayPort™ 1.2)
- 1 HDMI 1.4<sup>39</sup>
- 1 RJ-45
- 1 VGA or Serial Port
- 1 headphone/microphone combo
- 1 AC power

#### Expansion Slots

- 1 docking connector
  - 1 microSD (multi-format digital media reader)
- <sup>39</sup>. HDMI cable sold separately.

---

## SERVICE AND SUPPORT

HP Services offers 3-year and 1-year limited warranties and 90 day software support options depending on country and the customer. Batteries have a default one year limited warranty except for Long Life batteries which will have same 1-year or 3-year as the platform. On-site service and extended coverage is also available with HP Care Pack Services, optional extended service beyond the standard limited warranties. To choose the right level of service for your HP product, use the HP Care Pack Services <http://www.hp.com/go/cpc>.<sup>40</sup>

<sup>40</sup>. HP Care Packs are sold separately. Service levels and response times for HP Care Packs may vary depending on your geographic starts on date of hardware purchase. Restrictions and limitations apply. For details, visit <http://www.hp.com/go/cpc>. HP services the applicable HP terms and conditions of service provided or indicated to Customer at the time of purchase. Customer may have statutory rights according to applicable local laws, and such rights are not in any way affected by the HP terms and conditions Limited Warranty provided with your HP Product.

---

## CERTIFICATION AND COMPLIANCE

- ENERGY STAR® certified
- EPEAT® 2019 Silver<sup>41</sup>
- Low halogen<sup>42</sup>
- TCO 5.0 Certified

<sup>41</sup>. Based on US EPEAT® registration according to IEEE 1680.1-2018 EPEAT®. Status varies by country. Visit <http://www.epeat.com> for information.

<sup>42</sup>. External power supplies, power cords, cables and peripherals are not Low Halogen. Service parts obtained after purchase may be Halogen.

---

## SYSTEM UNIT

### Technical Specifications

<b>Stand-Alone Power Requirements (AC Power)</b>	<b>Nominal Operating Voltage</b>	19.5 V
	<b>Average Operating Power</b>	Win 10
	<b>Integrated Graphics</b>	11 W
	<b>Discrete Graphics</b>	16 W
	<b>Max Operating Power</b>	Discrete < 65W UMA < 45W
<b>Temperature</b>	<b>Operating</b>	32° to 95° F (0° to 35° C) (not writing optical)
	<b>Non-operating</b>	41° to 95° F (5° to 35° C) (writing optical)
<b>Relative Humidity</b>	<b>Operating</b>	10% to 90%, non-condensing
	<b>Non-operating</b>	5% to 95%, 101.6° F (38.7° C) maximum wet bulb temperature
<b>Shock</b>	<b>Operating</b>	40 G, 2 ms, half-sine
	<b>Non-operating</b>	200 G, 2 ms, half-sine
<b>Random Vibration</b>	<b>Operating</b>	0.75 grms
	<b>Non-operating</b>	1.50 grms
<b>Altitude (unpressurized)</b>	<b>Operating</b>	-50 to 10,000 ft (-15.24 to 3,048 m)
	<b>Non-operating</b>	-50 to 40,000 ft (-15.24 to 12,192 m)
<b>Planned Industry Standard Certifications</b>	<b>UL</b>	Yes
	<b>CSA</b>	Yes
	<b>FCC Compliance</b>	Yes
	<b>ENERGY STAR®</b>	Select models <sup>43</sup>
	<b>EPEAT® 2019</b>	Yes, Silver in U.S. <sup>44</sup>
	<b>ICES</b>	Yes
	<b>Australia / NZ A-Tick Compliance</b>	Yes
	<b>CCC</b>	Yes
	<b>Japan VCCI Compliance</b>	Yes
	<b>KC</b>	Yes
	<b>BSMI</b>	Yes
	<b>CE Marking Compliance</b>	Yes
	<b>BNCI or BELUS</b>	Yes
	<b>CIT</b>	Yes
	<b>GOST</b>	Yes
<b>Saudi Arabian Compliance (ICCP)</b>	Yes	
<b>SABS</b>	Yes	

43. Configurations of the HP ProBook 650 G5 that are ENERGY STAR® qualified are identified as HP ProBook 650 G5 ENERGY STAR and on <http://www.energystar.gov>.

44. Based on US EPEAT® registration according to IEEE 1680.1-2018 EPEAT®. Status varies by country. Visit <http://www.epeat.com> for more information.

### ENVIRONMENTAL & INDUSTRY

### Technical Specifications

<b>Environmental Data</b>	<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>• US Federal Energy Management Program (FEMP)</li> <li>• EPEAT® 2019 Silver registered in the United States. Based on EPEAT® registration according to IEEE 1680.1-2018 EPEAT®. Status varies by country. See <a href="http://www.epeat.net">http://www.epeat.net</a> for registration status in your country.</li> <li>• TCO Certified Edge</li> <li>• China Energy Conservation Program (CECP)</li> <li>• China State Environmental Protection Administration (SEPA)</li> <li>• Taiwan Green Mark</li> <li>• Korea Eco-label</li> <li>• Japan PC Green label*</li> </ul>		
	<b>System Configuration</b>	The configuration used for the Energy Consumption and Declared Noise Emissions data for the Notebook model is based on a "Typically Configured Notebook".		
	<b>Energy Consumption (in accordance with US ENERGY STAR® test method)</b>	<b>115VAC, 60Hz</b>	<b>230VAC, 50Hz</b>	<b>100VAC, 60Hz</b>
Normal Operation (Short idle)		4.75	4.84	4.86
Normal Operation (Long idle)		2.47	2.54	2.47
Sleep		0.78	0.83	0.79
Off		0.28	0.31	0.28
		<p>Note: Energy efficiency data listed is for an ENERGY STAR® compliant product if offered within the model family. HP computers marked with the ENERGY STAR® Logo are compliant with the applicable U.S. Environmental Protection Agency (EPA) ENERGY STAR® specifications for computers. If a model family does not offer ENERGY STAR® compliant configurations, then energy efficiency data listed is for a typically configured PC featuring a hard disk drive, a high efficiency power supply, and a Microsoft Windows® operating system.</p>		
	<b>Heat Dissipation*</b>	<b>115VAC, 60Hz</b>	<b>230VAC, 50Hz</b>	<b>100VAC, 60Hz</b>
Normal Operation (Short idle)		16	16	16
Normal Operation (Long idle)		8	8	8
Sleep		2	2	3
Off		1	1	1
		*NOTE: Heat dissipation is calculated based on the measured watts, assuming the service level is attained for one hour.		
<b>Declared Noise Emissions</b>		Sound Power (L <sub>WAd</sub> , bels)		Sound Pressure (L <sub>pAm</sub> , decibels)

### Technical Specifications

<p><b>(in accordance with ISO 7779 and ISO 9296)</b></p>		
<p>Typically Configured - Idle</p>	<p>2.5</p>	<p>15</p>
<p>Fixed Disk - Random writes</p>	<p>2.9</p>	<p>23</p>
<p><b>Longevity and Upgrading</b></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> <ul style="list-style-type: none"> <li>• 3 USB ports</li> <li>• 1 PC card slot (type I/II)</li> <li>• 1 ExpressCard/54 slot</li> <li>• 1 IEEE 1394 Port</li> <li>• 2 SODIMM memory slots</li> <li>• Optional expansion base docking station</li> <li>• 1 multi-bay II storage port</li> <li>• Interchangeable HDD</li> </ul> <p>Spare parts are available throughout the warranty period and or for up to "5"? years after the end of production.</p>	
<p><b>Batteries</b></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:</p> <p style="padding-left: 40px;">Mercury greater the1ppm by weight</p> <p style="padding-left: 40px;">Cadmium greater than 20ppm by weight</p> <p>Battery description: CR2032 (coin cell) / SS03050</p> <p>Battery type: Lithium / Li-Ion/Li-Ion Polymer</p> <p>Battery description: 6-cell high capacity Lithium-Ion battery (optional 8 cell available)</p> <p>Battery type:</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>• This product is in compliance with the IEEE 1680.1 (EPEAT) standard at the Silver level, see <a href="http://www.epeat.net">http://www.epeat.net</a></li> <li>• Plastics parts weighing over 25 grams used in the product are marked per ISO11469 and ISO1043.</li> <li>• This product contains 5.69% post-consumer recycled plastic (by wt.) according to IEEE 1680.1-2018 standard, criterion 4.2.1.1.</li> <li>• This product is 96.4% recycle-able when properly disposed of at end of life.</li> </ul>	



### Technical Specifications

<b>Packaging Materials</b>	<b>External:</b>	PAPER/Corrugated	345
	<b>Internal:</b>	PLASTIC/EPE (Expanded Polyethylene)	60
		PLASTIC/Polyethylene low density - LDPE	5
		PLASTIC/Polypropylene - PP	15
<b>Material Usage</b>	<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/supplychain/gen_specifications.htm">http://www.hp.com/hpinfo/globalcitizenship/environment/supplychain/gen_specifications.htm</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>• Bis(2-Ethylhexyl) phthalate (DEHP)</li> <li>• Benzyl butyl phthalate (BBP)</li> <li>• Dibutyl phthalate (DBP)</li> <li>• Diisobutyl phthalate (DIBP)</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> <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>Hewlett-Packard offers end-of-life HP product return and recycling programs in many geographical 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</p>		

### Technical Specifications

	WEEE treatment facilities as well as HP OEM customers who integrate and re-sell HP equipment.
<b>HP, Inc. Corporate Environmental Information</b>	<p>For more information about HP's commitment to the environment:</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></p> <p>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></p> <p>ISO 14001 certificates:  <a href="http://h20195.www2.hp.com/V2/GetDocument.aspx?docname=c04755842">http://h20195.www2.hp.com/V2/GetDocument.aspx?docname=c04755842</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>

### DISPLAYS

**Panel LCD 15.6 inch diagonal FHD (1920 x 1080) Anti-Glare WLED UWVA 72 percent cg 1000 nits eDP 1.4+PSR2 flat Privacy NWBZ**

<b>Outline Dimensions (W x H x D)</b>	349.52 x 204.79 mm (max)
<b>Active Area</b>	344.16 x 193.59 mm (typ.)
<b>Weight</b>	350 g (max)
<b>Diagonal Size</b>	15.6 inch
<b>Thickness</b>	2.6 mm (max)
<b>Interface</b>	eDP 1.4 + PSR2 (4 lane)
<b>Surface Treatment</b>	Anti-Glare
<b>Touch Enabled</b>	No
<b>Contrast Ratio</b>	2000:1 (typ.)
<b>Refresh Rate</b>	60 Hz
<b>Brightness*</b>	1000 nits
<b>Pixel Resolution</b>	1920 x 1080 (FHD)
<b>Format of LCD Pixel Arrangement</b>	RGB
<b>Backlight</b>	LED
<b>Color Gamut Coverage</b>	72% of NTSC
<b>Color Depth</b>	8 bits
<b>Viewing Angle</b>	UWVA 85/85/85/85

\*Touch-enabled display and Sure View privacy panel will lower actual brightness

### Technical Specifications

<b>Panel LCD 15.6 inch diagonal FHD (1920 x 1080) Anti-Glare WLED UWVA 45 percent cg 250 nits eDP 1.2 w/o PSR slim NWBZ</b>	<b>Outline Dimensions (W x H x D)</b>	350.96 x 216.65 mm (max)
	<b>Active Area</b>	344.16 x 193.59 mm (typ.)
	<b>Weight</b>	370 g (max)
	<b>Diagonal Size</b>	15.6 inch
	<b>Thickness</b>	3.2 mm (max)
	<b>Interface</b>	eDP 1.2 (2 lane)
	<b>Surface Treatment</b>	Anti-Glare
	<b>Touch Enabled</b>	No
	<b>Contrast Ratio</b>	600:1 (typ.)
	<b>Refresh Rate</b>	60 Hz
	<b>Brightness</b>	250 nits
	<b>Pixel Resolution</b>	1920 x 1080 (FHD)
	<b>Format of LCD Pixel Arrangement</b>	RGB
	<b>Backlight</b>	LED
	<b>Color Gamut Coverage</b>	45% of NTSC
<b>Color Depth</b>	6 bits	
<b>Viewing Angle</b>	UWVA 85/85/85/85	

---

<b>Panel LCD 15.6 inch diagonal FHD (1920 x 1080) Anti-Glare WLED UWVA 45 percent cg 250 nits eDP slim Touch on Panel NWBZ</b>	<b>Outline Dimensions (W x H x D)</b>	350.96 x 216.75 mm (max)
	<b>Active Area</b>	344.16 x 193.59 mm (typ.)
	<b>Weight</b>	385 g (max)
	<b>Diagonal Size</b>	15.6 inch
	<b>Thickness</b>	3.2 mm (panel side) / 3.4 mm (PCBA Side) (max)
	<b>Interface</b>	eDP 1.2
	<b>Surface Treatment</b>	Anti-Glare On-cell
	<b>Touch Enabled</b>	No
	<b>Contrast Ratio</b>	600:1 (typ.)
	<b>Refresh Rate</b>	60 Hz
	<b>Brightness</b>	250 nits
	<b>Pixel Resolution</b>	1920 x 1080 (FHD)
	<b>Format of LCD Pixel Arrangement</b>	RGB
	<b>Backlight</b>	LED
	<b>Color Gamut Coverage</b>	45% of NTSC
<b>Color Depth</b>	6 bits	
<b>Viewing Angle</b>	UWVA 85/85/85/85	

### Technical Specifications

<b>15.6" diagonal HD SVA anti-glare LED-backlit non-touch; 220 cd/m<sup>2</sup>; 45% percent cg (1366 x 768)</b>	<b>Outline Dimensions (W x H x D)</b>	360 x 224.3 (mm) max
	<b>Active Area</b>	344.2 x 193.5 (mm)
	<b>Weight</b>	370 g max
	<b>Diagonal Size</b>	15.6 (inch)
	<b>Thickness</b>	3.2 (mm) max
	<b>Interface</b>	eDP 1.2
	<b>Surface Treatment</b>	Anti-Glare (AG)
	<b>Touch Enabled</b>	None
	<b>Contrast Ratio</b>	300:1 (typical)
	<b>Refresh Rate</b>	60 Hz
	<b>Brightness</b>	220 nits
	<b>Pixel Resolution</b>	1366 x 768 (HD)
	<b>Format of LCD Pixel Arrangement</b>	RGB
	<b>Backlight</b>	LED
	<b>Color Gamut Coverage</b>	45% of NTSC
	<b>Color Depth</b>	6 bits + Hi FRC
<b>Viewing Angle</b>	SVA 45/45/25/35	

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

### STORAGE

<b>HDD 500 GB 7200 RPM 7mm SATA</b>	<b>Drive Weight</b>	0.21 lbs (95 g)
	<b>Rotation speed</b>	7200 RPM
	<b>Cache Buffer</b>	Up to 32 MB
	<b>Height</b>	0.28 in (7 mm)
	<b>Width</b>	2.75 in (69.85 mm)
	<b>Interface</b>	ATA-8, SATA 3.0
	<b>Transfer Rate</b>	600 MB/s
	<b>Seek Time</b>	Single Track: 2 ~ 1.5 ms; Average: 11 ~ 13 ms; Maximum: 18 ~ 22 ms
	<b>Logical Blocks</b>	976,773,168
	<b>Operating Temperature</b>	32° to 140°F (0° to 60°C) [ambient temp]
	<b>Security Features</b>	ATA Security
<b>Features</b>	S.M.A.R.T., NCQ, Ultra DMA	

### Technical Specifications

---

<b>HDD 500 GB 7200 RPM 7mm FIPS SATA Opal2</b>	<b>Drive Weight</b>	0.21 lbs (95 g)
	<b>Rotation speed</b>	7200 RPM
	<b>Cache Buffer</b>	Up to 32 MB
	<b>Height</b>	0.28 in (7 mm)
	<b>Width</b>	2.75 in (69.85 mm)
	<b>Interface</b>	ATA-8, SATA 3.0
	<b>Transfer Rate</b>	600 MB/s
	<b>Seek Time</b>	Single Track: 2 ~ 1.5 ms; Average: 11 ~ 13 ms; Maximum: 18 ~ 22 ms
	<b>Logical Blocks</b>	976,773,168
	<b>Operating Temperature</b>	32° to 140°F (0° to 60°C) [ambient temp]
	<b>Security Features Features</b>	ATA Security; TCG Opal 2.x, FIPS S.M.A.R.T., NCQ, Ultra DMA

---

<b>HDD 1 TB 7200 RPM 7mm SATA 2.5in</b>	<b>Drive Weight</b>	90 g
	<b>Rotation speed</b>	7200 RPM
	<b>Cache Buffer</b>	128 MB
	<b>Height</b>	7.2mm Max.
	<b>Width</b>	69.85mm
	<b>Interface</b>	ATA-8, SATA 3.0
	<b>Transfer Rate</b>	600 MB/s
	<b>Seek Time</b>	Single Track: 1.5 ms Average: 13 ms Maximum: 32 ms
	<b>Logical Blocks</b>	1,953,525,168
	<b>Operating Temperature</b>	0~60°C
	<b>Security Features Features</b>	ATA Security S.M.A.R.T., NCQ, Ultra DMA, TRIM

---

### Technical Specifications

<b>SSD 128 GB 2280 M2 SATA-3 TLC</b>	<b>Drive Weight</b>	0.02 lb (10 g)
	<b>Capacity</b>	128 GB
	<b>NAND Type</b>	TLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Interface</b>	ATA-8, SATA 3.0
	<b>Maximum Sequential Read</b>	Up To 520 MB/s
	<b>Maximum Sequential Write</b>	Up To 450 MB/s
	<b>Logical Blocks</b>	250,069,680
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
<b>Features</b>	DIPM; TRIM; DEVSLP	

---

<b>256 GB 2280 PCIe NVMe Value Solid State Drive</b>	<b>Drive Weight</b>	0.02 lb (10 g)
	<b>Capacity</b>	256 GB
	<b>NAND Type</b>	MLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Interface</b>	PCIe NVMe Gen3X4
	<b>Maximum Sequential Read</b>	Up To 1700 MB/s
	<b>Maximum Sequential Write</b>	Up To 600 MB/s
	<b>Logical Blocks</b>	703,282,608
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
<b>Features</b>	TRIM; L1.2	

---

<b>SSD 256 GB 2280 M2 PCIe-3x4 SS NVMe TLC</b>	<b>Drive Weight</b>	0.02 lb (10 g)
	<b>Capacity</b>	256 GB
	<b>NAND Type</b>	TLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Interface</b>	PCIe NVMe Gen3X4
	<b>Maximum Sequential Read</b>	Up To 2600 MB/s
	<b>Maximum Sequential Write</b>	Up To 900 MB/s
	<b>Logical Blocks</b>	500,118,192
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]

---

### Technical Specifications

**Features** TRIM; L1.2

---

**SSD 256 GB 2280 M2 SATA-3 Three Layer Cell Federal Information Processing Standard**

<b>Form Factor</b>	M.2 2280
<b>Capacity</b>	256 GB
<b>NAND Type</b>	TLC
<b>Height</b>	0.09 in (2.3 mm)
<b>Width</b>	0.87 in (22 mm)
<b>Interface</b>	0.02 lb (10 g)
<b>Maximum Sequential Read</b>	ATA-8, SATA 3.0
<b>Maximum Sequential Write</b>	Up To 530 MB/s
<b>Logical Blocks</b>	Up To 550 MB/s
<b>Operating Temperature</b>	500,118,192

**SSD 256 GB 2280 M2 SATA-3 Self Encrypted OPAL2 Three Layer Cell**

<b>Form Factor</b>	M.2 2280
<b>Capacity</b>	256 GB
<b>NAND Type</b>	TLC
<b>Height</b>	0.09 in (2.3 mm)
<b>Width</b>	0.87 in (22 mm)
<b>Weight</b>	0.02 lb (10 g)
<b>Interface</b>	ATA-8, SATA 3.0
<b>Maximum Sequential Read</b>	Around 530 ~ 560 MB/s
<b>Maximum Sequential Write</b>	Around 500 ~ 530 MB/s
<b>Logical Blocks</b>	500,118,192
<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
<b>Features</b>	ATA Security; TCG OPAL 2.0; DIPM; TRIM; DEVSLP

---

### Technical Specifications

<b>256 GB 2280 PCIe-3x2x2 NVMe+SSD 16 GB 3D Xpoint</b>	<b>Form Factor</b>	M.2 2280
	<b>Capacity</b>	256 GB
	<b>NAND Type</b>	QLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Weight</b>	0.02 lb (10 g)
	<b>Interface</b>	PCIe NVMe Gen3X4
	<b>Maximum Sequential Read</b>	Up To 1450 MB/s
	<b>Maximum Sequential Write</b>	Up To 650 MB/s
	<b>Logical Blocks</b>	500,118,192
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
	<b>Features</b>	TRIM; L1.2, Optane Storage acceleration

<b>SSD 512 GB 2280 PCIe NVMe Value</b>	<b>Form Factor</b>	M.2 2280
	<b>Capacity</b>	512 GB
	<b>NAND Type</b>	TLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Weight</b>	0.02 lb (10 g)
	<b>Interface</b>	PCIe NVMe Gen3X4
	<b>Maximum Sequential Read</b>	Around 1500 ~ 1700 MB/s
	<b>Maximum Sequential Write</b>	Around 860 ~ 1500 MB/s
	<b>Logical Blocks</b>	1,000,215,215
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
	<b>Features</b>	ATA Security; TRIM; L1.2

<b>SSD 512 GB 2280 M2 PCIe-3x4 SS NVMe TLC</b>	<b>Drive Weight</b>	0.02 lb (10 g)
	<b>Capacity</b>	512 GB
	<b>NAND Type</b>	TLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Interface</b>	PCIe NVMe Gen3X4
	<b>Maximum Sequential Read</b>	Up To 2600 MB/s
	<b>Maximum Sequential Write</b>	Up To 1400 MB/s
	<b>Logical Blocks</b>	1,000,215,216
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
	<b>Features</b>	TRIM; L1.2



### Technical Specifications

---

<b>SSD 512 GB 2280 PCIe-3x4 NVMe Self Encrypted OPAL2 Three Layer Cell</b>	<b>Form Factor</b>	M.2 2280
	<b>Capacity</b>	512 GB
	<b>NAND Type</b>	TLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Interface</b>	0.02 lb (10 g)
	<b>Maximum Sequential Read</b>	PCIe NVMe Gen3X4
	<b>Maximum Sequential Write</b>	Around 3000 ~ 3400 MB/s
	<b>Logical Blocks</b>	Around 1800 ~ 2500 MB/s
	<b>Operating Temperature</b>	1,000,215,216
	<b>Features</b>	32° to 158°F (0° to 70°C) [ambient temp]

---

<b>SSD 512 GB 2280 M2 SATA-3 TLC FIPS</b>	<b>Drive Weight</b>	0.02 lb (10 g)
	<b>Capacity</b>	512 GB
	<b>NAND Type</b>	TLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Interface</b>	ACS-3, SATA 3.2
	<b>Maximum Sequential Read</b>	Up To 530 MB/s
	<b>Maximum Sequential Write</b>	Up To 400 MB/s
	<b>Logical Blocks</b>	1,000,215,216
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
	<b>Features</b>	DIPM; TRIM; DEVSLP

---

<b>SSD 512 GB 2280 PCIe-3x2x2 NVMe+SSD 32 GB 3D Xpoint</b>	<b>Form Factor</b>	M.2 2280
	<b>Capacity</b>	512 GB
	<b>NAND Type</b>	TLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Weight</b>	0.02 lb (10 g)
	<b>Interface</b>	PCIe NVMe Gen3X4
	<b>Maximum Sequential Read</b>	Up To 2400 MB/s
	<b>Maximum Sequential Write</b>	Up To 1300 MB/s
	<b>Logical Blocks</b>	1,000,215,215
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
<b>Features</b>	ATA Security, TRIM; L1.2	

---

### Technical Specifications

---

<b>SSD 1 TB 2280 PCIe-3x4 NVMe TLC SS</b>	<b>Drive Weight</b>	0.02 lb (10 g)
	<b>Capacity</b>	1 TB
	<b>NAND Type</b>	TLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Interface</b>	PCIe NVMe Gen3X4
	<b>Maximum Sequential Read</b>	2900
	<b>Maximum Sequential Write</b>	2000
	<b>Logical Blocks</b>	2000409263
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
<b>Features</b>	TRIM; L1.2	

---

<b>SSD 16 GB 2280 PCIe-3x2 NVMe 3D Xpoint</b>	<b>Drive Weight</b>	M.2 2280
	<b>Capacity</b>	16 GB
	<b>NAND Type</b>	Xpoint
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Interface</b>	PCIe NVMe Gen3X2
	<b>Maximum Sequential Read</b>	1400
	<b>Maximum Sequential Write</b>	300
	<b>Logical Blocks</b>	28,181,188
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
<b>Features</b>	L1.2	

**NOTE:** For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 30 GB (for Windows 10) is reserved for system recovery software.

---

### OPTICAL DRIVES

---

### Technical Specifications

#### DVD-ROM Drive

<b>Access Times</b>	<b>Random</b> <140ms CD (typical) < 160ms DVD (typical)
<b>Weight</b>	150g max. 24X CD-ROM
<b>Max Data Transfer Rate</b>	8X DVD-ROM 5X DVD-RAM UDMA Mode 5
<b>Interface</b>	Gen 1 SATA CD-DA, CD-TEXT, CD-ROM, CD-ROM XA, MIXED MODE CD, CD-I, CD-I Bridge (Photo-CD, Video CD), Multisession CD (Photo-CD, CD-EXTRA, Portfolio, CD-R, CD-RW), CD-R, CD-RW, DVD-ROM (DVD-5, DVD-9, DVD-10, DVD-18), DVD-R, DVD-RW, DVD+R, DVD+RW, DVD-RAM
<b>Supported Media (read)</b>	
<b>Max Media Capacity (read)</b>	8.5 GB
<b>Transport</b>	Tray Loading

#### DVD Writer SATA Drive

<b>Access Times</b>	<b>Random</b> <140ms CD (typical) < 160ms DVD (typical)
<b>Weight</b>	150g max. 24X CD-ROM 8X DVD-ROM 24X CD-R 10X CD-RW 8X DVD+R
<b>Max Data Transfer Rate</b>	8X DVD+RW 8X DVD-R 6X DVD-RW 6X - DVD+R Dual Layer 6X - DVD-R Dual Layer 5X DVD-RAM
<b>Transfer Mode</b>	UDMA Mode 5
<b>Interface</b>	Gen 1 SATA CD-DA, CD-TEXT, CD-ROM, CD-ROM XA, MIXED MODE CD, CD-I, CD-I Bridge (Photo-CD, Video CD), Multisession CD (Photo-CD, CD-EXTRA, Portfolio, CD-R, CD-RW), CD-R, CD-RW, DVD-ROM (DVD-5, DVD-9, DVD-10, DVD-18), DVD-R, DVD-RW, DVD+R, DVD+RW, DVD-RAM
<b>Supported Media (read)</b>	
<b>Supported Media (write)</b>	CD-R, CD-RW, DVD+R, DVD+RW, DVD-R, DVD-RW, DVD-RAM, DVD+R DL, DVD-R DL
<b>Max Media Capacity (read)</b>	8.5 GB
<b>Max Media Capacity (write)</b>	8.5 GB
<b>Transport</b>	Tray Loading

### NETWORKING

### Technical Specifications

Intel® Wi-Fi® 6\*\*  
AX200 + BT5 vPro

#### Wireless LAN Standards

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

#### Interoperability

Wi-Fi® certified

#### Frequency Band

- 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

#### Data Rates

- 802.11b: 1, 2, 5.5, 11 Mbps
- 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps
- 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps
- 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)
- 802.11ac: MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, 80MHz & 160MHz)
- 802.11ax: MCS0 ~ MCS11, (1SS and 2SS) (20MHz, 40MHz, 80MHz & 160MHz)

#### Modulation

Direct Sequence Spread Spectrum  
OFDM, BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM  
, 1024QAM

#### Security<sup>3</sup>

IEEE and Wi-Fi compliant 64 / 128 bit WEP encryption for a/b/g mode only  
AES-CCMP: 128 bit in hardware  
802.1x authentication  
WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES.  
WPA2 certification  
IEEE 802.11i  
Cisco Certified Extensions, all versions through CCX4 and CCX Lite  
WAPI

#### Network Architecture Models

Ad-hoc (Peer to Peer)  
Infrastructure (Access Point Required)

#### Roaming

IEEE 802.11 compliant roaming between access points

#### Output Power<sup>2</sup>

- 802.11b: +18.5dBm minimum
- 802.11g: +17.5dBm minimum
- 802.11a: +18.5dBm minimum
- 802.11n HT20(2.4GHz): +15.5dBm minimum
- 802.11n HT40(2.4GHz): +14.5dBm minimum
- 802.11n HT20(5GHz): +15.5dBm minimum
- 802.11n HT40(5GHz): +14.5dBm minimum
- 802.11ac VHT80(5GHz): +11.5dBm minimum

### Technical Specifications

<b>Power Consumption</b>	<ul style="list-style-type: none"> <li>• 802.11ac VHT160(5GHz): +11.5dBm minimum</li> <li>• 802.11ax HT40(2.4GHz): +10dBm minimum</li> <li>• 802.11ax VHT160(5GHz): +10dBm minimum</li> <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 10 mW</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: -84dBm maximum</li> <li>• 802.11ac, MCS9: -59dBm maximum</li> <li>• 802.11ax, MCS11(HT40): -59dBm maximum</li> <li>• 802.11ax, MCS11(VHT160): -58.5dBm 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 126: 1.3g
<b>Operating Voltage</b>	3.3v +/- 9%
<b>Temperature</b>	<b>Operating</b> 14° to 158° F (-10° to 70° C) <b>Non-operating</b> -40° to 176° F (-40° to 80° C)
<b>Humidity</b>	<b>Operating</b> 10% to 90% (non-condensing) <b>Non-operating</b> 5% to 95% (non-condensing)
<b>Altitude</b>	<b>Operating</b> 0 to 10,000 ft (3,048 m) <b>Non-operating</b> 0 to 50,000 ft (15,240 m)

#### HP Integrated Module with Bluetooth 4.0/4.1/4.2/5.0/5.1 Wireless Technology

<b>Bluetooth Specification</b>	4.0/4.1/4.2/5.0/5.1 Compliant
<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>Signaling Data Rate</b>	Legacy: 3 Mbps signaling data rate <sup>1</sup> 2.17 Mbps BLE: 1 Mbps signaling data rate <sup>1</sup> 0.2 Mbps <b>1. Actual throughput may vary.</b> 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)

### Technical Specifications

<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</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)
<b>Security &amp; Manageability</b>	Intel® vPro™ support with appropriate Intel® chipset components

1. Wireless access point and Internet service is required. Availability of public wireless access point is limited.
  2. 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.
  3. Check latest software/driver release for updates on supported security features.
  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).
- \*\*Wireless access point and internet service required and sold separately. Availability of public wireless access points limited. Wi-Fi 6 is backwards compatible with prior 802.11 specs. The specifications for Wi-Fi 6 (802.11ax) are draft and are not final. If the final specifications differ from the draft specifications, it may affect the ability of the notebook to communicate with other 802.11ax devices. Only available in countries where 802.11ax is supported.

<b>Intel® Wi-Fi® 6** AX200 + BT5 non-vPro</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

### Technical Specifications

	IEEE 802.11r IEEE 802.11v
<b>Interoperability</b>	Wi-Fi® certified
<b>Frequency Band</b>	<ul style="list-style-type: none"> <li>• 802.11b/g/n/ax 2.402 - 2.482 GHz</li> <li>• 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</li> </ul>
<b>Data Rates</b>	<ul style="list-style-type: none"> <li>• 802.11b: 1, 2, 5.5, 11 Mbps</li> <li>• 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li> <li>• 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li> <li>• 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)</li> <li>• 802.11ac: MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, 80MHz &amp; 160MHz)</li> <li>• 802.11ax: MCS0 ~ MCS11, (1SS and 2SS) (20MHz, 40MHz, 80MHz &amp; 160MHz)</li> </ul>
<b>Modulation</b>	Direct Sequence Spread Spectrum OFDM, BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM , 1024QAM
<b>Security<sup>3</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 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>2</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>• 802.11ac VHT160(5GHz): +11.5dBm minimum</li> <li>• 802.11ax HT40(2.4GHz): +10dBm minimum</li> <li>• 802.11ax VHT160(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 10 mW</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

### Technical Specifications

<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: -84dBm maximum</li> <li>• 802.11ac, MCS9: -59dBm maximum</li> <li>• 802.11ax, MCS11(HT40): -59dBm maximum</li> <li>• 802.11ax, MCS11(VHT160): -58.5dBm 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 126: 1.3g
<b>Operating Voltage</b>	3.3v +/- 9%
<b>Temperature</b>	<b>Operating</b> 14° to 158° F (-10° to 70° C) <b>Non-operating</b> -40° to 176° F (-40° to 80° C)
<b>Humidity</b>	<b>Operating</b> 10% to 90% (non-condensing) <b>Non-operating</b> 5% to 95% (non-condensing)
<b>Altitude</b>	<b>Operating</b> 0 to 10,000 ft (3,048 m) <b>Non-operating</b> 0 to 50,000 ft (15,240 m)

### HP Integrated Module with Bluetooth 4.0/4.1/4.2/5.0/5.1 Wireless Technology

<b>Bluetooth Specification</b>	4.0/4.1/4.2/5.0/5.1 Compliant
<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>Signaling Data Rate</b>	Legacy: 3 Mbps signaling data rate <sup>1</sup> 2.17 Mbps BLE: 1 Mbps signaling data rate <sup>1</sup> 0.2 Mbps <b>1. Actual throughput may vary.</b> 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</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



### Technical Specifications

<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)

1. Wireless access point and Internet service is required. Availability of public wireless access point is limited.
  2. 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.
  3. Check latest software/driver release for updates on supported security features.
  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).
- \*\*Wireless access point and internet service required and sold separately. Availability of public wireless access points limited. Wi-Fi 6 is backwards compatible with prior 802.11 specs. The specifications for Wi-Fi 6 (802.11ax) are draft and are not final. If the final specifications differ from the draft specifications, it may affect the ability of the notebook to communicate with other 802.11ax devices. Only available in countries where 802.11ax is supported.

<b>Intel® 9560 802.11a/b/g/n/ac (2 x 2) Wi-Fi® and Bluetooth® 5.0 Combo<sup>1</sup> vPro</b>	<b>Wireless LAN Standards</b>	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n IEEE 802.11ac 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>	<ul style="list-style-type: none"> <li>• 802.11b/g/n 2.402 - 2.482 GHz</li> <li>• 802.11a/n/ac 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</li> </ul>
	<b>Data Rates</b>	<ul style="list-style-type: none"> <li>• 802.11b: 1, 2, 5.5, 11 Mbps</li> <li>• 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li> </ul>

### Technical Specifications

	<ul style="list-style-type: none"> <li>• 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li> <li>• 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)</li> <li>• 802.11ac: MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, 80MHz &amp; 160MHz)</li> </ul>
<b>Modulation</b>	Direct Sequence Spread Spectrum OFDM, BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM
<b>Security<sup>3</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 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>2</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>• 802.11ac VHT160(5GHz): +11.5dBm 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 10 mW</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>	802.11b, 1Mbps: -93.5dBm maximum 802.11b, 11Mbps: -84dBm maximum 802.11a/g, 6Mbps: -86dBm maximum 802.11a/g, 54Mbps: -72dBm maximum 802.11n, MCS07: -67dBm maximum 802.11n, MCS15: -64dBm maximum 802.11ac, MCS0: -84dBm maximum 802.11ac, MCS9: -59dBm maximum
<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 with CNVi Interface
<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 126: 1.3g
<b>Operating Voltage</b>	3.3v +/- 9%

### Technical Specifications

<b>Temperature</b>	<b>Operating</b>	14° to 158° F (-10° to 70° C)
	<b>Non-operating</b>	-40° to 176° F (-40° to 80° C)
<b>Humidity</b>	<b>Operating</b>	10% to 90% (non-condensing)
	<b>Non-operating</b>	5% to 95% (non-condensing)
<b>Altitude</b>	<b>Operating</b>	0 to 10,000 ft (3,048 m)
	<b>Non-operating</b>	0 to 50,000 ft (15,240 m)
<b>LED Activity</b>	LED Amber - Radio OFF LED White - Radio ON	

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

<b>Bluetooth Specification</b>	4.0/4.1/4.2/5.0 Compliant
<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>Signaling Data Rate</b>	Legacy: 3 Mbps signaling data rate <sup>1</sup> 2.17 Mbps BLE: 1 Mbps signaling data rate <sup>1</sup> 0.2 Mbps <a href="#">1. Actual throughput may vary.</a> 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>Bluetooth Software Supported</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) <sup>2</sup> Headset Profile (HSP) Hands Free Profile (HFP) Advanced Audio Distribution Profile (A2DP)
<b>Security &amp; Manageability</b>	Intel® vPro™ support with appropriate Intel® chipset components

### Technical Specifications

1. Wireless access point and Internet service is required. Availability of public wireless access point is limited.
2. 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.
3. Check latest software/driver release for updates on supported security features.
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).

<b>Intel® 9560 802.11a/b/g/n/ac (2 x 2) Wi-Fi® and Bluetooth® 5.0 Combo<sup>1</sup> non-vPro</b>	<b>Wireless LAN Standards</b>	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n IEEE 802.11ac 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>	<ul style="list-style-type: none"> <li>● 802.11b/g/n 2.402 - 2.482 GHz</li> <li>● 802.11a/n/ac 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</li> </ul>
	<b>Data Rates</b>	<ul style="list-style-type: none"> <li>● 802.11b: 1, 2, 5.5, 11 Mbps</li> <li>● 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li> <li>● 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li> <li>● 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)</li> <li>● 802.11ac: MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, 80MHz &amp; 160MHz)</li> </ul>
	<b>Modulation</b>	Direct Sequence Spread Spectrum BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM
	<b>Security<sup>3</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 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>2</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> </ul>

### Technical Specifications

	<ul style="list-style-type: none"> <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>• 802.11ac VHT160(5GHz): +11.5dBm 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/Modern 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>	802.11b, 1Mbps: -93.5dBm maximum 802.11b, 11Mbps: -84dBm maximum 802.11a/g, 6Mbps: -86dBm maximum 802.11a/g, 54Mbps: -72dBm maximum 802.11n, MCS07: -67dBm maximum 802.11n, MCS15: -64dBm maximum 802.11ac, MCS0: -84dBm maximum 802.11ac, MCS9: -59dBm maximum
<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 with CNVi Interface
<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 126: 1.3g
<b>Operating Voltage</b>	3.3v +/- 9%
<b>Temperature</b>	<b>Operating</b> 14° to 158° F (-10° to 70° C) <b>Non-operating</b> -40° to 176° F (-40° to 80° C)
<b>Humidity</b>	<b>Operating</b> 10% to 90% (non-condensing) <b>Non-operating</b> 5% to 95% (non-condensing)
<b>Altitude</b>	<b>Operating</b> 0 to 10,000 ft (3,048 m) <b>Non-operating</b> 0 to 50,000 ft (15,240 m)
<b>LED Activity</b>	LED Amber - Radio OFF LED White - Radio ON

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

<b>Bluetooth Specification</b>	4.0/4.1/4.2/5.0 Compliant
<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>Signaling Data Rate</b>	Legacy: 3 Mbps signaling data rate <sup>1</sup> 2.17 Mbps BLE: 1 Mbps signaling data rate <sup>1</sup> 0.2 Mbps <b>1. Actual throughput may vary.</b> Legacy: Synchronous Connection Oriented links up to 3, 64 kbps, voice channels Legacy: Asynchronous Connection Less links 2178.1 kbps/177.1 kbps

### Technical Specifications

	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>Bluetooth Software Supported</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)

1. Wireless access point and Internet service is required. Availability of public wireless access point is limited.
2. 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.
3. Check latest software/driver release for updates on supported security features.
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

<b>Intel® XMM™ 7360 LTE-Advanced CAT9<sup>1</sup></b>	<b>Technology/Operating bands</b>	FDD LTE: 2100 (Band 1), 1900 (Band 2), 1800 (Band 3), 1700/2100 (Band 4), 850 (Band 5), 2600 (Band 7), 900 (Band 8), 1400 (Band 11), 700 (Band 12 lower), 700 (Band 13 upper), 700 (Band 17 lower), 850 (Band 18 lower), 850 (Band 19 upper), 800 (Band 20), 1400 (Band 21), 850 (Band 26), 700 (Band 28), 700 (Band 29 RX only), 2300 (Band 30), 1700/2100 (Band 66). TDD LTE: 2600 (Band 38), 1900 (Band 39), 2400 (Band 40), 2500 (Band 41). HSPA+: 2100 (Band 1), 1900 (Band 2), 1700/2100 (Band 4), 850 (Band 5), 900 (Band 8) MHz
	<b>Wireless protocol standards</b>	3GPP Release 11 LTE Specification CAT.9, DL 60MHz BW throughput up to 450Mbps; UL 20MHz throughput up to 50Mbps WCDMA R99, 3GPP Release 5, 6, 7 and 8 UMTS Specification
	<b>GPS</b>	Standalone, A-GPS (MS-A, MS-B)
	<b>GPS bands</b>	1575.42 MHz ± 1.023 MHz, GLONASS 1596-1607MHz, Beidou 1561.098 MHz
	<b>Maximum data rates</b>	LTE: 450 Mbps (Download), 50 Mbps (Upload) DC-HSPA+: 42 Mbps (Download), 5.76 Mbps (Upload) HSPA+: 21Mbps (Download), 5.76 Mbps (Upload)
	<b>Maximum output power</b>	LTE: 23 dBm HSPA+: 23.5 dBm
	<b>Maximum power consumption</b>	LTE: 1,200 mA (peak); 900 mA (average) HSPA+: 1,100 mA (peak); 800 mA (average)
	<b>Form Factor</b>	M.2, 3042-S3 Key B
	<b>Weight</b>	5.8 g
	<b>Dimensions</b>	42 x 30 x 2.3 mm

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

<b>Intel® XMM™ 7262 LTE-Advanced DL CAT6</b>	<b>Technology/Operating bands</b>	FDD LTE: 2100 (Band 1), 1800 (Band 3), 850 (Band 5), 2600 (Band 7), 900 (Band 8), 800 (Band 20), 700 (Band 28), HSPA+: 2100 (Band 1), 850 (Band 5), 900 (Band 8)
	<b>Wireless protocol standards</b>	3GPP Release 11 LTE Specification CAT.6, DL 40MHz BW throughput up to 300Mbps; UL 20MHz throughput up to 50Mbps WCDMA R99, 3GPP Release 5, 6, 7 and 8 UMTS Specification
	<b>GPS</b>	Standalone, A-GPS (MS-A, MS-B and XTRA)
	<b>GPS bands</b>	1575.42 MHz ± 1.023 MHz, GLONASS 1596-1607MHz
	<b>Maximum data rates</b>	LTE: 300 Mbps (Download), 50 Mbps (Upload) DC-HSPA+: 42 Mbps (Download), 5.76 Mbps (Upload) HSPA+: 21Mbps (Download), 5.76 Mbps (Upload)
	<b>Maximum output power</b>	LTE: 23 dBm HSPA+: 23.5 dBm
	<b>Maximum power consumption</b>	LTE: 1,200 mA (peak); 830 mA (average) HSPA+: 1,100 mA (peak); 680 mA (average)
	<b>Form Factor</b>	M.2, 3042-S3 Key B
	<b>Weight</b>	6 g
	<b>Dimensions</b>	42 x 30 x 2.3 mm

### Technical Specifications

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

<b>Near Field Communications Controller (optional)</b>	<b>Dimensions (L x W x H)</b>	Module 25 mm by 10 mm by 2.0 mm
	<b>Chipset</b>	NPC100
	<b>System interface</b>	I2C
	<b>NFC RF standards</b>	ISO/IEC 14443 A ISO/IEC 14443 B ISO/IEC 15693 ISO/IEC 18092 ECMA-340 NFCIP-1 Target and Initiator ECMA-320 NFCIP-2
	<b>NFC Forum Support</b>	Tag Type 1, Type 2, Type3 and Type 4, NFCIP-1 and NFCIP-2
	<b>Reader (PCD-VCD) Mode<sup>1</sup></b>	ISO/IEC 14443 A ISO/IEC 14443 B ISO/IEC 15693 MIFARE 1K MIFARE 4K MIFARE DESFire FeliCa Jewel and Topaz cards
	<b>Card Emulation (PICC-VICC) Mode<sup>1</sup></b>	ISO/IEC 14443 A ISO/IEC 14443 B and B' MIFARE FeliCa
	<b>Frequency</b>	13.56 MHz
	<b>NFC Modes Supported</b>	Reader/Writer, Peer-to-Peer
	<b>Raw RF Data Rates</b>	106, 212, 424, 848 kbps
	<b>Operating temperature</b>	0°C to 70°C
	<b>Storage temperature</b>	-20°C to 125°C
	<b>Humidity</b>	10-90% operating 5-95% non-operating
	<b>Supply Operating voltage</b>	4.35 to 5.25 Volts
<b>I/O Voltage</b>	1.8V or 3.3V	



### Technical Specifications

<p><b>Intel® i219LM 10/100/1000 Integrated NIC</b></p>	<p><b>Connector</b></p> <p><b>System Interface</b></p> <p><b>Data rates supported</b></p> <p><b>IEEE Compliance</b></p> <p><b>Performance</b></p> <p><b>Power consumption</b></p> <p><b>Power Management</b></p> <p><b>Management Interface</b></p> <p><b>IT Manageability</b></p> <p><b>Security &amp; Manageability</b></p>	<p>RJ-45</p> <p>PCI (Intel proprietary) + SMBus</p> <p>10 Mbit/s operation (10BASE-T; IEEE 802.3i; IEEE 802.3 clauses 13-14) 100 Mbit/s operation (100BASE-TX; IEEE 802.3u; IEEE 802.3 clauses 21-30) 1000 Mbit/s operation (1000BASE-T; IEEE 802.3ab; IEEE 8023 clauses 40) Auto-Negotiation (Automatic Speed Selection) Full Duplex Operation at all Speeds, Half Duplex operation at 10 and 100 Mbit/s</p> <p>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)</p> <p>TCP/IP/UDP Checksum Offload (configurable) Protocol Offload (ARP &amp; NS) Large send offload and Giant send offload Receiving Side Scaling Jumbo Frame 9K</p> <p>Cable Disconnection: 25mW 100Mbps Full Run: 450mW 1000bp Full Run: 1000mW WoL Enable(S3/S4/S5): 50mW WoL Disable(S3/S4/S5): 25mW</p> <p>ACPI compliant - multiple power modes Situation-sensitive features reduce power consumption Advanced link down power saving for reducing link down power consumption</p> <p>Auto MDI/MDIX Crossover cable detection</p> <p>Wake-on-LAN from standby and hibernation (Magic Packet and Microsoft Wake-Up Frame); Wake-on-LAN from off (Magic Packet only) PXE 2.1 Remote Boot Statistics Gathering (SNMP MIB II, Ethernet-like MIB, Ethernet MIB (802.3x, clause 30)) Comprehensive diagnostic and configuration software suite Virtual Cable Doctor for Ethernet cable status</p> <p>Intel® vPro™ support with appropriate Intel® chipset components</p>
--	---	---

### Technical Specifications

<b>Intel® i219v 10/100/1000 Integrated NIC</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 8023 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 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 standby and hibernation (Magic Packet and Microsoft Wake-Up Frame); Wake-on-LAN from off (Magic Packet only) PXE 2.1 Remote Boot Statistics Gathering (SNMP MIB II, Ethernet-like MIB, Ethernet MIB (802.3x, clause 30) Comprehensive diagnostic and configuration software suite Virtual Cable Doctor for Ethernet cable status
	<b>Security &amp; Manageability</b>	Intel® vPro™ support with appropriate Intel® chipset components

---

## POWER

### Technical Specifications

<b>AC Adapter 45 Watt nPFC Wall Mount USB type C Straight 1.8m C6NS</b>	<b>Dimensions</b>	62.0x62.0x28.5mm		
	<b>Weight</b>	unit: 220g +/- 10g		
	<b>Input</b>	<b>Input Efficiency</b>	Average Efficiency of 25%, 50%, 75%, condition with 115Vac/230Vac Spec: 5V: 81.5% 9V: 86.7% 10V: 87.5% 12V: 87.8% 15V: 87.8% 20V: 87.8%	
		<b>Input frequency range</b>	47 ~ 63 Hz	
	<b>Output</b>	<b>Input AC current</b>	Max. 1.4 A at 90 Vac	
		<b>Output power</b>	Average Efficiency of 25%, 50%, 75%, condition with 115Vac/230Vac Spec: 5V: 81.5% 9V: 86.7% 10V: 87.5%	
		<b>DC output</b>	5V: 81.5%	
		<b>Hold-up time</b>	9V: 86.7%	
	<b>Connector</b>	<b>Output current limit</b>	10V: 87.5%	
	<b>Environmental Design</b>	Non-Standard C6		
		<b>Operating temperature</b>	32°F to 95°F (0° to 35°C)	
		<b>Non-operating (storage) temperature</b>	-4°F to 185°F (-20° to 85°C)	
		<b>Altitude</b>	0 to 16,400 ft (0 to 5000m)	
<b>Humidity</b>		5% to 95%		
<b>EMI and Safety Certifications</b>	<b>Storage Humidity</b>	5% to 95%		
	Eg:			
	*CE Mark - full compliance with LVD and EMC directives * Worldwide safety standards - IEC60950, EN60950, UL60950, Class 1 approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CCC, NOM-1 NYCE. * MTBF - over 200,000 hours at 25°C ambient condition.			

<b>AC Adapter 45 Watt Smart nPFC Standard Barrel 4.5mm Right Angle 1.8m</b>	<b>Dimensions</b>	95.0x40.0x26.5mm		
	<b>Weight</b>	unit: 200g +/- 10g		
	<b>Input</b>	<b>Input Efficiency</b>	87.74 % at 115 Vac and 88.4 % at 230 Vac	
		<b>Input frequency range</b>	47 ~ 63Hz	
	<b>Output</b>	<b>Input AC current</b>	Max. 1.4 A at 90 Vac	
		<b>Output power</b>	45W	
		<b>DC output</b>	19.5V	
		<b>Hold-up time</b>	5ms at 115 Vac input	
	<b>Connector</b>	<b>Output current limit</b>	<8.0A	
	<b>Environmental Design</b>	C6		
		<b>Operating temperature</b>	32°F to 95°F (0° to 35°C)	
		<b>Non-operating (storage) temperature</b>	-4°F to 185°F (-20° to 85°C)	
		<b>Altitude</b>	0 to 16,400 ft (0 to 5000m)	
<b>Humidity</b>		20% to 95%		

### Technical Specifications

<b>Safety Certifications</b>	<b>Storage Humidity</b>	10% to 95%
	Eg:	
	*CE Mark - full compliance with LVD and EMC directives	
	* Worldwide safety standards - IEC60950, EN60950, UL60950, Class1 approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CCC, NOM-1 NYCE.	
	* MTBF - over 200,000 hours at 25°C ambient condition.	

<b>AC Adapter 45 Watt Smart nPFC Standard Barrel 4.5mm Right Angle 1.8m Argentina</b>	<b>Dimensions</b>	95.0 x 40.0 x 26.5 mm	
	<b>Weight</b>	unit: 200 g +/- 10 g	
	<b>Input</b>	<b>Input Efficiency</b>	87.74 % at 115 Vac and 88.4 % at 230 Vac
		<b>Input frequency range</b>	47 ~ 63 Hz
	<b>Output</b>	<b>Input AC current</b>	Max. 1.4 A at 90 Vac
		<b>Output power</b>	45W
		<b>DC output</b>	19.5V
		<b>Hold-up time</b>	5ms at 115 Vac input
		<b>Output current limit</b>	<8.0A
	<b>Connector</b>	C6	
	<b>Environmental Design</b>	<b>Operating temperature</b>	32°F to 95°F (0°to 35°C)
		<b>Non-operating (storage) temperature</b>	-4°F to 185°F (-20°to 85°C)
		<b>Altitude</b>	0 to 16,400 ft (0 to 5000m)
<b>Humidity</b>		20% to 95%	
<b>Safety Certifications</b>	<b>Storage Humidity</b>	10% to 95%	
		CE Mark - full compliance with LVD and EMC directives Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CCC, NOM-1 NYCE. MTBF - over 200,000 hours at 25°C ambient condition.	

### Technical Specifications

<b>AC Adapter 45 Watt Smart nPFC Standard Barrel 4.5mm Right Angle 1.8m 2prong</b>	<b>Dimensions</b>	95.0x40.0x26.5mm		
	<b>Weight</b>	unit: 200g +/- 10g		
	<b>Input</b>	<b>Input Efficiency</b>	87.74 % at 115 Vac and 88.4 % at 230 Vac	
		<b>Input frequency range</b>	47 ~ 63 Hz	
		<b>Input AC current</b>	Max. 1.4 A at 90 Vac	
		<b>Output</b>	<b>Output power</b>	45W
			<b>DC output</b>	19.5V
			<b>Hold-up time</b>	5 msec at 115 VAC input
			<b>Output current limit</b>	<8.0A
	<b>Connector</b>	C6		
	<b>Environmental Design</b>	<b>Operating temperature</b>	32° to 95° F (0° to 35° C)	
		<b>Non-operating (storage) temperature</b>	-4° to 185° F (-20° to 85° C)	
		<b>Altitude</b>	0 to 16,400 ft (0 to 5,000 m)	
<b>Humidity</b>		20% to 95%		
<b>Storage Humidity</b>		10% to 95%		
<b>Safety Certifications</b>	Eg: *CE Mark - full compliance with LVD and EMC directives * Worldwide safety standards - IEC60950, EN60950, UL60950, Class1 approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CCC, NOM-1 NYCE. * MTBF - over 200,000 hours at 25°C ambient condition.			

<b>AC Adapter 65 Watt nPFC USB type C Straight 1.8m C6NS</b>	<b>Dimensions</b>	74x74x28.5mm		
	<b>Weight</b>	unit: 245g +/- 10g		
	<b>Input</b>	<b>Input Efficiency</b>	81.5% min at 115 Vac/ 230Vac @ 5V/ 86.7% min at 115 Vac/ 230Vac @ 9V/ 88% min at 115 Vac/ 230Vac @ 10V/ 88% min at 115 Vac/ 230Vac @ 12V/ 89% min at 115 Vac/ 230Vac @ 15V/ 89% min at 115 Vac/ 230Vac @ 20V/	
		<b>Input frequency range</b>	47 ~ 63 Hz	
		<b>Input AC current</b>	1.7 A at 90 VAC and maximum load	
		<b>Output</b>	<b>Output power</b>	65W
			<b>DC output</b>	5V/9V/10V/12V/15V/20V
			<b>Hold-up time</b>	5ms at 115 Vac input
			<b>Output current limit</b>	<8.0A
	<b>Connector</b>	Non-Standard C6		
	<b>Environmental Design</b>	<b>Operating temperature</b>	32° to 95° F (0° to 35° C)	
		<b>Non-operating (storage) temperature</b>	-4° to 185° F (-20° to 85° C)	
		<b>Altitude</b>	0 to 16,400 ft (0 to 5000m)	
<b>Humidity</b>		5% to 95%		
<b>Storage Humidity</b>		5% to 95%		

### Technical Specifications

#### Safety Certifications

Eg:

\*CE Mark - full compliance with LVD and EMC directives

\* Worldwide safety standards - IEC60950, EN60950, UL60950, Class1 approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CCC, NOM-1 NYCE.

\* MTBF - over 100,000 hours at 25°C ambient condition.

#### AC Adapter 65 Watt Smart nPFC EM Barrel 4.5mm New EM

#### Dimensions

102x55x30mm

#### Weight

unit: 250g +/- 10g

#### Input

#### Input Efficiency

88.0 % at 115 Vac and 89.0 % at 230V

#### Input frequency range

47 ~ 63 Hz

#### Input AC current

Max. 1.7 A at 90 Vac

#### Output

#### Output power

65W

#### DC output

19.5V

#### Hold-up time

5ms at 115 Vac input

#### Output current limit

<11.0A

#### Connector

C6

#### Environmental Design

#### Operating temperature

0° to 35° C

#### Non-operating (storage) temperature

-20° to 85° C

#### Altitude

0 to 16,400 ft (0 to 5000m)

#### Humidity

20% to 95%

#### Storage Humidity

10% to 95%

#### Safety Certifications

Eg:

\*CE Mark - full compliance with LVD and EMC directives

\* Worldwide safety standards - IEC60950, EN60950, UL60950, Class1 approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CCC, NOM-1 NYCE.

\* MTBF - over 200,000 hours at 25°C ambient condition.

#### AC Adapter 65 Watt Smart nPFC Standard Barrel 4.5mm Right Angle 1.8m

#### Dimensions

90.0x51x28.5mm

#### Weight

unit: 230g +/- 10g

#### Input

#### Input Efficiency

88.0 % at 115 Vac and 89.0 % at 230V

#### Input frequency range

47 ~ 63 Hz

#### Input AC current

Max. 1.7 A at 90 Vac

#### Output

#### Output power

65W

#### DC output

19.5V

#### Hold-up time

5ms at 115 Vac input

#### Output current limit

<11.0A

#### Connector

C6

#### Environmental Design

#### Operating temperature

32°F to 95°F (0° to 35°C)

#### Non-operating (storage) temperature

-4°F to 185°F (-20° to 85°C)

#### Altitude

0 to 16,400 ft (0 to 5000m)

#### Humidity

20% to 95%

### Technical Specifications

#### Safety Certifications

#### Storage Humidity

10% to 95%

Eg:

\*CE Mark - full compliance with LVD and EMC directives

\* Worldwide safety standards - IEC60950, EN60950, UL60950, Class 1 approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CCC, NOM-1 NYCE.

\* MTBF - over 200,000 hours at 25°C ambient condition.

#### HP 3-cell Long Life Li-Ion (48 WHr)

#### Dimensions (H x W x L)

8.05. x185.15x95 mm

#### Weight

0.26 kg

#### Cells/Type

3cell Lithium-Ion Polymer cell / 606072

#### Energy

#### Voltage

11.4V

#### Amp-hour capacity

4.212Ah /4.0Ah

#### Watt-hour capacity

48Wh

#### Temperature

#### Operating (Charging)

32° to 113° F (0° to 45° C)

#### Operating (Discharging)

14° to 122° F (-10° to 60° C)

#### Warranty

3 years

#### Optional Travel Battery Available

No

### COUNTRY OF ORIGIN

China

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

Type	Description	Part #
<b>Cases</b>	HP Essential Top Load Case	H2W17AA#xxx
	HP Essential Backpack (up to 15.6")	H1D24AA
	HP Essential Messenger Case (up to 17.3")	H1D25AA
<b>Docking</b>	HP UltraSlim Docking Station	D9Y32AA#xxx
	HP UltraSlim Docking Station TAA US	E5C22AV#ABA
	HP Thunderbolt Dock 120W G2	2UK37AA
	HP Thunderbolt Dock 120W G2 TAA	2UK37AA
	HP TB Dock G2 w/ Combo Cable	3TR87AA
	HP TB Dock 120W G2 w/ Audio	3YE87AA#xxx
	HP USB-C Universal Dock	1MK33AA#xxx
	HP USB-C/A Universal Dock G2	5TW13AA#XXX
	HP USB-C Universal Dock w/4.5mm Adapter	2UF95AA
	HP USB-C Universal Dock NF	3DV65AA
	HP USB-C Dock G4	3FF69AA#xxx
	HP USB-C Dock G5	5TW10AA#XXX
	HP USB-C Mini Dock	1PM64AA#xxx
	HP USB-C Travel Dock	T0K29AA#xxx
	HP USB Travel Dock	T0K30AA#xxx
	HP TB Dock Audio Module	3AQ21AA
	HP TB Dock 120W G2 cable	3XB94AA
	HP TB Dock G2 combo cable	3XB96AA
	HP Adjustable Dual Display Stand	AW664AA#xxx
	HP Display and Notebook Stand II	E8G00AA#xxx
HP USB-C Mini Dock	1PM64AA#xxx	
<b>Input/Output</b>	HP Slim USB Keyboard and Mouse	T6T83AA#xxx
	HP Slim Wireless Keyboard and Mouse	T6L04AA#xxx
	HP USB Essential Keyboard and Mouse	H6L29AA
	HP Ultra Mobile Wireless Mouse	H6F25AA#xxx
	HP Comfort Grip Wireless Mouse	H2L63AA
	HP 3-Button USB Laser Mouse	H4B81AA
	HP USB Travel Mouse	G1K28AA
	HP Slim Bluetooth Mouse	F3J92AA#xxx
	HP Essential USB Mouse	2TX37AA#xxx
	HP Elite Presenter Mouse	2CE30AA#xxx
	HP HDMI to DVI Adapter	F5A28AA
	HP USB-C to DP	N9K78AA
	HP USB-C to HDMI 2.0	1WC36AA#xxx
	HP USB-C to USB-A Hub	Z6A00AA
	HP UC Wireless Mono Headset	W3K08AA
	HP UC Wireless Duo Headset	W3K09AA
	HP Stereo 3.5mm Headset	T1A66AA



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

	HP Stereo USB Headset	T1A67AA
	HP TB Dock Audio Module	3AQ21AA
	HP Thunderbolt 120W 1m cable	3AQ23AA
	HP Thunderbolt 1m combo cable	3AQ25AA
<b>Power</b>	HP 45W Smart AC Adapter 4.5mm	H6Y88AA#xxx
	HP 65W Smart AC Adapter	H6Y89AA#xxx
	HP 65W Slim AC Adapter	H6Y82AA#xxx
	HP 45W USB-C Power Adapter	1HE07AA#xxx
	HP 65W USB-C Power Adapter	1HE08AA#xxx
	HP 65W USB-C Slim Power Adapter (w/additional USB-A)	3PN48AA#xxx
	3-cell Prismatic Battery	TBD
	HP Power Bank	N9F71AA#xxx
	HP USB-C Notebook Power Bank	2NA10AA
	HP 65W USB-C Slim Power Adapter	3PN48AA
<b>Storage</b>	HP External USB Optical Drive	F2B56AA
	HP 256GB TLC PCIe 3x4 NVMe M.2 SSD	1FU87AA
	HP 512GB TLC PCIe 3x4 NVMe M.2 SSD	1FU88AA
	HP 500GB 7200rpm HDD	F3B97AA
<b>Security</b>	HP Essential Combination Lock	TOY16AA
	HP Combination Lock	TOY15AA
	HP Keyed Cable lock	TOY14AA
	HP 15.6 Touchable Privacy Filter	3KP53AA
	HP Docking Station Cable Lock	AU656AA#XXX
	HP Keyed Cable Lock 10mm	T1A62AA
<b>UCC</b>	HP Conferencing Keyboard	K8P74AA#xxx
	HP Speaker Phone	K7V16AA
	HP Wired Headset	K7V17AA
<b>Memory</b>	HP 4GB 2666MHz DDR4 Memory	4VN05AA
	HP 8GB 2666MHz DDR4 Memory	4VN06AA
	HP 16GB 2666MHz DDR4 Memory	4VN07AA
<b>Displays</b>	HP ProDisplay P223 21.5-inch Monitor	X7R61AA
	HP ProDisplay P240va 23.8-inch Monitor	N3H14AA
	HP EliteDisplay E243 23.8-inch Monitor	1FH47AA

### Summary of Changes

<b>Date of change:</b>	<b>Version History:</b>	<b>Updated</b>	<b>Description of change:</b>
June 10, 2019	V1 to V2	Added	HP Cloud Recovery
June 21, 2019	V2 to V3	Added	Environmental Tab
June 24, 2019	V3 to V4	Updated	Display Section
June 27, 2019	V4 to V5	Updated	Display Section
September 9, 2019	V5 to V6	Updated	Intel® Optane™ and disclaimer for 1000 nit Sure View panel
September 11, 2019	V6 to V7	Updated	Ports and Slots section
March 30, 2020	V7 to V8	Updated	Images section, USB-C port

Copyright © 2020 HP Development Company, L.P. The only warranties for HP products are set forth in the express limited warranty statements accompanying such products. Nothing herein should be construed as constituting an additional warranty. HP shall not be liable for technical or editorial errors or omissions contained herein. Intel, Core and Intel vPro are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries. DisplayPort™ and the DisplayPort™ logo are trademarks owned by the Video Electronics Standards Association (VESA®) in the United States and other countries. USB Type-C™ and USB-C™ are trademarks of USB Implementers Forum. ENERGY STAR is a registered trademark of the U.S. Environmental Protection Agency. Microsoft and Windows are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

### Overview

### HP ProBook 640 G5 Notebook PC



#### Left

- |    |                            |     |   |
|----|----------------------------|-----|---|
| 1. | Webcam (Select models)     | 6.  | Smart Card Reader (Select models)         |
| 2. | Internal Microphones (2)   | 7.  | Audio Combo Jack                          |
| 3. | Camera Privacy Shutter     | 8.  | USB 3.1 Gen 1 Port                        |
| 4. | Webcam LED (Select models) | 9.  | Security Lock Slot (Lock sold separately) |
| 5. | Clickpad                   | 10. | Power Button                              |

### Overview



#### Right

- |                                   |  |
|-----------------------------------|--|
| 1. Micro SD Card Slot             | 7. USB 3.1 Gen 1 port                          |
| 2. Power Connector                | 8. USB 3.1 Gen 1 Charging Port                 |
| 3. Docking Connector              | 9. USB Type-C™ Charging Port (PD+DP 1.2, Gen1) |
| 4. VGA Port                       | 10. HDD LED Indicator                          |
| 5. Ethernet Port                  | 11. Fingerprint Reader (Select models)         |
| 6. HDMI Port (Cable not included) |  |

### Overview

#### AT A GLANCE

- Windows 10 versions and FreeDOS
- Precision-crafted slim design with fingerprint resistant modern, fresh and comfortable natural silver finish
- Choice of 8th Generation Intel® Core™ processors, with integrated graphics or optional AMD Radeon™ 540X 64 bit Discrete Graphics
- HP Advanced keyboard, spill resistant with optional backlit design
- Large Clickpad with gestures support
- Enhanced security features including TPM2.0, HP Privacy Camera, Optional HP Sure View Gen3, optional Smart Card Reader, optional Touch FingerPrint Reader<sup>3</sup> (select models), HP Sure Sense<sup>2</sup> and HP Sure Start Gen5.
- LED-backlit display 35.56 cm (14") diagonal HD, FHD, Touch FHD or FHD with HP Sure View Gen3.
- Optional WWAN
- HDMI port for connecting to high-resolution displays
- Optional HD webcam with dual-microphone array for video conferencing
- Three USB 3.1 Gen1 ports (1 charging) and one USB-C™ port (PD+DP 1.2, Gen1)
- Flexible wireless connectivity options, including 802.11 AX WLAN module and CAT9 WWAN module
- Battery hours up to 15 hours and 30 minutes with fast charging technology
- Dual storage combines SSD fast boot up and app access with cost effective HDD mass storage
- Passed MIL-STD 810G test<sup>1</sup>
- Compliance with FCC (Class B)

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

2. HP Sure Sense requires Windows 10. See product specifications for availability.

3. HP Fingerprint Sensor is an optional feature and requires configuration at purchase.

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

### Technical Specifications

## PRODUCT NAME

HP ProBook 640 G5 Notebook PC

---

## OPERATING SYSTEM

<b>Preinstalled</b>	Windows 10 Pro 64 <sup>1</sup> Windows 10 Pro 64 (National Academic only) <sup>2</sup> Windows 10 Home 64 <sup>1</sup> Windows 10 Home Single Language 64 <sup>1</sup> Windows 10 Pro (Windows 10 Enterprise available with a Volume Licensing Agreement) <sup>1</sup> FreeDOS
---------------------	---

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

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

---

## PROCESSORS

Intel® Core™ i7-8665U vPro™ with Intel® UHD graphics 620 (1.9 GHz base frequency, up to 4.8 GHz with Intel® Turbo Boost Technology, 4 cores)<sup>3,4,5</sup>

Intel® Core™ i7-8565U with Intel® UHD graphics 620 (1.8 GHz base frequency, up to 4.6 GHz with Intel® Turbo Boost Technology, 4 cores)<sup>3,4,5</sup>

Intel® Core™ i5-8365U vPro™ with Intel® UHD Graphics 620 (1.6 GHz base frequency, up to 4.1 GHz with Intel® Turbo Boost Technology, 4 cores)<sup>3,4,5</sup>

Intel® Core™ i5-8265U with Intel® UHD Graphics 620 (1.6 GHz base frequency, up to 3.9 GHz with Intel® Turbo Boost Technology, 4 cores)<sup>3,4,5</sup>

Intel® Core™ i3-8145U with Intel® UHD Graphics 620 (2.1 GHz base frequency, up to 3.9 GHz with Intel® Turbo Boost Technology, 4 cores)<sup>3,4,5</sup>

### Processor Family

8th Generation Intel® Core™ i7 processor (i7-8665U, i7-8565U models)<sup>5</sup>

8th Generation Intel® Core™ i5 processor (i5-8365U, i5-8265U models)<sup>5</sup>

8th Generation Intel® Core™ i3 processor (i3-8145U model)<sup>5</sup>

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

4. Processor speed denotes maximum performance mode; processors will run at lower speeds in battery optimization mode.

5. In accordance with Microsoft's support policy, HP does not support the Windows 8 or Windows 7 operating system on product Intel and AMD 7th generation and forward processors or provide any Windows 8 or Windows 7 drivers on <http://www.support.hp.com>

---

### Technical Specifications

#### CHIPSET

Chipset is integrated with processor

---

#### GRAPHICS

##### Integrated

Intel® UHD graphics 620<sup>7</sup>

##### Discrete

AMD Radeon™ 540X (2 GB GDDR5 dedicated)<sup>6</sup>

##### Supports

Support HD decode, DX12, HDMI 1.4b

7. HD content required to view HD images.

6. AMD Dynamic Switchable Graphics technology requires an Intel processor, plus an AMD Radeon™ discrete graphics configuration available on FreeDOS and Linux OS. With AMD Dynamic Switchable Graphics technology, full enablement of all discrete graphics features may not be supported on all systems (e.g. OpenGL applications will run on the integrated GPU or the APU as the case may be).

---

#### DISPLAY

##### Non-Touch HD

35.56 cm (14") diagonal HD SVA eDP anti-glare LED-backlit, 220 cd/m<sup>2</sup>, 45% NTSC (1366 x 768)<sup>7,8</sup>

35.56 cm (14") diagonal HD SVA eDP anti-glare LED-backlit, 220 cd/m<sup>2</sup>, 45% NTSC, for HD camera (1366 x 768)<sup>7,8</sup>

35.56 cm (14") diagonal HD SVA eDP anti-glare LED-backlit, 220 cd/m<sup>2</sup>, 45% NTSC, for WWAN (1366 x 768)<sup>7,8</sup>

35.56 cm (14") diagonal HD SVA eDP anti-glare LED-backlit, 220 cd/m<sup>2</sup>, 45% NTSC, for HD camera and WWAN (1366 x 768)<sup>7,8</sup>

##### Non-Touch FHD

35.56 cm (14") diagonal FHD IPS eDP anti-glare LED-backlit, 250 cd/m<sup>2</sup>, 45% NTSC (1920 x 1080)<sup>7,8</sup>

35.56 cm (14") diagonal FHD IPS eDP anti-glare LED-backlit, 250 cd/m<sup>2</sup>, 45% NTSC, for HD camera (1920 x 1080)<sup>7,8</sup>

35.56 cm (14") diagonal FHD IPS eDP anti-glare LED-backlit, 250 cd/m<sup>2</sup>, 45% NTSC, for WWAN (1920 x 1080)<sup>7,8</sup>

35.56 cm (14") diagonal FHD IPS eDP anti-glare LED-backlit, 250 cd/m<sup>2</sup>, 45% NTSC, for HD camera and WWAN (1920 x 1080)<sup>7,8</sup>

##### Touch FHD

35.56 cm (14") diagonal FHD IPS eDP LED-backlit touch screen, 250 cd/m<sup>2</sup>, 45% NTSC, for HD camera and WWAN (1920 x 1080)<sup>7,8</sup>

##### Non-Touch FHD Privacy Panel

HP Sure View Gen3 Integrated Privacy Screen 35.56 cm (14") diagonal FHD IPS eDP anti-glare LED-backlit, 1000 cd/m<sup>2</sup>, 72% NTSC, for HD camera and WWAN (1920 x 1080)\*

7. HD content required to view HD images.

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

\*Touch-enabled display and Sure View privacy panel will lower actual brightness

### Technical Specifications

Docking station model	Total number of supported displays (incl. the notebook display)	Max. resolutions supported	Dock Connectors	Technical limitations
HP UltraSlim Docking Station	3	Dual 2.5K @ 60Hz	2xDP, 1xVGA	Dual 2.5k only with I DP
HP Thunderbolt Dock G2	3	Single 4K@60Hz (3840 x 2160)	2xDP, 1xVGA, 1xTB, 1xUSB-C alt-mode	System will perform speeds when connect (5Gbits) Thunderbolt port will USB 2.0 port with da (15W) only.
HP USB-C Dock G4	3	Dual 2K @ 60Hz Single 4K @ 60Hz (3840 x 1440)	1xHDMI, 2xDP	
HP USB-C Universal Dock	3	Dual 4K @ 60Hz Single 5K @ 60Hz	2xDP	
HP USB-C Travel Dock	2	Single 2K @ 60Hz	1xHDMI, 1xVGA	Single external displi Only HDMI or VGA at
HP USB-C Mini Dock	2	Single 4K @ 30Hz	1xHDMI, 1xVGA	Single external displi Only HDMI or VGA at

### STORAGE AND DRIVES

#### Primary Storage

500 GB 7200 rpm SATA<sup>9</sup>  
500 GB 7200 rpm SATA FIPS 140-2 SED<sup>9</sup>  
1 TB 7200 rpm SATA<sup>9</sup>

#### Primary M.2 Storage

128 GB SATA-3 SS TLC<sup>9</sup>  
256 GB PCIe<sup>®</sup> NVMe<sup>™</sup> SS Value<sup>9</sup>  
256 GB PCIe<sup>®</sup> Gen3x4 NVMe<sup>™</sup> SS TLC<sup>9</sup>  
256 GB SATA-3 TLC FIPS<sup>9</sup>  
256 GB SATA-3 SS TLC (Opal 2)<sup>9</sup>  
256 GB Intel<sup>®</sup> PCIe<sup>®</sup> NVMe<sup>™</sup> QLC M.2 SSD with 16 GB Intel<sup>®</sup> Optane<sup>™</sup> memory H10 (Available Q4 2019)<sup>9,10,11</sup>  
512 GB PCIe<sup>®</sup> NVMe<sup>™</sup> Value<sup>9</sup>  
512 GB PCIe<sup>®</sup> Gen3x4 NVMe<sup>™</sup> SS TLC<sup>9</sup>  
512 GB PCIe<sup>®</sup> Gen3x4 NVMe<sup>™</sup> SS TLC (Opal 2)<sup>9</sup>  
512 GB SATA-3 SS TLC (FIPS)<sup>9</sup>  
512 GB Intel<sup>®</sup> PCIe<sup>®</sup> NVMe<sup>™</sup> QLC M.2 SSD with 32 GB Intel<sup>®</sup> Optane<sup>™</sup> memory H10<sup>9,10,11</sup>  
1 TB PCIe<sup>®</sup> Gen3x4 NVMe<sup>™</sup> SS TLC<sup>9</sup>  
256GB SATA-3 SS TLC (for Brazil only)

#### Cache Memory

16 GB PCIe<sup>®</sup> NVMe<sup>™</sup> Intel<sup>®</sup> Optane<sup>™</sup> Memory for storage acceleration<sup>9</sup>

9. For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 30 GB (for Windows 10) i recovery software.

10. Intel<sup>®</sup> Optane<sup>™</sup> memory system acceleration does not replace or increase the DRAM in your system. Requires 8th Gen or higher Intel<sup>®</sup> Core<sup>™</sup> processor, BIOS version with Intel<sup>®</sup> Optane<sup>™</sup> supported, Windows 10 64-bit, and an Intel<sup>®</sup> Rapid Storage Technology (Intel<sup>®</sup> RST) driver.

11. Intel<sup>®</sup> Optane<sup>™</sup> memory H10 only for Intel<sup>®</sup> PCIe<sup>®</sup> NVMe<sup>™</sup> QLC M.2 SSD.

### MEMORY



### Technical Specifications

#### Maximum Memory

64 GB DDR4-2400 SDRAM<sup>12</sup>

#### Memory

4 GB Total System Memory (4 GB x 1)  
8 GB Total System Memory (4 GB x 2)  
8 GB Total System Memory (8 GB x 1)  
12 GB Total System Memory (8 GB + 4 GB)  
16 GB Total System Memory (16 GB x 1)  
16 GB Total System Memory (8 GB x 2)  
32 GB Total System Memory (16 GB x 2)  
48 GB Total System Memory (32 GB + 16 GB) (available Q4 2019)  
64 GB Total System Memory (32 GB x 2) (available Q4 2019)

#### Memory Slots

2 SODIMM  
Both slots are customer accessible / upgradeable  
DDR4 SODIMMS, System runs at: 2400  
Supports Dual Channel Memory

12. Due to the non-industry standard nature of some third-party memory modules, we recommend HP branded memory to ensure you mix memory speeds, the system will perform at the lower memory speed.

### NETWORKING/COMMUNICATIONS

#### WLAN

Intel® Wireless-AC 9560 802.11 ac (2x2) Wi-Fi® and Bluetooth® 5, vPro™<sup>13</sup>  
Intel® Wireless-AC 9560 802.11 ac (2x2) Wi-Fi® and Bluetooth® 5, non-vPro™<sup>13</sup>  
Intel® Wi-Fi 6\*\* AX200 + Bluetooth® 5 (802.11ax 2x2, vPro, supporting gigabit file transfer speeds)  
Intel® Wi-Fi 6\*\* AX200 + Bluetooth® 5 (802.11ax 2x2, non-vPro, supporting gigabit file transfer speeds)

#### WWAN

LTE CAT6: Intel® XMM™ 7262 LTE-Advanced, Fibocom LTE/HSPA+ w/GPS<sup>14</sup>  
LTE CAT9: Intel® XMM™ 7360 LTE-Advanced, Fibocom LTE/HSPA+ w/GPS<sup>14</sup>

#### NFC

NXP NPC300 Near Field Communication Module<sup>15</sup>

#### WPAN Bluetooth

BT 5.0 supported via all supported WLAN modules

#### Ethernet

Intel® Ethernet Connection I219-LM 10/100/1000 vPro™<sup>16</sup>  
Intel® Ethernet Connection I219-V 10/100/1000 Non-vPro™<sup>16</sup>

13. Wireless access point and Internet service required and sold separately. Availability of public wireless access points |

14. WWAN module requires separately purchased service contract. Check with service provider for coverage and availability. Connection speeds will vary due to location, environment, network conditions, and other factors. 4G LTE not available on all regions.

15. Sold separately or as an optional feature.

16. The term "10/100/1000" or "Gigabit" Ethernet indicates compatibility with IEEE standard 802.3ab for Gigabit Ethernet, connote actual operating speed of 1 Gb/s. For high-speed transmission, connection to a Gigabit Ethernet server and network infrastructure is required.

\*\*Wireless access point and internet service required and sold separately. Availability of public wireless access points limited. Not compatible with prior 802.11 specs. The specifications for Wi-Fi 6 (802.11ax) are draft and are not final. If the final specifications, it may affect the ability of the notebook to communicate with other 802.11ax devices. Only available in countries supported.

## Technical Specifications

---

### AUDIO/MULTIMEDIA

**Audio**

2 Integrated stereo speakers  
Integrated dual array microphone

**Webcam**

720p HD HP Privacy Camera<sup>7,15,17</sup>

7. HD content required to view HD images.

15. Sold separately or as an optional feature.

17. Internet access required.

---

### KEYBOARDS/POINTING DEVICES/BUTTONS & FUNCTION KEYS

**Keyboard**

HP Advanced Keyboard

**Pointing Device**

ClickPad, Spill-resistant with drain<sup>15</sup>

ClickPad, Spill-resistant with drain, DuraKeys & Backlit<sup>15</sup>

Dual Point, Spill-resistant with drain, DuraKeys & Backlit<sup>15</sup>

Dual Point, Spill-resistant with drain, DuraKeys & Backlit Privacy<sup>15</sup>

**Function Keys**

ESC: system information

F1 - Display Switching

F2 - Blank or Privacy

F3 - Brightness Down

F4 - Brightness Up

F5 - Speaker Mute

F6 - Volume Down

F7 - Volume Up

F8 - Mic Mute

F9 - Backlight Toggle (for backlit keyboard) or Blank

F10 - NumLock

F11 - Wi-fi® Toggle

F12 - Sleep

**Clickpad requirements:**

On/off control by driver

Taps enabled as default

**Gestures:**

Win 10:

Disabled by default:

3 Finger Flick

2 Finger Rotate

Momentum Motion

1 Finger Vertical Scroll

---

### Technical Specifications

Win 10:  
Support PTP with Miniport driver  
Settings enabled by default by MSFT:  
2 Finger Scrolling  
2 Finger Zoom (Pinch)  
OSD (enable/disable)  
3 finger tap - Cortana  
3 finger flick –App switch  
4 finger tap – Action Center

15. Sold separately or as an optional feature.

---

## SOFTWARE AND SECURITY

### Preinstalled Software

#### BIOS

HP BIOSphere Gen5<sup>18</sup>  
HP Drive Lock & Automatic Drive Lock<sup>19</sup>  
BIOS Update via Network  
Master Boot Record Security  
Power On Authentication  
Secure Erase<sup>20</sup>  
Absolute Persistence Module<sup>21</sup>  
Pre-boot Authentication

#### Software

HP Native Miracast Support<sup>22</sup>  
HP Connection Optimizer  
HP Image Assistant  
HP Hotkey Support  
HP JumpStart  
HP Support Assistant<sup>23</sup>  
HP Noise Cancellation Software  
Buy Office (sold separately)

#### Manageability Features

HP Driver Packs<sup>24</sup>  
HP System Software Manager (SSM)  
HP BIOS Config Utility (BCU)  
HP Client Catalog  
HP Manageability Integration Kit Gen3<sup>25</sup>  
HP Cloud Recovery<sup>26</sup>

#### Client Security Software

HP Client Security Suite Gen5<sup>27</sup>  
Power On Authentication

### Technical Specifications

HP Fingerprint Sensor<sup>28</sup> (select models)

HP Power On Authentication

Windows Defender<sup>29</sup>

#### Security Management

Pre-boot Authentication

TPM 2.0 Embedded Security Chip shipped with Windows 10 (Common Criteria EAL4+ Certified)<sup>30</sup>

Serial, USB enable/disable (via BIOS)

Power-on password (via BIOS)

Setup password (via BIOS)

Support for chassis padlocks and cable lock devices

HP Sure Click<sup>31</sup>

HP Sure Start Gen5<sup>32</sup>

HP Sure Sense<sup>33</sup>

#### Security

##### TPM

Model: Infineon SLB9670

Version: 7.85

Revision: TPM 2.0

FIPS 140-2 Compliant: Yes

##### Smartcard Reader

Model number: Alcor AU9560

FIPS 201 Compliant: Yes

##### IPv6 Compliance

Yes

#### MD5 Hash: Please follow the instructions below to access MD5 Hash.

Log-on to <http://hp.com/support>, enter your product name, select software and drivers, select OS, select driver. After selecting "Associated files"? and then click on "Download"?. When opening the file, under "Purpose"? you should see the appropriate "SOF

#### Is the BIOS on this notebook ISO/IEC 19678:2015 (formerly NIST 800-147) compliant?:

Yes

UEFI version: 2.6

18. HP BIOSphere Gen5 is available on select HP Pro and Elite PCs. See product specifications for details. Features may vary depending on platform and configurations.

19. HP Drive Lock & Automatic Drive Lock is not supported on NVMe drives

20. For the methods outlined in the National Institute of Standards and Technology Special Publication 800-88 "Clear" sanitization, Erase does not support platforms with Intel® Optane™.

21. Absolute agent is shipped turned off, and will be activated when customers activate a purchased subscription. Subscription terms range from multiple years. Service is limited, check with Absolute for availability outside the U.S. The Absolute Recovery Guarantee warranty. Certain conditions apply. For full details visit: <http://www.absolute.com/company/legal/agreements/computrace-agent> is an optional service provided by Absolute Software. If utilized, the Recovery Guarantee is null and void. In order to use the Data Protection Service, customers must first sign a Pre-Authorization Agreement and either obtain a PIN or purchase one or more RSA SecurID tokens from Absolute Software.

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

23. HP Support Assistant requires Windows and Internet access.

24. HP Driver Packs not preinstalled, however available for download at <http://www.hp.com/go/clientmanagement>.

### Technical Specifications

25. HP Manageability Integration Kit can be downloaded from <http://www.hp.com/go/clientmanagement>.
26. HP Cloud Recovery is available for HP Elite and Pro desktops and laptops PCs with Intel® or AMD processors and requires an internet connection. Note: You must back up important files, data, photos, videos, etc. before use to avoid loss of data. Detail please refer <https://support.hp.com/us-en/document/c05115630>
27. HP Client Security Manager Gen5 requires Windows and is available on the select HP Pro and Elite PCs. See product specifications for details.
28. HP Fingerprint Sensor is an optional feature and requires configuration at purchase.
29. Windows Defender Opt in and internet connection required for updates.
30. Firmware TPM is version 2.0. Hardware TPM is v1.2, which is a subset of the TPM 2.0 specification version v0.89 as implemented by Intel Platform Trust Technology (PTT).
31. HP Sure Click is available on most HP PCs and supports Microsoft® Internet Explorer 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.
32. HP Sure Start Gen5 is available on select HP PCs with Intel processors. See product specifications for availability.
33. HP Sure Sense requires Windows 10. See product specifications for availability.

### POWER

#### Power Supply

- HP Smart 45 W External AC power adapter<sup>34</sup>
- HP Smart 45 W External AC power adapter - Argentina<sup>34</sup>
- HP Smart 45 W 2-prong External AC power adapter<sup>34</sup>
- HP Smart 45 W USB Type-C™ adapter<sup>34</sup>
- HP Smart 65 W External AC power adapter<sup>34,35</sup>
- HP Smart 65 W EM External AC power adapter<sup>34,35</sup>
- HP Smart 65 W USB Type-C™ adapter<sup>34,35</sup>

#### Primary Battery

- HP Long Life 3-cell, 48 Wh Li-ion<sup>36,37</sup>
- HP Fast Charge Technology - 90% in 90minutes<sup>35,38</sup>

#### Battery Life

Up to 15 hours and 30 minutes

#### Power Cord

- 2-wire plug, 1.0m, Conventional<sup>34</sup>
- 3-wire plug, 1.0m, Conventional<sup>34</sup>
- 3-wire plug, 1.8m, Conventional<sup>34</sup>
- Duckhead power cord, 1.0m, Premium<sup>34</sup>
- Duckhead power cord, 1.8m, Premium<sup>34</sup>

34. Availability may vary by country.
35. Supports HP Fast Charging.
36. Battery is internal and not replaceable by customer. Serviceable by warranty.
37. Windows 10 MM14 battery life will vary depending on various factors including product model, configuration, loaded applications, wireless functionality, and power management settings. The maximum capacity of the battery will naturally decrease with time. For additional details, see <http://www.bapco.com>
38. Recharges the battery up to 90% within 90 minutes when the system is off or in standby mode. Power adapter with a minimum of 45 watts is required. After charging has reached 90% capacity, charging will return to normal. Charging time may vary +/-10% due to battery age and usage.

### Technical Specifications

## WEIGHTS & DIMENSIONS

### Weight

Starting at 3.8 lb (non-touch); Starting at 4.3 lb (touch)<sup>39</sup>  
Starting at 1.73 kg (non-touch); Starting at 1.95 kg (touch)<sup>39</sup>

### Dimensions (w x d x h)

13.4 x 9.5 x 0.83 in (non-touch); 13.4 x 9.5 x 0.87 in (touch)  
34 x 24 x 2.09 cm (non-touch); 34 x 24 x 2.19 cm (touch)

<sup>39</sup>. Weight will vary by configuration.

---

## PORTS/SLOTS

### Ports

1 USB 3.1 Type-C™ Gen 1 (Power delivery, DisplayPort™ 1.2)  
3 USB 3.1 Gen 1 (1 charging)  
1 HDMI 1.4<sup>40</sup>  
1 RJ-45  
1 VGA  
1 headphone/microphone combo  
1 AC power

### Expansion Slots

1 docking connector  
1 microSD (multi-format digital media reader)

<sup>40</sup>. HDMI cable sold separately.

---

## SERVICE AND SUPPORT

HP Services offers 3-year and 1-year limited warranties and 90 day software support options depending on country and the customer. Batteries have a default one year limited warranty except for Long Life batteries which will have same 1-year or 3-year as the platform. On-site service and extended coverage is also available with HP Care Pack Services, optional extended service beyond the standard limited warranties. To choose the right level of service for your HP product, use the HP Care Pack Services <http://www.hp.com/go/cpc>.<sup>41</sup>

<sup>41</sup>. HP Care Packs are sold separately. Service levels and response times for HP Care Packs may vary depending on your geographic starts on date of hardware purchase. Restrictions and limitations apply. For details, visit <http://www.hp.com/go/cpc>. HP service the applicable HP terms and conditions of service provided or indicated to Customer at the time of purchase. Customer may have statutory rights according to applicable local laws, and such rights are not in any way affected by the HP terms and conditions Limited Warranty provided with your HP Product.

---

### Technical Specifications

#### CERTIFICATION AND COMPLIANCE

ENERGY STAR® certified  
 EPEAT® 2019 Silver<sup>42</sup>  
 Low halogen<sup>43</sup>  
 TCO 5.0 Certified

42. Based on US EPEAT® registration according to IEEE 1680.1-2018 EPEAT®. Status varies by country. Visit <http://www.epeat.information>.

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

#### SYSTEM UNIT

<b>Stand-Alone Power Requirements (AC Power)</b>	<b>Nominal Operating Voltage</b>	19.5 V
	<b>Average Operating Power</b>	Win 10
	<b>Integrated Graphics</b>	10 W
	<b>Discrete Graphics</b>	15 W
	<b>Max Operating Power</b>	Discrete < 65W UMA < 45W
<b>Temperature</b>	<b>Operating</b>	32° to 95° F (0° to 35° C) (not writing optical)
	<b>Non-operating</b>	41° to 95° F (5° to 35° C) (writing optical)
<b>Relative Humidity</b>	<b>Operating</b>	10% to 90%, non-condensing
	<b>Non-operating</b>	5% to 95%, 101.6° F (38.7° C) maximum wet bulb temperature
<b>Shock</b>	<b>Operating</b>	40 G, 2 ms, half-sine
	<b>Non-operating</b>	200 G, 2 ms, half-sine
<b>Random Vibration</b>	<b>Operating</b>	0.75 grms
	<b>Non-operating</b>	1.50 grms
<b>Altitude (unpressurized)</b>	<b>Operating</b>	-50 to 10,000 ft (-15.24 to 3,048 m)
	<b>Non-operating</b>	-50 to 40,000 ft (-15.24 to 12,192 m)
<b>Planned Industry Standard Certifications</b>	<b>UL</b>	Yes
	<b>CSA</b>	Yes
	<b>FCC Compliance</b>	Yes
	<b>ENERGY STAR®</b>	Select models <sup>44</sup>
	<b>EPEAT® 2019</b>	Yes, Silver in U.S. <sup>45</sup>
	<b>ICES</b>	Yes
	<b>Australia / NZ A-Tick Compliance</b>	Yes
	<b>CCC</b>	Yes
	<b>Japan VCCI Compliance</b>	Yes
	<b>KC</b>	Yes
	<b>BSMI</b>	Yes
	<b>CE Marking Compliance</b>	Yes
	<b>BNCI or BELUS</b>	Yes

### Technical Specifications

<b>CIT</b>	Yes
<b>GOST</b>	Yes
<b>Saudi Arabian Compliance (ICCP)</b>	Yes
<b>SABS</b>	Yes

44. Configurations of the HP ProBook 640 G5 that are ENERGY STAR® qualified are identified as HP ProBook 640 G5 ENERGY STAR and on <http://www.energystar.gov>.

45. Based on US EPEAT® registration according to IEEE 1680.1-2018 EPEAT®. Status varies by country. Visit <http://www.epeat.net> for information.

### ENVIRONMENTAL & INDUSTRY

<b>Environmental Data</b>	<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><del>US ENERGY STAR®</del> <ul style="list-style-type: none"> <li>US Federal Energy Management Program (FEMP)</li> <li>EPEAT® 2019 Silver registered in the United States. Based on EPEAT® registration according to IEEE 1680.1-2018 EPEAT®. Status varies by country. See <a href="http://www.epeat.net">http://www.epeat.net</a> for registration status in your country.</li> <li>TCO Certified Edge</li> <li>China Energy Conservation Program (CECP)</li> <li>China State Environmental Protection Administration (SEPA)</li> <li>Taiwan Green Mark</li> <li>Korea Eco-label</li> <li>Japan PC Green label*</li> </ul> </li> </ul>		
	<b>System Configuration</b>	The configuration used for the Energy Consumption and Declared Noise Emissions data for the Notebook model is based on a "Typically Configured Notebook"?		
	<b>Energy Consumption (in accordance with US ENERGY STAR® test method)</b>	<b>115VAC, 60Hz</b>	<b>230VAC, 50Hz</b>	<b>100VAC, 60Hz</b>
	Normal Operation (Sort idle)	4.9	5.4	5.1
	Normal Operation (Long idle)	2.5	3	2.7
	Sleep	0.7	0.8	0.8
	Off	0.3	0.3	0.3
	<p>Note: Energy efficiency data listed is for an ENERGY STAR® compliant product if offered within the model family. HP computers marked with the ENERGY STAR® Logo are compliant with the applicable U.S. Environmental Protection Agency (EPA) ENERGY STAR® specifications for computers. If a model family does not offer ENERGY STAR® compliant configurations, then energy efficiency data listed is for a typically configured PC featuring a hard disk drive, a high efficiency power supply, and a Microsoft Windows® operating system.</p>			



### Technical Specifications

<b>Heat Dissipation*</b>	<b>115VAC, 60Hz</b>	<b>230VAC, 50Hz</b>	<b>100VAC, 60Hz</b>
Normal Operation (Short idle)	17	18	17
Normal Operation (Long idle)	9	10	9
Sleep	2	3	3
Off	1	1	1
	*NOTE: Heat dissipation is calculated based on the measured watts, assuming the service level is attained for one hour.		
<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	2.5		14
Fixed Disk – Random writes	3		23
<b>Longevity and Upgrading</b>	<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> <ul style="list-style-type: none"> <li>• 3 USB ports</li> <li>• 1 PC card slot (type I/II)</li> <li>• 1 ExpressCard/54 slot</li> <li>• 1 IEEE 1394 Port</li> <li>• 2 SODIMM memory slots</li> <li>• Optional expansion base docking station</li> <li>• 1 multi-bay II storage port</li> <li>• Interchangeable HDD</li> </ul> <p>Spare parts are available throughout the warranty period and or for up to "5"? years after the end of production.</p>		
<b>Batteries</b>	<p>This battery(s) in this product comply with EU Directive 2006/66/EC</p> <p>Batteries used in the product do not contain:</p> <p>Mercury greater the1ppm by weight</p> <p>Cadmium greater than 20ppm by weight</p> <p>Battery description: CR2032 (coin cell) / SS03050</p> <p>Battery type: Lithium / Li-Ion/Li-Ion Polymer</p> <p>Battery description: 6-cell high capacity Lithium-Ion battery (optional 8 cell available)</p> <p>Battery type:</p>		

### Technical Specifications

<b>Additional Information</b>	<ul style="list-style-type: none"> <li>• <del>This product is in compliance with the Restrictions of Hazardous Substances (RoHS) directive - 2011/65/EC.</del></li> <li>• <del>This HP product is designed to comply with the Waste Electrical and Electronic Equipment (WEEE) Directive – 2002/96/EC.</del></li> <li>• <del>This product is in compliance with California Proposition 65 (State of California; Safe Drinking Water and Toxic Enforcement Act of 1986).</del></li> <li>• <del>This product is in compliance with the IEEE 1680.1 (EPEAT) standard at the Silver level, see <a href="http://www.epeat.net">http://www.epeat.net</a></del></li> <li>• <del>Plastics parts weighing over 25 grams used in the product are marked per ISO11469 and ISO1043.</del></li> <li>• <del>This product contains 5.69% post-consumer recycled plastic (by wt.) according to IEEE 1680.1-2018 standard, criterion 4.2.1.1.</del></li> <li>• <del>This product is 96.4% recycle-able when properly disposed of at end of life.</del></li> </ul>		
<b>Packaging Materials</b>	<b>External:</b>	PAPER/Corrugated	261
	<b>Internal:</b>	PLASTIC/EPE (Expanded Polyethylene)	62
		PLASTIC/Polyethylene low density - LDPE	14
		PLASTIC/Polypropylene - PP	4
<b>Material Usage</b>	<p>This product does not contain any of the following substances in excess of regulatory limits (ref to the HP General Specification for the Environment at <a href="http://www.hp.com/hpinfo/globalcitizenship/environment/supplychain/gen_specifications.htm">http://www.hp.com/hpinfo/globalcitizenship/environment/supplychain/gen_specifications.htm</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>• Bis(2-Ethylhexyl) phthalate (DEHP)</li> <li>• Benzyl butyl phthalate (BBP)</li> <li>• Dibutyl phthalate (DBP)</li> <li>• Diisobutyl phthalate (DIBP)</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> <li>• Radioactive Substances</li> <li>• Tributyl Tin (TBT), Triphenyl Tin (TPT), Tributyl Tin Oxide (TBTO)</li> </ul>		
<b>Packaging</b>	HP follows these guidelines to decrease the environmental impact of product packaging:		

### Technical Specifications

<p><b>Usage</b></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>
<p><b>End-of-life Management and Recycling</b></p>	<p>Hewlett-Packard offers end-of-life HP product return and recycling programs in many geographical 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><b>HP, Inc. Corporate Environmental Information</b></p>	<p>For more information about HP's commitment to the environment:</p> <p>Global Citizenship Report</p> <p><a href="http://www.hp.com/hpinfo/globalcitizenship/gcreport/index.html">http://www.hp.com/hpinfo/globalcitizenship/gcreport/index.html</a></p> <p>Eco-label certifications</p> <p><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></p> <p>ISO 14001 certificates:</p> <p><a href="http://h20195.www2.hp.com/V2/GetDocument.aspx?docname=c04755842">http://h20195.www2.hp.com/V2/GetDocument.aspx?docname=c04755842</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>

### DISPLAYS

### Technical Specifications

<b>Panel LCD 14 inch diagonal FHD (1920 x 1080) Anti-Glare WLED UWVA 72 percent cg 1000 nits eDP 1.4+PSR2 flat Privacy NWBZ</b>	<b>Outline Dimensions (W x H)</b>	315.01 x 194.99 mm (typ.)
	<b>Active Area</b>	309.31 x 173.98 mm (typ.)
	<b>Weight</b>	265 g (max)
	<b>Diagonal Size</b>	14 inch
	<b>Thickness</b>	3.0 mm (max)
	<b>Interface</b>	eDP 1.4
	<b>Surface Treatment</b>	Anti-Glare
	<b>Touch Enabled</b>	No
	<b>Contrast Ratio</b>	2000:1 (typ.)
	<b>Refresh Rate</b>	60 Hz
	<b>Brightness*</b>	1000 nits
	<b>Pixel Resolution</b>	1920 x 1080 (FHD)
	<b>Format of LCD Pixel Arrangement</b>	RGB
	<b>Backlight</b>	LED
	<b>Color Gamut Coverage</b>	72% of NTSC
	<b>Color Depth</b>	8 bit
<b>Viewing Angle</b>	UWVA 85/85/85/85	

\*Touch-enabled display and Sure View privacy panel will lower actual brightness

<b>Panel LCD 14 inch diagonal FHD (1920 x 1080) Anti-Glare WLED UWVA 45 percent cg 250 nits eDP slim NB</b>	<b>Outline Dimensions (W x H)</b>	316.17 x 197.98 mm (max)
	<b>Active Area</b>	309.37 x 174.02 mm (typ.)
	<b>Weight</b>	285 g (max)
	<b>Diagonal Size</b>	14.0 inch
	<b>Thickness</b>	3.0 mm (max)
	<b>Interface</b>	eDP 1.2 (2 lane)
	<b>Surface Treatment</b>	Anti-Glare
	<b>Touch Enabled</b>	No
	<b>Contrast Ratio</b>	600:1 (typ.)
	<b>Refresh Rate</b>	60 Hz
	<b>Brightness</b>	250 nits
	<b>Pixel Resolution</b>	1920 x 1080 (FHD)
	<b>Format of LCD Pixel Arrangement</b>	RGB
	<b>Backlight</b>	LED
	<b>Color Gamut Coverage</b>	45% of NTSC
	<b>Color Depth</b>	6 bits

### Technical Specifications

**Viewing Angle** UWVA 85/85/85/85

**Panel LCD 14 inch diagonal FHD (1920 x 1080) Anti-Glare WLED UWVA 45 percent cg 250 nits eDP slim Touch on Panel NWBZ**

<b>Outline Dimensions (W x H)</b>	316.112 x 197.98 mm (max)
<b>Active Area</b>	309.37 x 174.02 mm (typ.)
<b>Weight</b>	290 g (max)
<b>Diagonal Size</b>	14.0 inch
<b>Thickness</b>	3.0 mm (panel side) / 3.2 mm (PCBA Side) (max)
<b>Interface</b>	eDP 1.2
<b>Surface Treatment</b>	Anti-Glare On-cell
<b>Touch Enabled</b>	Yes
<b>Contrast Ratio</b>	600:1 (typ.)
<b>Refresh Rate</b>	60 Hz
<b>Brightness</b>	250 nits
<b>Pixel Resolution</b>	1920 x 1080 (FHD)
<b>Format of LCD Pixel Arrangement</b>	RGB
<b>Backlight</b>	LED
<b>Color Gamut Coverage</b>	45% of NTSC
<b>Color Depth</b>	6 bits
<b>Viewing Angle</b>	UWVA 85/85/85/85

**14" diagonal HD SVA anti-glare LED-backlit non-touch; 220 cd/m<sup>2</sup>; 45% percent cg (1366 x 768)**

<b>Outline Dimensions (W x H)</b>	320.9 x 205.6 (mm) max
<b>Active Area</b>	309.40 x 173.95 (mm)
<b>Weight</b>	290 g max
<b>Diagonal Size</b>	14 (inch)
<b>Thickness</b>	3.0 (mm) max
<b>Interface</b>	eDP 1.2
<b>Surface Treatment</b>	Anti-Glare (AG)
<b>Touch Enabled</b>	None
<b>Contrast Ratio</b>	300:1 (typical)
<b>Refresh Rate</b>	60 Hz
<b>Brightness</b>	220 nits
<b>Pixel Resolution</b>	1366 x 768 (HD)
<b>Format of LCD Pixel Arrangement</b>	RGB
<b>Backlight</b>	LED

### Technical Specifications

<b>Color Gamut Coverage</b>	45% of NTSC
<b>Color Depth</b>	6 bits + Hi FRC
<b>Viewing Angle</b>	SVA 40/40/15/30

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

### STORAGE

#### HDD 500 GB 7200 RPM 7 mm SATA

<b>Drive Weight</b>	0.21 lbs (95 g)
<b>Rotation speed</b>	7200RPM
<b>Cache Buffer</b>	Up to 32MB
<b>Height</b>	0.28 in (7 mm)
<b>Width</b>	2.75 in (69.85 mm)
<b>Interface</b>	ATA-8, SATA 3.0
<b>Transfer Rate</b>	600 MB/s
<b>Seek Time</b>	Single Track: 2 ~ 1.5 ms Average: 11 ~ 13 ms Maximum: 18 ~ 22 ms
<b>Logical Blocks</b>	976773168
<b>Operating Temperature</b>	32° to 140°F (0° to 60°C) [ambient temp]
<b>Security Features</b>	ATA Security
<b>Features</b>	S.M.A.R.T., NCQ, Ultra DMA

#### HDD 500 GB 7200 RPM 7 mm FIPS SATA Opal2

<b>Drive Weight</b>	0.21 lbs (95 g)
<b>Rotation speed</b>	7200 rpm
<b>Cache Buffer</b>	Up to 32MB
<b>Width</b>	0.28 in (7 mm)
<b>Interface</b>	2.75 in (69.85 mm)
<b>Transfer Rate</b>	ATA-8, SATA 3.0
<b>Seek Time</b>	Single Track: 2 ~ 1.5 ms Average: 11 ~ 13 ms Maximum: 18 ~ 22 ms
<b>Logical Blocks</b>	976,773,168
<b>Operating Temperature</b>	32° to 140°F (0° to 60°C) [ambient temp]
<b>Security Features</b>	ATA Security; TCG Opal 2.x, FIPS
<b>Features</b>	S.M.A.R.T., NCQ, Ultra DMA

### Technical Specifications

#### HDD 1 TB 7200 RPM 7 mm SATA 2.5 in

<b>Drive Weight</b>	90 g
<b>Rotation speed</b>	7200 rpm
<b>Cache Buffer</b>	128 MB
<b>Height</b>	7.2 mm Max.
<b>Width</b>	69.85 mm
<b>Interface</b>	ATA-8, SATA 3.0
<b>Transfer Rate</b>	600 MB/s
<b>Seek Time</b>	Single Track: 1.5 ms Average: 13 ms Maximum: 32 ms
<b>Logical Blocks</b>	1,953,525,168
<b>Operating Temperature</b>	0~60°C
<b>Security Features</b>	ATA Security
<b>Features</b>	S.M.A.R.T., NCQ, Ultra DMA, TRIM

#### SSD 128 GB 2280 M2 SATA-3 TLC

<b>Form Factor</b>	0.02 lb (10 g)
<b>Capacity</b>	128 GB
<b>NAND Type</b>	TLC
<b>Height</b>	0.09 in (2.3 mm)
<b>Width</b>	0.87 in (22 mm)
<b>Interface</b>	ATA-8, SATA 3.0
<b>Maximum Sequential Read</b>	Up To 520 MB/s
<b>Maximum Sequential Write</b>	Up To 450 MB/s
<b>Logical Blocks</b>	250,069,680
<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
<b>Features</b>	DIPM; TRIM; DEVSLP

### Technical Specifications

<b>256 GB 2280 PCIe NVMe Value Solid State Drive</b>	<b>Form Factor</b>	0.02 lb (10 g)
	<b>Capacity</b>	256 GB
	<b>NAND Type</b>	MLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Interface</b>	PCIe NVMe Gen3X4
	<b>Maximum Sequential Read</b>	Up To 1700 MB/s
	<b>Maximum Sequential Write</b>	Up To 600 MB/s
	<b>Logical Blocks</b>	703,282,608
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
	<b>Features</b>	TRIM; L1.2

---

<b>SSD 256 GB 2280 M2 PCIe-3x4 SS NVMe TLC</b>	<b>Form Factor</b>	0.02 lb (10 g)
	<b>Capacity</b>	256 GB
	<b>NAND Type</b>	TLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Interface</b>	PCIe NVMe Gen3X4
	<b>Maximum Sequential Read</b>	Up To 2600 MB/s
	<b>Maximum Sequential Write</b>	Up To 900 MB/s
	<b>Logical Blocks</b>	500,118,192
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
	<b>Features</b>	TRIM; L1.2

---

<b>SSD 256 GB 2280 M2 SATA-3 Three Layer Cell Federal Information Processing Standard</b>	<b>Form Factor</b>	M.2 2280
	<b>Capacity</b>	256 GB
	<b>NAND Type</b>	TLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Weight</b>	0.02 lb (10 g)
	<b>Interface</b>	ATA-8, SATA 3.0
	<b>Maximum Sequential Read</b>	Up To 530 MB/s
	<b>Maximum Sequential Write</b>	Up To 550 MB/s
	<b>Logical Blocks</b>	500,118,192
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
<b>Features</b>	DIPM; TRIM; DEVSLP	

---

---



### Technical Specifications

<b>SSD 256 GB 2280 M2 SATA-3 Self Encrypted OPAL2 Three Layer Cell</b>	<b>Form Factor</b>	M.2 2280
	<b>Capacity</b>	256 GB
	<b>NAND Type</b>	TLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Weight</b>	0.02 lb (10 g)
	<b>Interface</b>	ATA-8, SATA 3.0
	<b>Maximum Sequential Read</b>	Around 530 ~ 560 MB/s
	<b>Maximum Sequential Write</b>	Around 500 ~ 530 MB/s
	<b>Logical Blocks</b>	500,118,192
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
	<b>Features</b>	ATA Security; TCG OPAL 2.0; DIPM; TRIM; DEVSLP

<b>256 GB 2280 PCIe-3x2x2 NVMe+SSD 16 GB 3D Xpoint</b>	<b>Form Factor</b>	M.2 2280
	<b>Capacity</b>	256 GB
	<b>NAND Type</b>	QLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Weight</b>	0.02 lb (10 g)
	<b>Interface</b>	PCIe NVMe Gen3X4
	<b>Maximum Sequential Read</b>	Up To 1450 MB/s
	<b>Maximum Sequential Write</b>	Up To 650 MB/s
	<b>Logical Blocks</b>	500,118,192
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
	<b>Features</b>	TRIM; L1.2, Optane Storage acceleration

<b>SSD 512 GB 2280 PCIe NVMe Value</b>	<b>Form Factor</b>	M.2 2280
	<b>Capacity</b>	512 GB
	<b>NAND Type</b>	TLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Weight</b>	0.02 lb (10 g)
	<b>Interface</b>	PCIe NVMe Gen3X4
	<b>Maximum Sequential Read</b>	Around 1500 ~ 1700 MB/s
	<b>Maximum Sequential Write</b>	Around 860 ~ 1500 MB/s
	<b>Logical Blocks</b>	1,000,215,215
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]

### Technical Specifications

**Features** ATA Security; TRIM; L1.2

---

**SSD 512 GB 2280 M2  
PCIe-3x4 SS NVMe TLC**

**Form Factor** 0.02 lb (10 g)  
**Capacity** 512 GB  
**NAND Type** TLC  
**Height** 0.09 in (2.3 mm)  
**Width** 0.87 in (22 mm)  
**Interface** PCIe NVMe Gen3X4  
**Maximum Sequential Read** Up To 2600 MB/s  
**Maximum Sequential Write** Up To 1400 MB/s  
**Logical Blocks** 1,000,215,216  
**Operating Temperature** 32° to 158°F (0° to 70°C) [ambient temp]  
**Features** TRIM; L1.2

---

**SSD 512 GB 2280 PCIe-3x4  
NVMe Self Encrypted OPAL2  
Three Layer Cell**

**Form Factor** M.2 2280  
**Capacity** 512 GB  
**NAND Type** TLC  
**Height** 0.09 in (2.3 mm)  
**Width** 0.87 in (22 mm)  
**Interface** PCIe NVMe Gen3X4  
**Maximum Sequential Read** Around 3000 ~ 3400 MB/s  
**Maximum Sequential Write** Around 1800 ~ 2500 MB/s  
**Logical Blocks** 1,000,215,216  
**Operating Temperature** 32° to 158°F (0° to 70°C) [ambient temp]  
**Features** ATA Security; TCG Opal 2.0; FIPS; DIPM; TRIM; DEVSLP

---

### Technical Specifications

<b>SSD 512 GB 2280 M2 SATA-3 TLC FIPS</b>	<b>Form Factor</b>	0.02 lb (10 g)
	<b>Capacity</b>	512 GB
	<b>NAND Type</b>	TLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Interface</b>	ACS-3, SATA 3.2
	<b>Maximum Sequential Read</b>	Up To 530 MB/s
	<b>Maximum Sequential Write</b>	Up To 400 MB/s
	<b>Logical Blocks</b>	1,000,215,216
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
	<b>Features</b>	DIPM; TRIM; DEVSLP

---

<b>SSD 512 GB 2280 PCIe-3x2x2 NVMe+SSD 32 GB 3D Xpoint</b>	<b>Form Factor</b>	M.2 2280
	<b>Capacity</b>	512 GB
	<b>NAND Type</b>	TLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Weight</b>	0.02 lb (10 g)
	<b>Interface</b>	PCIe NVMe Gen3X4
	<b>Maximum Sequential Read</b>	Up To 2400 MB/s
	<b>Maximum Sequential Write</b>	Up To 1300 MB/s
	<b>Logical Blocks</b>	1,000,215,215
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
<b>Features</b>	ATA Security, TRIM; L1.2	

---

<b>SSD 1 TB 2280 PCIe-3x4 NVMe TLC SS</b>	<b>Form Factor</b>	0.02 lb (10 g)
	<b>Capacity</b>	1TB
	<b>NAND Type</b>	TLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Interface</b>	PCIe NVMe Gen3X4
	<b>Maximum Sequential Read</b>	2900
	<b>Maximum Sequential Write</b>	2000
	<b>Logical Blocks</b>	2000409263
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
	<b>Features</b>	TRIM; L1.2

---

### Technical Specifications

<b>SSD 16 GB 2280 PCIe-3x2 NVMe 3D Xpoint</b>	<b>Form Factor</b>	M.2 2280
	<b>Capacity</b>	16 GB
	<b>NAND Type</b>	Xpoint
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Interface</b>	PCIe NVMe Gen3X2
	<b>Maximum Sequential Read</b>	1400
	<b>Maximum Sequential Write</b>	300
	<b>Logical Blocks</b>	28,181,188
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
	<b>Features</b>	L1.2

<b>SSD 256 GB 2280 M2 SATA-3 TLC</b>	<b>Form Factor</b>	M.2 2280
	<b>Capacity</b>	256 GB
	<b>NAND Type</b>	TLC
	<b>Height</b>	0.09 in (2.3 mm)
	<b>Width</b>	0.87 in (22 mm)
	<b>Weight</b>	0.02 lb (10 g)
	<b>Interface</b>	ATA-8, SATA 3.0
	<b>Maximum Sequential Read</b>	Up To 550 MB/s
	<b>Maximum Sequential Write</b>	Up To 450 MB/s
	<b>Logical Blocks</b>	500,118,192
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]
<b>Features</b>	DIPM; TRIM; DEVSLP	

**NOTE:** For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 30 GB (for Windows 10) is reserved for system recovery software.

### NETWORKING/COMMUNICATIONS

<b>Intel® Wi-Fi 6** AX200 + BT5 vPro</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

### Technical Specifications

<b>Interoperability</b>	Wi-Fi® certified
<b>Frequency Band</b>	<ul style="list-style-type: none"> <li>● 802.11b/g/n/ax 2.402 – 2.482 GHz</li> <li>● 802.11a/n/ac/ax 4.9 – 4.95 GHz (Japan)</li> <li>5.15 – 5.25 GHz</li> <li>5.25 – 5.35 GHz</li> <li>5.47 – 5.725 GHz</li> <li>5.825 – 5.850 GHz</li> </ul>
<b>Data Rates</b>	<ul style="list-style-type: none"> <li>● 802.11b: 1, 2, 5.5, 11 Mbps</li> <li>● 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li> <li>● 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li> <li>● 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)</li> <li>● 802.11ac: MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, 80MHz &amp; 160MHz)</li> <li>● 802.11ax: MCS0 ~ MCS11, (1SS and 2SS) (20MHz, 40MHz, 80MHz &amp; 160MHz)</li> </ul>
<b>Modulation</b>	Direct Sequence Spread Spectrum OFDM, BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM, 1024QAM
<b>Security<sup>3</sup></b>	IEEE and Wi-Fi compliant 64 / 128 bit WEP encryption for a/b/g mode only AES-CCMP: 128 bit in hardware 802.1x authentication WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES. WPA2 certification IEEE 802.11i Cisco Certified Extensions, all versions through CCX4 and CCX Lite WAPI
<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>2</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>● 802.11ac VHT160(5GHz): +11.5dBm minimum</li> <li>● 802.11ax HT40(2.4GHz): +10dBm minimum</li> <li>● 802.11ax VHT160(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 10 mW</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> </ul>

### Technical Specifications

- 802.11a/g, 6Mbps: -86dBm maximum
- 802.11a/g, 54Mbps: -72dBm maximum
- 802.11n, MCS07: -67dBm maximum
- 802.11n, MCS15: -64dBm maximum
- 802.11ac, MCS0: -84dBm maximum
- 802.11ac, MCS9: -59dBm maximum
- 802.11ax, MCS11(HT40): -59dBm maximum
- 802.11ax, MCS11(VHT160): -58.5dBm maximum

<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 126: 1.3g	
<b>Operating Voltage</b>	3.3v +/- 9%	
<b>Temperature</b>	<b>Operating</b>	14° to 158° F (–10° to 70° C)
	<b>Non-operating</b>	–40° to 176° F (–40° to 80° C)
<b>Humidity</b>	<b>Operating</b>	10% to 90% (non-condensing)
	<b>Non-operating</b>	5% to 95% (non-condensing)
<b>Altitude</b>	<b>Operating</b>	0 to 10,000 ft (3,048 m)
	<b>Non-operating</b>	0 to 50,000 ft (15,240 m)

#### HP Integrated Module with Bluetooth 4.0/4.1/4.2/5.0/5.1 Wireless Technology

<b>Bluetooth Specification</b>	4.0/4.1/4.2/5.0/5.1 Compliant
<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>Signaling Data Rate</b>	Legacy: 3 Mbps signaling data rate <sup>1</sup> 2.17 Mbps BLE: 1 Mbps signaling data rate <sup>1</sup> 0.2 Mbps <a href="#">1. Actual throughput may vary.</a> 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</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</b>	BT4.1-ESR 5/6/7 Compliance

### Technical Specifications

#### Supported

LE Link Layer Ping  
 LE Dual Mode  
 LE Link Layer  
 LE Low Duty Cycle Directed Advertising  
 LE L2CAP Connection Oriented Channels  
 Train Nudging & Interlaced Scan  
 BT4.2 ESR08 Compliance  
 LE Secure Connection- Basic/Full  
 LE Privacy 1.2 –Link Layer Privacy  
 LE Privacy 1.2 –Extended Scanner Filter Policies  
 LE Data Packet Length Extension  
 FAX Profile (FAX)  
 Basic Imaging Profile (BIP)2  
 Headset Profile (HSP)  
 Hands Free Profile (HFP)  
 Advanced Audio Distribution Profile (A2DP)

#### Security & Manageability

Intel® vPro™ support with appropriate Intel® chipset components

1. Wireless access point and Internet service is required. Availability of public wireless access point is limited.
2. 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.
3. Check latest software/driver release for updates on supported security features.
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).

\*\*Wireless access point and internet service required and sold separately. Availability of public wireless access points limited. Wi-Fi 6 is backwards compatible with prior 802.11 specs. The specifications for Wi-Fi 6 (802.11ax) are draft and are not final. If the final specifications differ from the draft specifications, it may affect the ability of the notebook to communicate with other 802.11ax devices. Only available in countries where 802.11ax is supported.

#### Intel® Wi-Fi 6\*\* AX200 Wireless LAN Standards + BT5 non-vPro

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

#### Interoperability

Wi-Fi® certified

#### Frequency Band

- 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

#### Data Rates

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

### Technical Specifications

	<ul style="list-style-type: none"> <li>• 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)</li> <li>• 802.11ac: MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, 80MHz &amp; 160MHz)</li> <li>• 802.11ax: MCS0 ~ MCS11, (1SS and 2SS) (20MHz, 40MHz, 80MHz &amp; 160MHz)</li> </ul>
<b>Modulation</b>	Direct Sequence Spread Spectrum OFDM, BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM, 1024QAM
<b>Security<sup>3</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 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>2</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>• 802.11ac VHT160(5GHz): +11.5dBm minimum</li> <li>• 802.11ax HT40(2.4GHz): +10dBm minimum</li> <li>• 802.11ax VHT160(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 10 mW</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: -84dBm maximum</li> <li>• 802.11ac, MCS9: -59dBm maximum</li> <li>• 802.11ax, MCS11(HT40): -59dBm maximum</li> <li>• 802.11ax, MCS11(VHT160): -58.5dBm 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



### Technical Specifications

<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 126: 1.3g
<b>Operating Voltage</b>	3.3v +/- 9%
<b>Temperature</b>	<b>Operating</b> 14° to 158° F (–10° to 70° C) <b>Non-operating</b> –40° to 176° F (–40° to 80° C)
<b>Humidity</b>	<b>Operating</b> 10% to 90% (non-condensing) <b>Non-operating</b> 5% to 95% (non-condensing)
<b>Altitude</b>	<b>Operating</b> 0 to 10,000 ft (3,048 m) <b>Non-operating</b> 0 to 50,000 ft (15,240 m)

### HP Integrated Module with Bluetooth 4.0/4.1/4.2/5.0/5.1 Wireless Technology

<b>Bluetooth Specification</b>	4.0/4.1/4.2/5.0/5.1 Compliant
<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>Signaling Data Rate</b>	Legacy: 3 Mbps signaling data rate <sup>1</sup> 2.17 Mbps BLE: 1 Mbps signaling data rate <sup>1</sup> 0.2 Mbps <b>1. Actual throughput may vary.</b> 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</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) <sup>2</sup> Headset Profile (HSP) Hands Free Profile (HFP)

### Technical Specifications

#### Advanced Audio Distribution Profile (A2DP)

1. Wireless access point and Internet service is required. Availability of public wireless access point is limited.
  2. 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.
  3. Check latest software/driver release for updates on supported security features.
  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).
- \*\*Wireless access point and internet service required and sold separately. Availability of public wireless access points limited. Wi-Fi 6 is backwards compatible with prior 802.11 specs. The specifications for Wi-Fi 6 (802.11ax) are draft and are not final. If the final specifications differ from the draft specifications, it may affect the ability of the notebook to communicate with other 802.11ax devices. Only available in countries where 802.11ax is supported.

<b>Intel® 9560 802.11a/b/g/n/ac (2 x 2) Wi-Fi® and Bluetooth® 5.0 Combo<sup>1</sup> vPro</b>	<b>Wireless LAN Standards</b>	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n IEEE 802.11ac 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>	<ul style="list-style-type: none"> <li>• 802.11b/g/n 2.402 – 2.482 GHz</li> <li>• 802.11a/n/ac 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</li> </ul>
	<b>Data Rates</b>	<ul style="list-style-type: none"> <li>• 802.11b: 1, 2, 5.5, 11 Mbps</li> <li>• 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li> <li>• 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li> <li>• 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)</li> <li>• 802.11ac: MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, 80MHz &amp; 160MHz)</li> </ul>
	<b>Modulation</b>	Direct Sequence Spread Spectrum OFDM, BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM
	<b>Security<sup>3</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 IEEE 802.11i WAPI
	<b>Network Architecture Models</b>	Ad-hoc (Peer to Peer) Infrastructure (Access Point Required)

### Technical Specifications

<b>Roaming</b>	IEEE 802.11 compliant roaming between access points	
<b>Output Power<sup>2</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>• 802.11ac VHT160(5GHz): +11.5dBm 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 10 mW</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>	802.11b, 1Mbps: -93.5dBm maximum 802.11b, 11Mbps: -84dBm maximum 802.11a/g, 6Mbps: -86dBm maximum 802.11a/g, 54Mbps: -72dBm maximum 802.11n, MCS07: -67dBm maximum 802.11n, MCS15: -64dBm maximum 802.11ac, MCS0: -84dBm maximum 802.11ac, MCS9: -59dBm maximum	
<b>Antenna type</b>	High efficiency antenna with spatial diversity, mounted in the display enclosure	
<b>Form Factor</b>	Two embedded dual band 2.4/5 GHz antennas are provided to the card to support WLAN MIMO communications and Bluetooth communications	
<b>Dimensions</b>	PCI-Express M.2 MiniCard with CNVi Interface	
<b>Weight</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>Operating Voltage</b>	1. Type 2230: 2.8g 2. Type 126: 1.3g	
<b>Temperature</b>	<b>Operating</b>	3.3v +/- 9% 14° to 158° F (-10° to 70° C)
	<b>Non-operating</b>	-40° to 176° F (-40° to 80° C)
<b>Humidity</b>	<b>Operating</b>	10% to 90% (non-condensing)
	<b>Non-operating</b>	5% to 95% (non-condensing)
<b>Altitude</b>	<b>Operating</b>	0 to 10,000 ft (3,048 m)
	<b>Non-operating</b>	0 to 50,000 ft (15,240 m)
<b>LED Activity</b>	LED Amber – Radio OFF LED White – Radio ON	

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

<b>Bluetooth Specification</b>	4.0/4.1/4.2/5.0 Compliant
<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)

### Technical Specifications

<b>Signaling Data Rate</b>	Legacy: 3 Mbps signaling data rate <sup>1</sup> 2.17 Mbps BLE: 1 Mbps signaling data rate <sup>1</sup> 0.2 Mbps <a href="#">1. Actual throughput may vary.</a> 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-DHS) 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>Bluetooth Software Supported</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) <sup>2</sup> Headset Profile (HSP) Hands Free Profile (HFP) Advanced Audio Distribution Profile (A2DP)
<b>Security &amp; Manageability</b>	Intel® vPro™ support with appropriate Intel® chipset components

1. Wireless access point and Internet service is required. Availability of public wireless access point is limited.
2. 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.
3. Check latest software/driver release for updates on supported security features.
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).

<b>Intel® 9560 802.11a/b/g/n/ac (2 x 2) Wi-Fi® and Bluetooth® 5.0 Combo<sup>1</sup> non-vPro</b>	<b>Wireless LAN Standards</b>	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n IEEE 802.11ac IEEE 802.11d IEEE 802.11e IEEE 802.11h
--	-------------------------------	---

### Technical Specifications

	IEEE 802.11i IEEE 802.11k IEEE 802.11r IEEE 802.11v
<b>Interoperability</b>	Wi-Fi® certified
<b>Frequency Band</b>	<ul style="list-style-type: none"> <li>• 802.11b/g/n 2.402 – 2.482 GHz</li> <li>• 802.11a/n/ac 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</li> </ul>
<b>Data Rates</b>	<ul style="list-style-type: none"> <li>• 802.11b: 1, 2, 5.5, 11 Mbps</li> <li>• 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li> <li>• 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li> <li>• 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)</li> <li>• 802.11ac: MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, 80MHz &amp; 160MHz)</li> </ul>
<b>Modulation</b>	Direct Sequence Spread Spectrum BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM
<b>Security<sup>3</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 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>2</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>• 802.11ac VHT160(5GHz): +11.5dBm 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/Modern 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>	802.11b, 1Mbps: -93.5dBm maximum 802.11b, 11Mbps: -84dBm maximum 802.11a/g, 6Mbps: -86dBm maximum 802.11a/q, 54Mbps: -72dBm maximum

### Technical Specifications

	802.11n, MCS07: -67dBm maximum 802.11n, MCS15: -64dBm maximum 802.11ac, MCS0: -84dBm maximum 802.11ac, MCS9: -59dBm maximum
<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 with CNVi Interface
<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 126: 1.3g
<b>Operating Voltage</b>	3.3v +/- 9%
<b>Temperature</b>	<b>Operating</b> 14° to 158° F (-10° to 70° C) <b>Non-operating</b> -40° to 176° F (-40° to 80° C)
<b>Humidity</b>	<b>Operating</b> 10% to 90% (non-condensing) <b>Non-operating</b> 5% to 95% (non-condensing)
<b>Altitude</b>	<b>Operating</b> 0 to 10,000 ft (3,048 m) <b>Non-operating</b> 0 to 50,000 ft (15,240 m)
<b>LED Activity</b>	LED Amber – Radio OFF LED White – Radio ON

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

<b>Bluetooth Specification</b>	4.0/4.1/4.2/5.0 Compliant
<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>Signaling Data Rate</b>	Legacy: 3 Mbps signaling data rate <sup>1</sup> 2.17 Mbps BLE: 1 Mbps signaling data rate <sup>1</sup> 0.2 Mbps <a href="#">1. Actual throughput may vary.</a> 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>Bluetooth Software Supported</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

### Technical Specifications

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)

1. Wireless access point and Internet service is required. Availability of public wireless access point is limited.
2. 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.
3. Check latest software/driver release for updates on supported security features.
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).

<b>Intel® XMM™ 7360 LTE-Advanced CAT9<sup>1</sup></b>	<b>Technology/Operating bands</b>	FDD LTE: 2100 (Band 1), 1900 (Band 2), 1800 (Band 3), 1700/2100 (Band 4), 850 (Band 5), 2600 (Band 7), 900 (Band 8), 1400 (Band 11), 700 (Band 12 lower), 700 (Band 13 upper), 700 (Band 17 lower), 850 (Band 18 lower), 850 (Band 19 upper), 800 (Band 20), 1400 (Band 21), 850 (Band 26), 700 (Band 28), 700 (Band 29 RX only), 2300 (Band 30), 1700/2100 (Band 66). TDD LTE: 2600 (Band 38), 1900 (Band 39), 2400 (Band 40), 2500 (Band 41). HSPA+: 2100 (Band 1), 1900 (Band 2), 1700/2100 (Band 4), 850 (Band 5), 900 (Band 8) MHz
	<b>Wireless protocol standards</b>	3GPP Release 11 LTE Specification CAT.9, DL 60MHz BW throughput up to 450Mbps; UL 20MHz throughput up to 50Mbps WCDMA R99, 3GPP Release 5, 6, 7 and 8 UMTS Specification
	<b>GPS</b>	Standalone, A-GPS (MS-A, MS-B)
	<b>GPS bands</b>	1575.42 MHz ± 1.023 MHz, GLONASS 1596-1607MHz, Beidou 1561.098 MHz
	<b>Maximum data rates</b>	LTE: 450 Mbps (Download), 50 Mbps (Upload) DC-HSPA+: 42 Mbps (Download), 5.76 Mbps (Upload) HSPA+: 21Mbps (Download), 5.76 Mbps (Upload)
	<b>Maximum output power</b>	LTE: 23 dBm HSPA+: 23.5 dBm
	<b>Maximum power consumption</b>	LTE: 1,200 mA (peak); 900 mA (average) HSPA+: 1,100 mA (peak); 800 mA (average)
	<b>Form Factor</b>	M.2, 3042-S3 Key B
	<b>Weight</b>	5.8 g
	<b>Dimensions</b>	42 x 30 x 2.3 mm

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

### Technical Specifications

<b>Intel® XMM™ 7262 LTE-Advanced DL CAT6</b>	<b>Technology/Operating bands</b>	FDD LTE: 2100 (Band 1), 1800 (Band 3), 850 (Band 5), 2600 (Band 7), 900 (Band 8), 800 (Band 20), 700 (Band 28), HSPA+: 2100 (Band 1), 850 (Band 5), 900 (Band 8)
	<b>Wireless protocol standards</b>	3GPP Release 11 LTE Specification CAT.6, DL 40MHz BW throughput up to 300Mbps; UL 20MHz throughput up to 50Mbps WCDMA R99, 3GPP Release 5, 6, 7 and 8 UMTS Specification
	<b>GPS</b>	Standalone, A-GPS (MS-A, MS-B and XTRA)
	<b>GPS bands</b>	1575.42 MHz ± 1.023 MHz, GLONASS 1596-1607MHz
	<b>Maximum data rates</b>	LTE: 300 Mbps (Download), 50 Mbps (Upload) DC-HSPA+: 42 Mbps (Download), 5.76 Mbps (Upload) HSPA+: 21Mbps (Download), 5.76 Mbps (Upload)
	<b>Maximum output power</b>	LTE: 23 dBm HSPA+: 23.5 dBm
	<b>Maximum power consumption</b>	LTE: 1,200 mA (peak); 830 mA (average) HSPA+: 1,100 mA (peak); 680 mA (average)
	<b>Form Factor</b>	M.2, 3042-S3 Key B
	<b>Weight</b>	6 g
	<b>Dimensions</b>	42 x 30 x 2.3 mm

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

<b>Near Field Communications Controller (optional)</b>	<b>Dimensions (L x W x H)</b>	Module 25 mm by 10 mm by 2.0 mm
	<b>Chipset</b>	NPC100
	<b>System interface</b>	I2C
	<b>NFC RF standards</b>	ISO/IEC 14443 A ISO/IEC 14443 B ISO/IEC 15693 ISO/IEC 18092 ECMA-340 NFCIP-1 Target and Initiator ECMA-320 NFCIP-2
	<b>NFC Forum Support</b>	Tag Type 1, Type 2, Type3 and Type 4, NFCIP-1 and NFCIP-2
	<b>Reader (PCD-VCD) Mode<sup>1</sup></b>	ISO/IEC 14443 A ISO/IEC 14443 B ISO/IEC 15693 MIFARE 1K MIFARE 4K MIFARE DESFire FeliCa Jewel and Topaz cards
	<b>Card Emulation (PICC-VICC) Mode<sup>1</sup></b>	ISO/IEC 14443 A ISO/IEC 14443 B and B' MIFARE FeliCa
	<b>Frequency</b>	13.56 MHz
	<b>NFC Modes Supported</b>	Reader/Writer, Peer-to-Peer
	<b>Raw RF Data Rates</b>	106, 212, 424, 848 kbps
	<b>Operating temperature</b>	0°C to 70°C



### Technical Specifications

<b>Storage temperature</b>	-20°C to 125°C
<b>Humidity</b>	10-90% operating 5-95% non-operating
<b>Supply Operating voltage</b>	4.35 to 5.25 Volts
<b>I/O Voltage</b>	1.8V or 3.3V

<b>Power Consumption (Booster enable, VBAT= 3.3V, VCC_BOOST = 5V)</b>	<b>Mode</b>	Power Consumption, Typical
	<b>Polling</b>	7.3 mA
	<b>Detected Test Tag Type 1</b>	Total 283.8 mA Net Module 236.8 mA
	<b>Detected Test Tag Type 2</b>	Total 288.8 mA Net Module 241.8 mA
	<b>Detected Test Tag Type 3</b>	Total 287.7 mA Net Module 240.7 mA
	<b>Detected Test Tag Type 4</b>	Total 282.3 mA Net Module 235.3 mA
	<b>Antenna</b>	Antenna connector, 0.5mm pitch, 7 connector FPC. Antenna matching is external to module.

<b>Intel® i219LM 10/100/1000 Integrated NIC</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 8023 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 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

### Technical Specifications

<b>Management Interface</b>	Auto MDI/MDIX Crossover cable detection
<b>IT Manageability</b>	Wake-on-LAN from standby and hibernation (Magic Packet and Microsoft Wake-Up Frame); Wake-on-LAN from off (Magic Packet only) PXE 2.1 Remote Boot Statistics Gathering (SNMP MIB II, Ethernet-like MIB, Ethernet MIB (802.3x, clause 30)) Comprehensive diagnostic and configuration software suite Virtual Cable Doctor for Ethernet cable status
<b>Security &amp; Manageability</b>	Intel® vPro™ support with appropriate Intel® chipset components

---

<b>Intel® i219v 10/100/1000 Integrated NIC</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 8023 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 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 standby and hibernation (Magic Packet and Microsoft Wake-Up Frame); Wake-on-LAN from off (Magic Packet only) PXE 2.1 Remote Boot Statistics Gathering (SNMP MIB II, Ethernet-like MIB, Ethernet MIB (802.3x, clause 30)) Comprehensive diagnostic and configuration software suite Virtual Cable Doctor for Ethernet cable status
	<b>Security &amp; Manageability</b>	Intel® vPro™ support with appropriate Intel® chipset components

---

### Technical Specifications

## POWER

<b>AC Adapter 45 Watt nPFC Wall Mount USB type C™ Straight 1.8m C6NS</b>	<b>Dimensions</b>	62.0 x 62.0 x 28.5 mm	
	<b>Weight</b>	unit: 220 g +/- 10 g	
	<b>Input</b>	<b>Input Efficiency</b>	Average Efficiency of 25%, 50%, 75%, condition with 115Vac/230Vac Spec: 5V: 81.5% 9V: 86.7% 10V: 87.5% 12V: 87.8% 15V: 87.8% 20V: 87.8%
		<b>Input frequency range</b>	47 ~ 63 Hz
		<b>Input AC current</b>	1.4 A at 90 VAC
	<b>Output</b>	<b>Output power</b>	Average Efficiency of 25%, 50%, 75%, condition with 115Vac/230Vac Spec 5V: 81.5% 9V: 86.7% 10V: 87.5%
		<b>DC output</b>	
		<b>Hold-up time</b>	
		<b>Output current limit</b>	
	<b>Connector</b>		Non-Standard C6
<b>Environmental Design</b>	<b>Operating temperature</b>	32°F to 95°F (0° to 35°C)	
	<b>Non-operating (storage) temperature</b>	-4°F to 185°F (-20° to 85°C)	
	<b>Altitude</b>	0 to 16,400 ft (0 to 5000m)	
	<b>Humidity</b>	20% to 95%	
<b>EMI and Safety Certifications</b>	<b>Storage Humidity</b>	10% to 95%	
		CE Mark - full compliance with LVD and EMC directives Worldwide safety standards - IEC60950, EN60950, UL60950, Class 1, approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CCC, NOM-1 NYCE. MTBF - over 200,000 hours at 25°C ambient condition.	

### Technical Specifications

<b>AC Adapter 45 Watt Smart nPFC Standard Barrel 4.5mm Right Angle 1.8m</b>	<b>Dimensions</b>	95.0 x 40.0 x 26.5 mm	
	<b>Weight</b>	unit: 200 g +/- 10 g	
	<b>Input</b>	<b>Input Efficiency</b>	87.74 % at 115 Vac and 88.4 % at 230 Vac
		<b>Input frequency range</b>	47 ~ 63 Hz
	<b>Output</b>	<b>Input AC current</b>	Max. 1.4 A at 90 Vac
		<b>Output power</b>	45W
		<b>DC output</b>	19.5V
		<b>Hold-up time</b>	5ms at 115 Vac input
		<b>Output current limit</b>	<8.0A
		<b>Connector</b>	C6
	<b>Environmental Design</b>	<b>Operating temperature</b>	32°F to 95°F (0°to 35°C)
		<b>Non-operating (storage) temperature</b>	-4°F to 185°F (-20°to 85°C)
		<b>Altitude</b>	0 to 16,400 ft (0 to 5000m)
		<b>Humidity</b>	20% to 95%
<b>Safety Certifications</b>	<b>Storage Humidity</b>	10% to 95%	
	CE Mark - full compliance with LVD and EMC directives Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CCC, NOM-1 NYCE.		
	MTBF - over 200,000 hours at 25°C ambient condition.		

<b>AC Adapter 45 Watt Smart nPFC Standard Barrel 4.5mm Right Angle 1.8m Argentina</b>	<b>Dimensions</b>	95.0 x 40.0 x 26.5 mm	
	<b>Weight</b>	unit: 200 g +/- 10 g	
	<b>Input</b>	<b>Input Efficiency</b>	87.74 % at 115 Vac and 88.4 % at 230 Vac
		<b>Input frequency range</b>	47 ~ 63 Hz
	<b>Output</b>	<b>Input AC current</b>	Max. 1.4 A at 90 Vac
		<b>Output power</b>	45W
		<b>DC output</b>	19.5V
		<b>Hold-up time</b>	5ms at 115 Vac input
		<b>Output current limit</b>	<8.0A
		<b>Connector</b>	C6
	<b>Environmental Design</b>	<b>Operating temperature</b>	32°F to 95°F (0°to 35°C)
		<b>Non-operating (storage) temperature</b>	-4°F to 185°F (-20°to 85°C)
		<b>Altitude</b>	0 to 16,400 ft (0 to 5000m)
		<b>Humidity</b>	20% to 95%
<b>Safety Certifications</b>	<b>Storage Humidity</b>	10% to 95%	
	CE Mark - full compliance with LVD and EMC directives Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CCC, NOM-1 NYCE.		
	MTBF - over 200,000 hours at 25°C ambient condition.		

### Technical Specifications

<b>AC Adapter 45 Watt Smart nPFC Standard Barrel 4.5mm Right Angle 1.8m 2prong</b>	<b>Dimensions</b>	95.0 x 40.0 x 26.5 mm	
	<b>Weight</b>	unit: 200 g +/- 10 g	
	<b>Input</b>	<b>Input Efficiency</b>	87.74% at 115Vac and 88.4% at 230V
		<b>Input frequency range</b>	47 to 63 Hz
	<b>Output</b>	<b>Input AC current</b>	Max. 1.4 A at 90 Vac
		<b>Output power</b>	45W
		<b>DC output</b>	19.5V
		<b>Hold-up time</b>	5ms at 115 VAC input
		<b>Output current limit</b>	<8.0A
	<b>Connector</b>	C6	
	<b>Environmental Design</b>	<b>Operating temperature</b>	32°F to 95°F (0°to 35°C)
		<b>Non-operating (storage) temperature</b>	-4°F to 185°F (-20°to 85°C)
		<b>Altitude</b>	0 to 16,400 ft (0 to 5000m)
<b>Humidity</b>		20% to 95%	
<b>Safety Certifications</b>	<b>Storage Humidity</b>	10% to 95%	
	CE Mark - full compliance with LVD and EMC directives Worldwide safety standards - IEC60950, EN60950, UL60950, Class 1, approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CCC, NOM-1 NYCE.		
	MTBF - over 200,000 hours at 25°C ambient condition.		

<b>AC Adapter 65 Watt nPFC USB type C Straight 1.8m C6NS</b>	<b>Dimensions</b>	74 x 74x28.5mm		
	<b>Weight</b>	unit: 245 g +/- 10 g		
	<b>Input</b>	<b>Input Efficiency</b>	81.5% min at 115 Vac/ 230Vac @ 5V 86.7% min at 115 Vac/ 230Vac @ 9V 88% min at 115 Vac/ 230Vac @ 10V/ 88% min at 115 Vac/ 230Vac @ 12V/ 89% min at 115 Vac/ 230Vac @ 15V/ 89% min at 115 Vac/ 230Vac @ 20V/	
		<b>Input frequency range</b>	47 ~ 63 Hz	
		<b>Input AC current</b>	1.7 A at 90 VAC and maximum load	
		<b>Output</b>	<b>Output power</b>	65W
			<b>DC output</b>	5V/9V/10V/12V/15V/20V
			<b>Hold-up time</b>	5ms at 115 Vac input
	<b>Connector</b>	<b>Output current limit</b>	<8.0A	
			Non-Standard C6	
	<b>Environmental Design</b>	<b>Operating temperature</b>	32° to 95° F (0° to 35° C)	
		<b>Non-operating (storage) temperature</b>	-4° to 185° F (-20° to 85° C)	
		<b>Altitude</b>	0 to 16,400 ft (0 to 5000m)	
<b>Humidity</b>		5% to 95%		
	<b>Storage Humidity</b>	5% to 95%		

### Technical Specifications

#### Safety Certifications

CE Mark - full compliance with LVD and EMC directives  
 Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CCC, NOM-1 NYCE.  
 MTBF - over 100,000 hours at 25°C ambient condition.

#### AC Adapter 65 Watt Smart nPFC EM Barrel 4.5 mm New EM

#### Dimensions

102 x 55 x 30 mm

#### Weight

unit: 250 g +/- 10 g

#### Input

**Input Efficiency** 88.0 % at 115 Vac and 89.0 % at 230V

**Input frequency range** 47 ~ 63 Hz

**Input AC current** Max. 1.7 A at 90 Vac

#### Output

**Output power** 65W

**DC output** 19.5V

**Hold-up time** 5ms at 115 Vac input

**Output current limit** <11.0A

#### Connector

C6

#### Environmental Design

**Operating temperature** 32° to 95° F (0° to 35° C)

**Non-operating (storage) temperature** -4° to 185° F (-20° to 85° C)

**Altitude** 0 to 16,400 ft (0 to 5000m)

**Humidity** 20% to 95%

**Storage Humidity** 10% to 95%

#### Safety Certifications

CE Mark - full compliance with LVD and EMC directives  
 Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CCC, NOM-1 NYCE.  
 MTBF - over 200,000 hours at 25°C ambient condition.

#### AC Adapter 65 Watt Smart nPFC Standard Barrel 4.5 mm Right Angle 1.8 m

#### Dimensions

90.0 x 51 x 28.5 mm

#### Weight

unit: 230 g +/- 10 g

#### Input

**Input Efficiency** 88.0 % at 115 Vac and 89.0 % at 230V

**Input frequency range** 47 ~ 63 Hz

**Input AC current** Max. 1.7 A at 90 Vac

#### Output

**Output power** 65W

**DC output** 19.5V

**Hold-up time** 5ms at 115 Vac input

**Output current limit** <11.0A

#### Connector

4.5mm Barrel Type C6

#### Environmental Design

**Operating temperature** 32° to 95° F (0° to 35° C)

**Non-operating (storage) temperature** -4° to 185° F (-20° to 85° C)

**Altitude** 0 to 16,400 ft (0 to 5000m)

**Humidity** 20% to 95%

**Storage Humidity** 10% to 95%

### Technical Specifications

#### Safety Certifications

CE Mark - full compliance with LVD and EMC directives  
Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CCC, NOM-1 NYCE.  
MTBF - over 200,000 hours at 25°C ambient condition.

---

<b>HP 3-cell Long Life Li-Ion (48 WHr)</b>	<b>Dimensions (H x W x L)</b>	8.05 x 185.15 x 95 mm	
	<b>Weight</b>	0.26 kg	
	<b>Cells/Type</b>	3cell Lithium-Ion Polymer cell / 606072	
	<b>Energy</b>	<b>Voltage</b>	11.4V
		<b>Amp-hour capacity</b>	4.212Ah /4.0Ah
		<b>Watt-hour capacity</b>	48Wh
	<b>Temperature</b>	<b>Operating (Charging)</b>	32° to 113° F (0° to 45° C)
		<b>Operating (Discharging)</b>	14° to 122° F (-10° to 60° C)
	<b>Optional Travel Battery Available</b>	No	

---

### COUNTRY OF ORIGIN

China

---

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

Type	Description	Part #
<b>Cases</b>	HP Essential Top Load Case	H2W17AA#xxx
	HP Essential Backpack (up to 15.6")	H1D24AA
	HP Essential Messenger Case (up to 17.3")	H1D25AA
<b>Docking</b>	HP UltraSlim Docking Station	D9Y32AA#xxx
	HP UltraSlim Docking Station TAA US	E5C22AV#ABA
	HP Thunderbolt Dock 120W G2	2UK37AA
	HP Thunderbolt Dock 120W G2 TAA	2UK37AA
	HP TB Dock G2 w/ Combo Cable	3TR87AA
	HP TB Dock 120W G2 w/ Audio	3YE87AA#xxx
	HP USB-C Universal Dock	1MK33AA#xxx
	HP USB-C/A Universal Dock G2	5TW13AA#XXX
	HP USB-C Universal Dock w/4.5mm Adapter	2UF95AA
	HP USB-C Universal Dock NF	3DV65AA
	HP USB-C Dock G4	3FF69AA#xxx
	HP USB-C Dock G5	5TW10AA#XXX
	HP USB-C Mini Dock	1PM64AA#xxx
	HP USB-C Travel Dock	T0K29AA#xxx
	HP USB Travel Dock	T0K30AA#xxx
	HP TB Dock Audio Module	3AQ21AA
	HP TB Dock 120W G2 cable	3XB94AA
	HP TB Dock G2 combo cable	3XB96AA
	HP Adjustable Dual Display Stand	AW664AA#xxx
	HP Display and Notebook Stand II	E8G00AA#xxx
HP USB-C Mini Dock	1PM64AA#xxx	
<b>Input/Output</b>	HP Slim USB Keyboard and Mouse	T6T83AA#xxx
	HP Slim Wireless Keyboard and Mouse	T6L04AA#xxx
	HP USB Essential Keyboard and Mouse	H6L29AA
	HP Ultra Mobile Wireless Mouse	H6F25AA#xxx
	HP Comfort Grip Wireless Mouse	H2L63AA
	HP 3-Button USB Laser Mouse	H4B81AA
	HP USB Travel Mouse	G1K28AA
	HP Slim Bluetooth Mouse	F3J92AA#xxx
	HP Essential USB Mouse	2TX37AA#xxx
	HP Elite Presenter Mouse	2CE30AA#xxx
	HP HDMI to DVI Adapter	F5A28AA
	HP USB-C to DP	N9K78AA
	HP USB-C to HDMI 2.0	1WC36AA#xxx
	HP USB-C to USB-A Hub	Z6A00AA
	HP UC Wireless Mono Headset	W3K08AA



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

	HP UC Wireless Duo Headset	W3K09AA
	HP Stereo 3.5mm Headset	T1A66AA
	HP Stereo USB Headset	T1A67AA
	HP TB Dock Audio Module	3AQ21AA
	HP Thunderbolt 120W 1m cable	3AQ23AA
	HP Thunderbolt 1m combo cable	3AQ25AA
<b>Power</b>	HP 45W Smart AC Adapter 4.5mm	H6Y88AA#xxx
	HP 65W Smart AC Adapter	H6Y89AA#xxx
	HP 65W Slim AC Adapter	H6Y82AA#xxx
	HP 45W USB-C Power Adapter	1HE07AA#xxx
	HP 65W USB-C Power Adapter	1HE08AA#xxx
	3-cell Prismatic Battery	TBD
	HP Notebook Power Bank	N9F71AA#xxx
	HP USB-C Notebook Power Bank	2NA10AA
	HP 65W USB-C Slim Power Adapter	3PN48AA#xxx
<b>Storage</b>	HP External USB Optical Drive	F2B56AA
	HP 256GB TLC PCIe 3x4 NVMe M.2 SSD	1FU87AA
	HP 512GB TLC PCIe 3x4 NVMe M.2 SSD	1FU88AA
	HP 500GB 7200rpm HDD	F3B97AA
<b>Security</b>	HP Essential Combination Loc	T0Y16AA
	HP Combination Lock	T0Y15AA
	HP Keyed Cable lock	T0Y14AA
	HP 14.0" Notebook Privacy Filter	J6E65AA
	HP Docking Station Cable Lock	AU656AA#XXX
	HP Keyed Cable Lock 10mm	T1A62AA
<b>UCC</b>	HP Conferencing Keyboard	K8P74AA#xxx
	HP Speaker Phone	K7V16AA
	HP Wired Headset	K7V17AA
<b>Memory</b>	HP 4GB DDR4 Memory	Z4Y84AA
	HP 8GB DDR4 Memory	Z4Y85AA
	HP 16GB DDR4 Memory	Z4Y86AA
<b>Displays</b>	HP ProDisplay P223 21.5-inch Monitor	X7R61AA
	HP ProDisplay P240va 23.8-inch Monitor	N3H14AA
	HP EliteDisplay E243 23.8-inch Monitor	1FH47AA

### Summary of Changes

Date of change:	Version History:	Update	Description of change:
June 10, 2019	V1 to V2	Added	HP Cloud Recovery
June 21, 2019	V2 to V3	Added	Environmental Tab
June 24, 2019	V3 to V4	Updated	Display Section
June 27, 2019	V4 to V5	Updated	Display Section
September 9, 2019	V5 to V6	Updated	Intel® Optane™ and disclaimer for 1000 nit Sure View panel
September 11, 2019	V6 to V7	Updated	Ports and Slots section
March 30, 2020	V7 to V8	Updated	Images section, USB-C port

Copyright © 2020 HP Development Company, L.P. The information contained herein is subject to change without notice. The only warranties for HP products are set forth in the express limited warranty statements accompanying such products. Nothing herein should be construed as constituting an additional warranty. HP shall not be liable for technical or editorial errors or omissions contained herein.

Intel®, Optane™, vPro and Thunderbolt are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries. AMD is a trademark of Advanced Micro Devices, Inc. USB Type-C™ and USB-C™ are trademarks of USB Implementers Forum. microSD is a registered trademark of SD-3C in the United States, other countries or both. Qualcomm is a trademark of Qualcomm Incorporated, registered in the United States and other countries, used with permission. ENERGY STAR is a registered trademark of the U.S. Environmental Protection Agency. All other trademarks are the property of their respective owners.