

### Overview

#### HP ProBook 450 G6 Notebook PC



#### Left

- |                             |  |
|-----------------------------|--|
| 1. Internal microphones (2) | 6. SD card reader                            |
| 2. Webcam                   | 7. Thermal vent                              |
| 3. Webcam LED               | 8. USB 2.0 port                              |
| 4. Clickpad                 | 9. Security lock slot (Lock sold separately) |
| 5. Hard drive LED           | 10. Power button                             |

### 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           |

### Overview

#### At a Glance

- Preinstall with Windows 10 versions or FreeDOS 3.0
- Choice of 8th 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
- Optional Nvidia GeForce MX130 with 2 GB GDDR5 dedicated video memory or integrated Intel® HD Graphics 610 or Intel® UHD 620
- Enhanced security features including TPM2.0, HP BIOSphere, Hardware enforced Firmware Protection, optional Fingerprint sensor, and optional IR camera
- Designed to pass MIL-STD 810G testing.<sup>1</sup>
- Weight starting at 4.41 lbs (2.0 kgs)
- HP Long-Life Rechargeable battery, with HP Fast Charge Technology recharges 50% in 30 minutes<sup>2</sup>
- Supports wireless LAN and wireless WWAN 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 pending and is not intended to demonstrate fitness for U.S. Department of Defense contract requirements or for military use. Test results are not a guarantee of future performance under these test conditions. 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.

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



## Technical Specifications

### PRODUCT NAMES

HP ProBook 450 G6 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 China Government Edition FreeDOS 3.0
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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™ i7-8565U processor with Intel® UHD Graphics 620 (1.8 GHz base frequency, up to 4.6 GHz with Intel® Turbo Boost Technology, 8 MB L3 cache, 4 cores)<sup>3,4,5,6</sup>

Intel® Core™ i5-8265U with Intel® UHD Graphics 620 Graphics (1.6 GHz base frequency, up to 3.9 GHz with Intel® Turbo Boost Technology, 6 MB L3 cache, 4 cores)<sup>3,4,5,6</sup>

Intel® Core™ i3-8145U with Intel® UHD Graphics 620 Graphics (2.1 GHz base frequency, up to 3.9 GHz with Intel® Turbo Boost Technology, 4 MB L3 cache, 2 cores)<sup>3,4,5,6</sup>

Intel® Core™ i7+ 8565U processor (Core™ i7 and 16 GB Intel® Optane™ memory) with Intel® UHD Graphics 620 (1.8 GHz base frequency, up to 4.6 GHz with Intel® Turbo Boost Technology, 8 MB L3 cache, 4 cores)<sup>3,4,5,6,7</sup>

Intel® Core™ i5+ 8265U processor (Core™ i5 and 16 GB Intel® Optane™ memory) with Intel® UHD Graphics 620 (1.6 GHz base frequency, up to 3.9 GHz with Intel® Turbo Boost Technology, 6 MB L3 cache, 4 cores)<sup>3,4,5,6,7</sup>

#### Processors Family

8th Generation Intel® Core™ i7 processor (i7-8565U)<sup>6</sup>

8th Generation Intel® Core™ i5 processor (i5-8265U)<sup>6</sup>

8th Generation Intel® Core™ i3 processor (i3-8145U)<sup>6</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 and 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. NOTE: In accordance with Microsoft's support policy, HP does not support the Windows 8 or Windows 7 operating system on products configured with Intel and AMD 7th generation and forward processors or provide any Windows 8 or Windows 7 drivers on <http://www.support.hp.com>.



## Technical Specifications

- Intel® Optane™ memory system acceleration does not replace or increase the DRAM in your system and requires configuration with an optional Intel® Core™ i(5 or 7)+ processor.

### CHIPSET

Integrated with processor

### GRAPHICS

#### Integrated

Intel® UHD graphics 620<sup>8</sup>

#### Discrete

NVIDIA® GeForce® MX130 (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

- HD content required to view HD images.
- 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 all 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

#### Internal

##### Non-Touch

39.6 cm (15.6") diagonal HD SVA eDP anti-glare LED-backlit slim, 220 cd/m<sup>2</sup>, 67% sRGB for two WLAN antennas (1366 x 768)<sup>8,10</sup>

39.6 cm (15.6") diagonal HD SVA eDP anti-glare LED-backlit slim, 220 cd/m<sup>2</sup>, 67% sRGB for HD camera and one WLAN antenna (1366 x 768)<sup>8,10</sup>

39.6 cm (15.6") diagonal HD SVA eDP anti-glare LED-backlit slim, 220 cd/m<sup>2</sup>, 67% sRGB for HD camera and two WLAN antennas (1366 x 768)<sup>8,10</sup>

39.6 cm (15.6") diagonal HD SVA eDP anti-glare LED-backlit slim, 220 cd/m<sup>2</sup>, 67% sRGB for HD+IR camera and two WLAN antennas (1366 x 768)<sup>8,10</sup>

39.6 cm (15.6") diagonal HD SVA eDP anti-glare LED-backlit slim, 220 cd/m<sup>2</sup>, 67% sRGB for HD camera, WWAN and two WLAN antennas (1366 x 768)<sup>8,10</sup>

39.6 cm (15.6") diagonal FHD UWVA eDP anti-glare LED-backlit slim, 220 cd/m<sup>2</sup>, 67% sRGB for two WLAN antennas (1920 x 1080)<sup>8,10</sup>

39.6 cm (15.6") diagonal FHD UWVA eDP anti-glare LED-backlit slim, 220 cd/m<sup>2</sup>, 67% sRGB for HD camera and one WLAN antenna (1920 x 1080)<sup>8,10</sup>

39.6 cm (15.6") diagonal FHD UWVA eDP anti-glare LED-backlit slim, 220 cd/m<sup>2</sup>, 67% sRGB for HD camera and two WLAN antennas (1920 x 1080)<sup>8,10</sup>

39.6 cm (15.6") diagonal FHD UWVA eDP anti-glare LED-backlit slim, 220 cd/m<sup>2</sup>, 67% sRGB for HD+IR camera and two WLAN antennas (1920 x 1080)<sup>8,10</sup>

39.6 cm (15.6") diagonal FHD UWVA eDP anti-glare LED-backlit slim, 220 cd/m<sup>2</sup>, 67% sRGB for HD camera, WWAN and two WLAN antennas (1920 x 1080)<sup>8,10</sup>



## Technical Specifications

### Touch

39.6 cm (15.6") diagonal HD SVA eDP LED-backlit slim touch screen, 220 cd/m<sup>2</sup>, 67% sRGB for HD camera and two WLAN antennas (1366 x 768)<sup>8,10,11</sup>  
 39.6 cm (15.6") diagonal HD SVA eDP LED-backlit slim touch screen, 220 cd/m<sup>2</sup>, 67% sRGB for HD camera, WWAN and two WLAN antennas (1366 x 768)<sup>8,10,11</sup>

### HDMI

Supports resolutions up to 4K 30Hz

- 8. HD content required to view HD images.
- 10. Resolutions are dependent upon monitor capability, and resolution and color depth settings.
- 11. Sold separately or as an optional feature.

Docking station model	Total number of supported displays (incl. the notebook display)	Max. resolutions supported	Dock Connect3ors	Technical limitations
HP UltraSlim Docking Station	3	Dual 2.5K @ 60Hz	2xDP, 1xVGA	Dual 2.5k only with both displays into DP
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

## STORAGE AND DRIVES

### Primary Storage

1 TB 5400 rpm SATA<sup>12</sup>  
 500 GB 7200 rpm SATA<sup>12</sup>

### Primary M.2 Storage

128 GB M.2 SATA TLC Solid State Drive<sup>12</sup>  
 256 GB PCIe® NVMe™ M.2 Value Solid State Drive<sup>12</sup>  
 512 GB PCIe® NVMe™ M.2 TLC Solid State Drive<sup>12</sup>



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## Technical Specifications

12. 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.

**Note:** PCIe SSD not available for Celeron

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### MEMORY

#### Maximum Memory

32 GB DDR4-2400 SDRAM<sup>13</sup>

#### Memory

32 GB DDR4-2400 SDRAM (2 X 16 GB)<sup>13</sup>

16 GB DDR4- 2400 SDRAM (1 X 16 GB)

16 GB DDR4- 2400 SDRAM (2 X 8 GB)<sup>13</sup>

12 GB DDR4- 2400 SDRAM (4 GB and 8 GB (1 x 8 GB))<sup>13</sup>

8 GB DDR4- 2400 SDRAM (1 x 8 GB)

8 GB DDR4- 2400 SDRAM (2 x 4 GB)<sup>13</sup>

4 GB DDR4- 2400 SDRAM (1 x 4 GB)

#### Memory Slots

2 SODIMM

Both slots are customer accessible / upgradeable

DDR4 PC4 SODIMMS, system runs at 2400

Supports Dual Channel Memory

13. 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.

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### NETWORKING/COMMUNICATIONS

#### WLAN

Intel® Dual Band Wireless-AC 9560 802.11ac (2x2) WLAN and Bluetooth® 5 Combo, non-vPro™<sup>14</sup>

Realtek RTL8821CE 802.11ac (1x1) WLAN + Bluetooth®4.2 Combo<sup>14</sup>

Realtek RTL8822BE 802.11ac (2x2) WLAN + Bluetooth®4.2 Combo<sup>14</sup>

#### WWAN

Intel® XMM™ 7262 LTE-Advanced (Cat6)<sup>15</sup>

Intel® XMM™ 7360 LTE-Advanced (Cat9)<sup>15</sup>

#### Ethernet

Realtek RTL8111HSH-CG 10/100/1000 GbE NIC<sup>16</sup>

14. 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.

15. WWAN module 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.

16. 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.



### Technical Specifications

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#### AUDIO/MULTIMEDIA

**Audio**

Integrated microphone (Mono or Dual Array)  
2 Integrated stereo speakers

**Camera**

720p HD camera<sup>8</sup>  
720p HD camera+IR Camera<sup>8,17</sup>

- 8. HD content required to view HD images.
  - 17. Sold separately or as an optional feature.
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#### 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  
F3 - Brightness Down  
F4 - Brightness Up  
F5 - Audio Mute  
F6 - Volume Down  
F7 - Volume Up  
F8 - Mic Mute  
F9 - Blank or Backlit Toggle  
F10 - Blank  
F11 - Wireless  
F12 - Sleep

**Hidden Functions**

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

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#### SOFTWARE AND SECURITY

**BIOS**

HP BIOSphere Gen4<sup>18</sup>  
HP DriveLock & Automatic DriveLock  
BIOS Update via Network  
Secure Erase<sup>19</sup>  
Absolute Persistence Module<sup>20</sup>





### Technical Specifications

Pre-boot Authentication

HP Wireless Wakeup

#### Software

HP Native Miracast Support<sup>21</sup>

HP LAN-Wireless Protection

HP Connection Optimizer

HP 3D DriveGuard

HP Hotkey Support - CMIT

HP Jumpstart

HP Support Assistant<sup>22</sup>

HP Noise Cancellation Software

HP PhoneWise<sup>23</sup>

HP Host Based MAC Address Manager

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 Gen2<sup>25</sup>

Ivanti Management Suite<sup>26</sup>

#### Client Security Software

- HP Client Security Suite Gen4<sup>27</sup> including:

- HP Security Manager<sup>28</sup> (including Credential Manager, HP Password Manager, HP Spare Key)

- HP Fingerprint Sensor<sup>29</sup>

- HP Device Access Manager<sup>30</sup>

- HP Power On Authentication

Windows Defender<sup>31</sup>

#### Security Management

Secure Erase<sup>19</sup>

TPM 2.0 Embedded Security Chip shipped with Windows 10 (Common Criteria EAL4+ Certified)<sup>32</sup>

SATA 0,1 port disablement (viaBIOS)

RAID configurations<sup>33</sup>

Serial, USB enable/disable (viaBIOS)

Power-on password (viaBIOS)

Setup password (viaBIOS)

Support for chassis padlocks and cable lock devices



## Technical Specifications

Integrated hood sensor

HP Sure Click<sup>34</sup>

18. HP BIOSphere Gen4 requires Intel(R) or AMD 8th Gen processors. Features may vary depending on the platform and configurations.
19. For the methods outlined in the National Institute of Standards and Technology Special Publication 800-88 "Clear" sanitation method.
20. 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.
21. Miracast is a wireless technology your PC can use to project your screen to TVs, projectors, and streaming
22. HP Support Assistant requires Windows and Internet access.
23. HP PhoneWise Client is only available on select platforms. For supported platforms and HP PhoneWise system requirements see <http://www.hp.com/go/HPPhoneWise>.
24. HP Driver Packs not preinstalled, however available for download at <http://www.hp.com/go/clientmanagement>.
25. HP Manageability Integration Kit can be downloaded from <http://www8.hp.com/us/en/ads/clientmanagement/overview.html>.
26. Ivanti Management Suite subscription required.
27. HP Client Security Suite Gen 4 requires Windows and Intel® or AMD 8th generation processors.
28. HP Password Manager requires Internet Explorer or Chrome or FireFox. Some websites and applications may not be supported. User may need to enable or allow the add-on / extension in the internet browser.
29. HP Fingerprint Sensor sold separately or as an optional feature.
30. HP Device Access Manager requires HP Client Security Suite Gen4.
31. Windows Defender Opt in and internet connection required for updates.
32. 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).
33. RAID configuration is optional and does require a second hard drive.
34. 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.

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## POWER

### Power Supply

HP Smart 65 W External AC power 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>

HP Smart 45 W External AC power adapter<sup>35</sup>

HP Smart 45 W USB Type-C™ adapter<sup>35</sup>

### Primary Battery

3-cell, 45 Wh Long Life Li-ion<sup>36</sup>



### Technical Specifications

**Battery Life**

Up to 12 hours and 30 minutes <sup>37</sup>

**Power Cord**

3-wire plug - 1m<sup>35</sup>

3-wire plug - 1.8m<sup>35</sup>

2-wire plug - 1m<sup>35</sup>

Duckhead power cord- 1.0m<sup>35</sup>

Duckhead power cord- 1.8m<sup>35</sup>

**Battery Weight**

0.49 lb

0.22 kg

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, features, use, wireless functionality, and power management settings. The maximum capacity of the battery will naturally decrease with time and usage. See [www.bapco.com](http://www.bapco.com) for additional details.

### WEIGHTS & DIMENSIONS

**Weight**

Starting at 4.41 lbs<sup>38</sup>

Starting at 2.0 kgs<sup>38</sup>

**Dimensions (w x d x h)**

14.37 x 10.11 x 0.75 in

36.49 x 25.69 x 1.9 cm

38. Weight will vary by configuration.

### PORTS/SLOTS

**Ports**

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

1 USB 2.0 (Powered port)

2 USB 3.1

1 HDMI 1.4b<sup>39</sup>

1 RJ-45

1 AC power

1 Headphone/microphone combo jack

**Expansion Slots**

1 SD

Supports SD, SDHC, SDXC

39. HDMI cable sold separately.



### Technical Specifications

#### 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 the HP Care Pack Services Lookup Tool at: <http://www.hp.com/go/cpc>.<sup>40</sup>

40. 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.



### Technical Specifications

#### SYSTEM UNIT

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

Nominal Operating Voltage	19V
Average Operating Power	Win 10
Integrated graphics	5.71W
Discrete Graphics	6.78W
Max Operating Power	Discrete < 65W UMA < 45W

##### Temperature

Operating	32° to 95° F (0° to 35° C)
Non-operating	-4° to 140° F (-20° to 60° C)

##### Relative Humidity

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

##### Shock

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

##### Random Vibration

Operating	0.75 grms
Non-operating	1.50 grms

##### Altitude (unpressurized)

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

##### Planned Industry Standard Certifications

UL	Yes
CSA	Yes
FCC Compliance	Yes
Energy Star®	Selected models <sup>41</sup>
EPEAT	Registered Gold in United States <sup>42</sup>
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



### Technical Specifications

SABS	Yes
UKRSERTCOMPUTER	Yes

- Configurations of the HP ProBook 450 G6 that are ENERGY STAR® certified<sup>2</sup> are identified as HP ProBook 450 G6 ENERGY STAR on HP websites and on <http://www.energystar.gov>.
- EPEAT® registered where applicable. EPEAT registration varies by country. See <http://www.epeat.net> for registration status by country. Search keyword generator on HP's 3rd party option store for solar generator accessories at <http://www.hp.com/go/options>.

### 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 diagonal FHD (1920x1080) Anti-Glare WLED UWVA 45% cg 220nits eDP 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>	600:1 (typ) - AG
	<b>Refresh Rate</b>	60Hz
	<b>Brightness</b>	220 nits typical (Panel Only)
	<b>Pixel Resolution</b>	1920 x 1080 (FHD)
	<b>Format</b>	RGB
	<b>Backlight</b>	LED
<b>Color Gamut Coverage</b>	45%	
<b>Color Depth</b>	6 bits + Hi FRC	
<b>Viewing Angle</b>	UWVA 85/85/85/85	

<b>Panel LCD 15.6 inch diagonal HD (1366x768) Anti-Glare WLED SVA 45% cg 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



### Technical Specifications

<b>Touch Enabled</b>	No
<b>Contrast Ratio</b>	300:1 (typ)
<b>Refresh Rate</b>	60Hz
<b>Brightness</b>	220 nits typical (Panel Only)
<b>Pixel Resolution</b>	1366 x 768 (HD)
<b>Format</b>	RGB
<b>Backlight</b>	LED
<b>Color Gamut Coverage</b>	45%
<b>Color Depth</b>	6 bits + Hi FRC
<b>Viewing Angle</b>	SVA 40/40/15/30

**Panel LCD 15.6 inch diagonal HD (1366x768) WLED SVA 45% cg 220nits eDP 1.2 w/o PSR slim NB touch**

<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>	<568g max.
<b>Diagonal Size</b>	15.6"
<b>Thickness</b>	3.4mm max.
<b>Interface</b>	eDP 1.2
<b>Surface Treatment</b>	BrightView Glass
<b>Touch Enabled</b>	Yes
<b>Contrast Ratio</b>	300:1 (typ)
<b>Refresh Rate</b>	60Hz
<b>Brightness</b>	220 nits typical (Panel Only)
<b>Pixel Resolution</b>	1366 x 768 (HD)
<b>Format</b>	RGB
<b>Backlight</b>	LED
<b>Color Gamut Coverage</b>	45%
<b>Color Depth</b>	6 bits + Hi FRC
<b>Viewing Angle</b>	SVA 40/40/15/30

### STORAGE AND DRIVES

#### Hard Drives

**500 GB 7200 rpm SATA Hard Drive**

<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;



### Technical Specifications

		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
<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





### Technical Specifications

<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

<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>16 GB 2280 PCIe-3x2 NVMe 3D Xpoint Solid State Drive</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	



## Technical Specifications

### NETWORKING/COMMUNICATIONS

#### WWAN

<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.

<b>Intel® XMM™ 7262 LTE-Advanced DL CAT6<sup>1</sup></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)



### Technical Specifications

<b>Form Factor</b>	M.2, 3042-S3 Key B
<b>Weight</b>	6 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.

### WLAN

**Intel® 9560**  
**802.11a/b/g/n/ac (2x2)**  
**WLAN and Bluetooth® 5.0**  
**Combo<sup>1</sup> non-vPro**

<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>	802.11b/g/n <ul style="list-style-type: none"> <li>• 2.402 – 2.482 GHz</li> </ul> 802.11a/n/ac <ul style="list-style-type: none"> <li>• 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> </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>• Cisco Certified Extensions, all versions through CCX4 and CCX Lite</li> <li>• WAPI</li> </ul>



### Technical Specifications

<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
<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 White – Radio ON

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



### 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> <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</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) <sup>2</sup> Headset Profile (HSP) Hands Free Profile (HFP) Advanced Audio Distribution Profile (A2DP)

**Realtek  
802.11a/b/g/n/ac (2x2)  
WLAN and Bluetooth® 4.1  
Combo<sup>1</sup>**

**Wireless LAN Standards** IEEE 802.11a  
IEEE 802.11b  
IEEE 802.11g  
IEEE 802.11n  
IEEE 802.11ac



### Technical Specifications

<b>Interoperability</b>	Wi-Fi® certified
<b>Frequency Band</b>	802.11b/g/n <ul style="list-style-type: none"> <li>• 2.402 – 2.482 GHz</li> </ul> 802.11a/n/ac <ul style="list-style-type: none"> <li>• 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)</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>• Cisco Certified Extensions, all versions through CCX4 and CCX Lite</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: +14dBm minimum</li> <li>• 802.11g: +12dBm minimum</li> <li>• 802.11a: +12dBm minimum</li> <li>• 802.11n HT20(2.4GHz): +12dBm minimum</li> <li>• 802.11n HT40(2.4GHz): +12dBm minimum</li> <li>• 802.11n HT20(5GHz): +10dBm minimum</li> <li>• 802.11n HT40(5GHz): +10dBm minimum</li> <li>• 802.11ac VHT80(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
<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



### 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
<b>Dimensions</b>	Type 2230: 2.3 x 22.0 x 30.0 mm
<b>Weight</b>	Type 2230: 2.8g
<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 White – Radio ON

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

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

<b>Bluetooth Specification</b>	4.0/4.1 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> BLE: 1 Mbps signaling data rate <sup>1</sup> 1. Actual throughput may vary.
	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

Not all configuration components are available in all regions/countries.  
c06142921 — DA 16312 - Worldwide — Version 01 — November 12, 2018



### Technical Specifications

<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)

<b>Realtek 802.11a/b/g/n/ac (1x1) WLAN and Bluetooth® 4.2 Combo<sup>1</sup></b>	<b>Wireless LAN Standards</b>	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n IEEE 802.11ac
	<b>Interoperability</b>	Wi-Fi certified
	<b>Frequency Band</b>	802.11b/g/n <ul style="list-style-type: none"> <li>• 2.402 – 2.482 GHz</li> </ul> 802.11a/n <ul style="list-style-type: none"> <li>• 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, and 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>• Cisco Certified Extensions, all versions through CCX4 and CCX Lite</li> <li>• WAPI</li> </ul>





### Technical Specifications

<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: +14dBm minimum</li> <li>• 802.11g: +12dBm minimum</li> <li>• 802.11a: +12dBm minimum</li> <li>• 802.11n HT20(2.4GHz): +12dBm minimum</li> <li>• 802.11n HT40(2.4GHz): +12dBm minimum</li> <li>• 802.11n HT20(5GHz): +10dBm minimum</li> <li>• 802.11n HT40(5GHz): +10dBm minimum</li> <li>• 802.11ac VHT80(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
<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
<b>Dimensions</b>	Type 2230: 2.3 x 22.0 x 30.0 mm
<b>Weight</b>	Type 2230: 2.8g
<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 White – Radio ON

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

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

Not all configuration components are available in all regions/countries.  
 c06142921 — DA 16312 - Worldwide — Version 01 — November 12, 2018



### Technical Specifications

<b>Bluetooth Specification</b>	4.0/4.1/4.2 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) <sup>2</sup> Headset Profile (HSP) Hands Free Profile (HFP) Advanced Audio Distribution Profile (A2DP)

### 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 (175g) max



### Technical Specifications

<b>Input</b>	90 to 265 VAC
	<b>Input Efficiency</b> 87.74% at 115Vac and 88.4% at 230Vac
<b>Output</b>	<b>Input frequency range</b> 47 to 63 Hz
	<b>Input AC current</b> 1.4 A at 90 VAC
	<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> 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)
	<b>Humidity</b> 20% to 95%
	<b>Storage Humidity</b> 10% to 95%
<b>EMI and Safety Certifications</b>	*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.

<b>HP 65W Smart AC adapter</b>	<b>Dimensions</b> 90x51x28.5mm
	<b>Weight</b> unit: 220g +/- 10g
<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>Output</b>	<b>Input AC current</b> 1.7 A at 90 VAC
	<b>Output power</b> 65W
	<b>DC output</b> 19.5V
	<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>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%	



### 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.

#### HP 65W EM Smart AC adapter

#### Dimensions

102x55x30mm

#### Weight

270g +/- 10g

#### Input

- Input Efficiency** 87% min at 115V/230V
- Input frequency range** 47 to 63 Hz
- Input AC current** 1.7 A at 90 VAC and maximum load
- DC output** 65W(19.5V/3.33A)
- Hold-up time** 5 msec at 115 VAC input
- Output current limit** <11A, Over voltage protection- 29V max automatic shutdown

#### Connector

4.5mm Barrel Type, 3 pin/grounded, mates with interchangeable cords

#### Environmental Design

- Operating temperature** 0° to 35° C
- Non-operating (storage) temperature** -20° to 85° C
- Altitude** 0 to 5,000 m
- Humidity** 0% to 95%
- Storage Humidity** 0% 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.

#### AC Adapter 65 Watt nPFC USB type C

#### Dimensions

74x74x28.5mm

#### Weight

unit: 245g +/- 10g

#### Input

- Input Efficiency** 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
- Input frequency range** 47 to 63 Hz
- Input AC current** 1.7 A at 90 VAC and maximum load
- Output power** 65W
- DC output** 5V/9V/10V/12V/15V/20V
- Hold-up time** 5ms at 115 Vac input



### Technical Specifications

<b>Connector</b>	<b>Output current limit</b>	<8.0A
	Type C	
<b>Environmental Design</b>	<b>Operating temperature</b>	0° to 35° C
	<b>Non-operating (storage) temperature</b>	-20° to 85° C
	<b>Altitude</b>	0 to 5,000 m
	<b>Humidity</b>	0% to 95%
	<b>Storage Humidity</b>	0% to 95%
<b>EMI and Safety Certifications</b>	*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.	

<b>AC Adapter 45 Watt nPFC USB type C</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%, 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%
		<b>Input frequency range</b>	47 to 63 Hz
		<b>Input AC current</b>	Max. 1.4 A at 90 Vac
		<b>Output power</b>	5V/15W
			9V/27W
			10V/37.5W
			12V/45W
			15V/45W
		20V/45W	
		<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>	<5.0A	
	<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 5000m)	
	<b>Humidity</b>	20% to 95%	
	<b>Storage Humidity</b>	10% to 95%	
<b>EMI and Safety Certifications</b>	*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.		



### Technical Specifications

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

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<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. x184.7x88.9 mm
	<b>Weight</b>	0.22 kg (0.48lb)
	<b>Cells/Type</b>	3cell Lithium-Ion
	<b>Voltage</b>	11.55V
	<b>Amp-hour capacity</b>	3.900Ah
	<b>Watt-hour capacity</b>	45Wh
	<b>Operating (Charging)</b>	32° to 113° F (0° to 45° C)
	<b>Operating (Discharging)</b>	14° to 122° F (-10° to 60° C)

1. 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.



### 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	H1D24AA
	HP Essential Messenger Case	H1D25AA
<b>Dockings</b>	HP USB-C Mini Dock	1PM64AA
	HP USB-C Universal Dock	1MK33AA
	HP USB-C Dock G4	3FF69AA
<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
<b>Memory</b>	4GB 2666MHz DDR4	4VN05AA
	8GB 2666MHz DDR4	4VN06AA
	16GB 2666 MHz DDR4	4VN07AA
<b>Power</b>	HP 45W Smart AC Adapter 4.5mm	H6Y88AA
	HP 65W Slim AC Adapter	H6Y82AA
	HP 65W USB-C Power Adapter	3PN48AA
	HP 45W USB-C Power Adapter	1HE17AA
	HP 65W USB-C Power Adapter	1HE08AA
	HP Power Bank	N9F71AA
	HP USB-C Power Bank	2NA10AA
<b>Storage</b>	HP 45W LC USB-C Power Adapter	1MZ01AA#ABA
	HP External USB Optical Drive	F2B56AA
	HP 500GB 7200rpm HDD	F3B97AA
<b>Security</b>	HP Combination Lock	T0Y15AA
	HP Essential Keyed Cable lock 12.3mm	T0Y14AA
	HP Keyed Cable Lock 10mm	T1A62AA
	HP UltraSlim Keyed Cable Lock	T1A62AA
<b>UCC</b>	HP Conferencing Keyboard	K8P74AA
	HP Speaker Phone	K7V16AA
	HP Wired Headset	K7V17AA
<b>Displays</b>	HP ProDisplay P223 21.5-inch Monitor	X7R61AA
	HP ProDisplay P232 23-inch Monitor	K7X31AA
	HP ProDisplay P240va 23.8-inch Monitor	X3B48AA
	HP EliteDisplay E243 23.8-inch Monitor	1FH47AA
	HP EliteDisplay E243m 23.8-inch Collaboration Monitor	1FH48AA
	HP EliteDisplay E273 27-inch Monitor	1FH50AA



### Summary of Changes

Date of change:	Version History:		Description of change:
	<b>V1 to V2</b>		

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