

### Overview

### HP ProBook 450 G5 Notebook PC



#### Front

- |                       |  |
|-----------------------|--|
| 1. Microphones (2)    | 7. SD Card reader                              |
| 2. Webcam             | 8. Headphone/microphone combo jack             |
| 3. Webcam light       | 9. USB 2.0 (power port)                        |
| 4. Fingerprint reader | 10. Power button                               |
| 5. Clickpad           | 11. Security lock slot (Lock sold separately.) |
| 6. Hard drive LED     |  |

### Overview



#### Rear

- |                              |                                    |
|------------------------------|------------------------------------|
| 1. Power connector           | 4. HDMI port (Cable not included.) |
| 2. Ethernet port (RJ-R45)    | 5. USB 3.1 Gen 1                   |
| 3. External VGA monitor port | 6. USB Type-C™ port                |

### Overview

#### At a Glance

1. Preinstalled with Windows 10 versions or FreeDOS 2.0
2. Choice of Intel® Core™ processors
3. Full size HP Premium Keyboard, spill-resistant keyboard with a thin layer of mylar film to prevent minor spills
4. Function keys provide control of features including: standby mode, display brightness, external display, microphone mute, volume down, volume up, and backlight toggle for backlit keyboard (Select models only.)
5. Large Clickpad with gestures support
6. Enhanced security features with preinstalled software and hardware options
7. Optional HD webcam with dual-microphone array for video conferencing <sup>1</sup>
8. HDMI port for connecting to high-resolution displays
9. Choice of displays
  - 39.6 cm (15.6") diagonal FHD UWVA anti-glare flat LED backlit non-touch; 220 cd/m<sup>2</sup>; 45% sRGB (1920 x 1080)
  - 39.6 cm (15.6") diagonal HD SVA anti-glare LED-backlit non-touch; 220 cd/m<sup>2</sup>; 45% sRGB (1366 x 768)
  - 39.6 cm (15.6") diagonal HD SVA LED-backlit touch screen; 220 cd/m<sup>2</sup>, 45% sRGB (1366 x 768)
10. Flexible wireless connectivity options
11. Battery life up to 14 hours and 30 minutes (i3, HD with SSD)
12. HP 3-cell, 48 WHr Li-ion battery
13. Passed MIL-STD testing <sup>2</sup>
  1. Sold separately or as an optional feature.
  2. 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.

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



## Features

### PRODUCT NAMES

HP Probook 450 G5 Notebook PC

### OPERATING SYSTEMS

#### Preinstalled

Windows 10 Pro 64 <sup>1</sup>  
 Windows 10 Pro 64 (National Academic License) <sup>1,2</sup>  
 Windows 10 Home 64 <sup>1</sup>  
 Windows 10 Home Single Language 64 <sup>1</sup>  
 Windows 10 Home 64 (National Academic License) <sup>1,2</sup>  
 FreeDOS 2.0

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™ i7-8550U Intel® UHD graphics 620 (1.8 GHz, up to 4.0 GHz with Intel® Turbo Boost Technology 2.0, 8 MB cache, 4 cores) <sup>3,4,5</sup>

Intel® Core™ i5-8250U Intel® UHD Graphics 620 (1.6 GHz, up to 3.4 GHz with Intel® Turbo Boost Technology 2.0, 6 MB cache, 4 cores) <sup>3,4,5</sup>

Intel® Core™ i5-7200U with Intel® HD Graphics 620 (2.5GHz/3.1GHz Dual Core Turbo, 3MB L3 Cache 15W)

Intel® Core™ i3-8130U Intel® UHD Graphics 620 (2.2 GHz, up to 3.4 GHz with Intel® Turbo Boost Technology 2.0, 4 MB cache, 2 cores)

Intel® Core™ i3-8130U with Intel® HD Graphics 620 (2.2GHz/3.4GHz Dual Core Turbo, 4MB L3 Cache 15W)

Intel® Core™ i3-7100U with Intel® HD Graphics 620 (2.4 GHz, 3 MB cache, 2 cores) <sup>3,4,5</sup>

Intel® Core™ i3-7020U with Intel® HD Graphics 620 (2.3GHz, 3MB L3 cache 15W)

Intel® Core™ i3-6006U with Intel® HD Graphics 520 (2 GHz, 3 MB cache, 2 cores) <sup>3,4</sup>

Intel® Celeron® 3865U with Intel® HD Graphics (1.8 GHz, 2 MB cache, 2 cores) <sup>3,4,5</sup>

#### Processors Family

8th Generation Intel® Core™ i7 processor (i7-8550U model) <sup>5</sup>

8th Generation Intel® Core™ i5 processor (i5-8250U model) <sup>5</sup>

8th Generation Intel® Core™ i3 processor (i3-8130U model)

7th Generation Intel® Core™ i5 processor (i5-7200U model)

7th Generation Intel® Core™ i3 processor (i3-7100U model) <sup>5</sup>

7th Generation Intel® Core™ i3 processor (i3-7020 model)

6th Generation Intel® Core™ i3 processor (i3-6006U model)

Intel® Celeron® processor (3865U is Windows 10 only) <sup>5</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 is not a measurement of higher performance.



### Features

4. Processor speed denotes maximum performance mode; processors will run at lower speeds in battery optimization mode.
5. **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>.

### CHIPSET

Integrated with processor

### GRAPHICS

#### Integrated

Intel® UHD graphics 620 <sup>6</sup>

Intel® HD graphics 620 <sup>6</sup>

Intel® HD graphics 520 <sup>6</sup>

Intel® HD graphics <sup>6</sup>

**Note:** View processor section for details.

#### Discrete

NVIDIA® GeForce® 930MX (2 GB DDR3 dedicated, switchable) <sup>7</sup>

#### Supports

Support HD decode, DX12, HDMI 1.4b

6. HD content required to view HD images.

7. NVIDIA® technology requires an Intel® processor, plus an NVIDIA® GeForce® discrete graphics configuration and is available on Windows 10 Professional 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

##### eDP FHD Flat

39.6 cm (15.6") diagonal FHD UWVA anti-glare flat LED backlit, 220 cd/m<sup>2</sup>, 45% sRGB (1920 x 1080) <sup>6,8</sup>

##### eDP HD Flat

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

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

#### Display Size

15.6"

39.6 cm (15.6")

6. HD content required to view HD images.

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



---

## Features

### STORAGE AND DRIVES

#### Hard Drives

- 500 GB SATA (7200 rpm) <sup>9</sup>
- 500 GB (8 GB cache) SATA SSHD (5400 rpm) <sup>9</sup>
- 1 TB SATA (5400 rpm) <sup>9</sup>

#### Primary M.2 Storage

- 128 GB M.2 SATA TLC SSD <sup>9</sup>
- 256 GB M.2 PCIe NVMe Value SSD <sup>9</sup>
- 512 GB M.2 PCIe NVMe TLC SSD <sup>9</sup>

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

9. For Solid State Drives or Hard 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.
- 

### MEMORY

- 16 GB DDR4-2400 SDRAM (1 x 16 GB) <sup>10</sup>
- 16 GB DDR4-2400 SDRAM (2 x 8 GB) <sup>10</sup>
- 12 GB DDR4-2400 SDRAM (4 and 8 GB) <sup>10</sup>
- 8 GB DDR4-2400 SDRAM (1 x 8 GB) <sup>10</sup>
- 8 GB DDR4-2400 SDRAM (2 x 4 GB) <sup>10</sup>
- 4 GB DDR4-2400 SDRAM (1 x 4 GB) <sup>10</sup>

#### Maximum

- 32 GB DDR4-2400 SDRAM <sup>10</sup>

#### Memory Slots

- 2 SODIMM
- Both slots are customer accessible / upgradeable
- DDR4 PC4 SODIMMS, system runs at 2133 (Intel®8th Gen CPU runs at 2400)
- Supports Dual Channel Memory

10. 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

#### Wireless LAN (WLAN)

- Realtek 802.11ac (1x1) WiFi® and Bluetooth® 4.2 Combo <sup>11</sup>
- Realtek 802.11ac (2x2) WiFi® and Bluetooth® 4.2 Combo <sup>11</sup>
- Intel® Dual Band Wireless-AC 3168 802.11 a/b/g/n/ac (1x1) WiFi® and Bluetooth® 4.2 Combo (non-vPro™) <sup>11</sup>
- Intel® Dual Band Wireless-AC 8265 802.11a/b/g/n/ac (2x2) WiFi® and Bluetooth® 4.2 Combo (non-vPro™) <sup>11</sup>

#### Broadband Wireless (WWAN)

- HP lt4132 LTE/HSPA+ 4G Mobile Broadband <sup>12</sup>
- HP lt4210 LTE/HSPA+ 4G Mobile Broadband <sup>12</sup>

#### Ethernet

- Realtek RTL8111HSH Gigabit Ethernet



### Features

---

11. 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.
  12. 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.
- 

### AUDIO/MULTIMEDIA

#### Audio

2 Integrated stereo speakers  
Integrated dual array microphone

#### Webcam

HD webcam <sup>6,13</sup>  
HD IR webcam <sup>6,13</sup>

6. HD content required to view HD images.
  13. Internet access required.
- 

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

#### Keyboard

HP Premium Keyboard  
Full-sized island-style, spill resistant

#### Pointing Device

Clickpad with multi-touch gesture support image sensor, taps enabled as default

#### Gestures

##### Enabled by default Win 10

2 Finger Scrolling  
2 Finger Zoom (Pinch)  
OSD (enable/disable)  
3 finger tap = Cortana  
3 finger flick = App switch  
4 finger tap = Action Center

##### Disabled by default Win 10

3 Finger Flick  
2 Finger Rotate  
Momentum Motion  
1 Finger Vertical Scroll

#### Function Keys

ESC: system information  
F1 - Display Switching  
F2 - Blank  
F3 - Brightness Down



### Features

- 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 - Wifi Toggle
- F12 - Sleep

#### Hidden Functions

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

---

## SOFTWARE AND SECURITY

### BIOS

- HP BIOSphere Gen4 <sup>14</sup>
- HP DriveLock & Automatic DriveLock
- BIOS Update via Network
- Master Boot Record Security
- Power On Authentication
- Secure Erase<sup>15</sup>
- Absolute Persistence Module<sup>16</sup>
- Pre-boot Authentication

### Software

- HP Native Miracast Support <sup>17</sup>
- HP LAN-Wireless Protection
- HP Wireless Wakeup
- HP Connection Optimizer
- HP Velocity
- HP 3D DriveGuard 6
- HP ePrint + JetAdvantage <sup>18</sup>
- HP Hotkey Support
- HP Recovery Manager
- HP Jumpstart
- HP Support Assistant <sup>19</sup>
- HP Noise Cancellation Software
- Buy Office
- Bing Search

### Manageability Features





## Features

HP Driver Packs <sup>20</sup>

HP System Software Manager

HP BIOS Config Utility (BCU)

HP Client Catalog

HP Management Integration Kit for Microsoft System Center Configuration Manager <sup>21</sup>

LANDESK Management <sup>22</sup>

### Client Security Software

HP Client Security Suite Gen3 <sup>23</sup> including:

HP Security Manager (including Credential Manager and Password Manager)

HP DriveLock

HP Fingerprint Sensor

HP Password Manager <sup>24</sup>

Microsoft Defender <sup>25</sup>

TPM 2.0

14. HP BIOSphere Gen4 requires Intel® 7th or 8th Generation processors.
15. Secure Erase for the methods outlined in the National Institute of Standards and Technology Special Publication 800-88. Supported on Elite platforms with BIOS version F.03 or higher.
16. 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.
17. Miracast is a wireless technology your PC can use to project your screen to TVs, projectors, and streaming media players that also support Miracast. You can use Miracast to share what you're doing on your PC and present a slide show. For more information: <http://windows.microsoft.com/en-us/windows-8/project-wireless-screen-miracast>
18. HP ePrint Drive requires an Internet connection to HP web-enabled printer and HP ePrint account registration (for a list of eligible printers, supported documents and image types and other HP ePrint details, see [www.hp.com/go/eprintcenter](http://www.hp.com/go/eprintcenter)). Print times and connection speeds may vary.
19. HP Support Assistant requires Windows and Internet access.
20. HP Driver Packs not preinstalled, however available for download at <http://www.hp.com/go/clientmanagement>.
21. HP Management Integration Kit can be downloaded from <http://www8.hp.com/us/en/ads/clientmanagement/overview.html>.
22. LANDESK Management subscription required.
23. HP Client Security Suite Gen3 requires Windows and Intel® or AMD 7th or 8th Generation processors.
24. 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.
25. Microsoft Defender Opt in and internet connection required for updates.



## Features

### POWER

#### Power Supply

- 45 W HP Smart AC adapter <sup>26</sup>
- 45 W HP Smart AC adapter 2-prong (Japan only) <sup>26</sup>
- 65 W HP Smart AC adapter <sup>26</sup>
- 65 W EM Smart AC adapter <sup>26</sup>

#### Primary Battery

3-cell, 48 Wh Long Life Li-ion <sup>27</sup>

#### Power Cord

- 2-wire plug - 1m (2-prong Japan only) <sup>26</sup>
- 3-wire plug - 1m <sup>26</sup>
- 3-wire plug - 1.8m <sup>26</sup>

#### Battery life

- Up to 14 hours and 30 minutes (i3, HD with SSD) <sup>28</sup>
- Up to 14 hours and 15 minutes (i5 quad core, HD with SSD) <sup>28</sup>

26. Availability may vary by country.

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

28. 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 4.64 lb <sup>29</sup>
- Starting at 2.02 kg <sup>29</sup>

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

##### Non-touch

- 14.8 x 10.4 x 0.82 in
- 37.6 x 26.3 x 2.09 cm

##### Touch

- 14.8 x 10.4 x 0.89 in
- 37.6 x 26.3 x 2.28 cm

29. Weight will vary by configuration.

### PORTS/SLOTS

- 1 USB 3.1 Type-C™
- 1 USB 2.0 (powered port)
- 2 USB 3.1 Gen 1



### Features

- 1 HDMI 1.4b <sup>30</sup>
- 1 RJ-45
- 1 VGA
- 1 AC power
- 1 headphone/microphone combo jack

#### Expansion Slots

- 1 multi-format digital media reader
- Supports SD, SDHC, SDXC.

30. HDMI cable sold separately.

### ENVIRONMENTAL & INDUSTRY

|                           |  |   |                     |                     |
|---------------------------|--|---|---------------------|---------------------|
| <b>Environmental Data</b> | <b>Eco-Label Certifications &amp; declarations</b>                         | 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: <ul style="list-style-type: none"> <li>• IT ECO declaration</li> <li>• US ENERGY STAR®</li> <li>• EPEAT<sup>®</sup> Gold registered in the United States. See <a href="http://www.epeat.net">http://www.epeat.net</a> for registration status in your country. Search keyword <i>generator</i> on HP's 3rd party option store for solar energy accessory at <a href="http://www.hp.com/go/options">http://www.hp.com/go/options</a></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)  | 7.89 W  | 7.95 W              | 7.84 W              |
|                           | Normal Operation (Long idle)   | 3.43 W  | 3.46 W              | 3.4 W               |
|                           | Sleep  | 0.55 W  | 0.58 W              | 0.56 W              |
|                           | Off  | 0.39 W  | 0.43 W              | 0.4 W               |
|                           |  | Note: Energy efficiency data listed is for an ENERGY STAR® compliant product if offered within the model family. HP computers marked with the ENERGY STAR® Logo are compliant with the applicable U.S. Environmental Protection Agency (EPA) ENERGY STAR® specifications for computers. If a model family does not offer ENERGY STAR® compliant configurations, then energy efficiency data listed is for a typically configured PC featuring a hard disk drive, a high efficiency power supply, and a Microsoft Windows® operating system.   |                     |                     |
|                           | <b>Heat Dissipation*</b>   | <b>115VAC, 60Hz</b>   | <b>230VAC, 50Hz</b> | <b>100VAC, 60Hz</b> |
|                           | Normal Operation (Short idle)  | 27  | 27                  | 27                  |
|                           | Normal Operation (Long idle)   | 12  | 12                  | 12                  |
|                           | Sleep  | 2   | 2                   | 2                   |
|                           | Off  | 1   | 1                   | 1                   |



### Features

|  |  |  |       |
|--|--|--|-------|
|  | *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>WA</sub> d, bels)  | Sound Pressure (L <sub>pAm</sub> , decibels) |       |
| Typically Configured – Idle  | 2.9  | 21   |       |
| Fixed Disk – Random writes   | 2.9  | 21   |       |
| <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:<br/>Mercury greater the 1ppm by weight<br/>Cadmium greater than 20ppm by weight</p> <p>Battery size: CR2032 (coin cell)<br/>Battery type: Lithium</p> <p>Battery size: CR2032 (coin cell)<br/>Battery type: Lithium"</p>  |  |       |
| <b>Additional Information</b>  | <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 (EPEAT) standard at the Gold 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 0% post-consumer recycled plastic (by wt.)</li> <li>• • This product is 94.4% recycle-able when properly disposed of at end of life."</li> </ul> |  |       |
| <b>Packaging Materials</b>   | <b>External:</b>   | PAPER/Corrugated                             | 359 g |
|  | <b>Internal:</b>   | PLASTIC/EPE (Expanded Polyethylene)          | 82 g  |
|  |  | PLASTIC/Polyethylene low density             | 10 g  |
| The plastic packaging material contains at least 50% recycled content.     |  |  |       |



### Features

|  |   |   |
|--|---|---|
|  |   | The corrugated paper packaging materials contains at least 75% recycled content.  |
|  | <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 (PBEBs)</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, 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 geographic areas. To recycle your product, please go to: <a href="http://www.hp.com/go/reuse-recycle">http://www.hp.com/go/reuse-recycle</a> or contact your nearest HP sales office. Products returned to HP will be recycled, recovered or disposed of in a responsible manner.</p>  |



### Features

|  |  |   |
|--|--|---|
|  |  | <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<br/> <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<br/> <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:<br/> <a href="http://h20195.www2.hp.com/V2/GetDocument.aspx?docname=c04755842">http://h20195.www2.hp.com/V2/GetDocument.aspx?docname=c04755842</a><br/> <a href="http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/cert.pdf">http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/cert.pdf</a></p> |

### SERVICE AND SUPPORT

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>31</sup>

31. 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 [www.hp.com/go/cpc](http://www.hp.com/go/cpc). HP services are governed by the applicable HP terms and conditions of service provided or indicated to Customer at the time of purchase. Customer may have additional statutory rights according to applicable local laws, and such rights are not in any way affected by the HP terms and conditions of service or the HP Limited Warranty provided with your HP Product.

### CERTIFICATION AND COMPLIANCE

ENERGY STAR<sup>®</sup> certified  
 EPEAT<sup>®</sup> Gold <sup>32</sup>  
 Low halogen <sup>33</sup>

32. EPEAT<sup>®</sup> 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 [www.hp.com/go/options](http://www.hp.com/go/options).
33. External power supplies, power cords, cables and peripherals are not Low Halogen. Service parts obtained after purchase may not be Low Halogen.



## Features



### Technical Specifications

#### SYSTEM UNIT

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

|                           |                             |
|---------------------------|-----------------------------|
| Nominal Operating Voltage | 19V                         |
| Average Operating Power   | Win 10<br>5.71W             |
| Integrated graphics       | 5.71W                       |
| Discrete Graphics         | 6.78W                       |
| Max Operating Power       | Discrete < 65W<br>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 7.0® | Selected models <sup>34</sup> |
| EPEAT            |                               |

Registered Gold in United States <sup>32</sup>

|                      |     |
|----------------------|-----|
| ICES                 | Yes |
| Australia /          | Yes |
| NZ A-Tick Compliance | Yes |
| CCC                  | Yes |





### Technical Specifications

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 |
| UKRSERTCOMPUTER                 | Yes |

32. 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](http://www.hp.com/go/options).

34. Configurations of the HP ProBook 450 G4 is ENERGY STAR® qualified are identified as HP ProBook 450 G4 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>15.6" diagonal FHD UWVA anti-glare flat LED backlit non-touch; 220 cd/m<sup>2</sup>; 45% sRGB (1920 x 1080)</b> | <b>Outline Dimensions (W x H x D)</b> | 360.0 x 224.3mm max |
|  | <b>Active Area</b>                    | 344.16 x 193.59     |
|  | <b>Weight</b>                         | 360g max.           |
|  | <b>Diagonal Size</b>                  | 15.6 (inch)         |
|  | <b>Thickness</b>                      | 3.2mm max           |
|  | <b>Interface</b>                      | eDP 1.2             |
|  | <b>LCD Mode</b>                       | IPS                 |
|  | <b>PPI</b>                            |                     |
|  | <b>Surface Treatment</b>              | Anti-Glare (AG)     |
|  | <b>Touch Enabled</b>                  | None                |
|  | <b>Contrast Ratio</b>                 | 600:1 (typical)     |
|  | <b>Refresh Rate</b>                   | 60Hz                |
|  | <b>Brightness</b>                     | 220 nits            |
|  | <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 + FRC                          |                     |
| <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% sRGB (1366 x 768)</b> | <b>Outline Dimensions (W x H)</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>LCD Mode</b>                   | TN                   |
|  | <b>PPI</b>                        |                      |
|  | <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</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 45/45/25/35                   |                      |

|   |                                       |                      |
|---|---------------------------------------|----------------------|
| <b>15.6" diagonal HD SVA LED-backlit touch; 220 cd/m<sup>2</sup>; 45% sRGB (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>LCD Mode</b>                       | TN                   |
|   | <b>PPI</b>                            |                      |
|   | <b>Surface Treatment</b>              |                      |
|   | <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</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 45/45/25/35                       |                      |



### Technical Specifications

#### STORAGE AND DRIVES

##### HARD DRIVES

|  |                              |  |
|--|------------------------------|--|
| <b>500 GB 7200 rpm SATA Hard Drive</b> | <b>Drive Weight</b>          | 0.01 lb (6 g) ~ 0.02 lb (10 g)           |
|  | <b>Rotation Speed</b>        | 5400 rpm                                 |
|  | <b>Cache Buffer</b>          | Up to 16MB                               |
|  | <b>NAND Type/Size</b>        | 0.28 in (7 mm)                           |
|  | <b>Height</b>                | 2.75 in (69.85 mm)                       |
|  | <b>Width</b>                 | ATA-8, SATA 3.0                          |
|  | <b>Interface</b>             | 600 MB/s                                 |
|  | <b>Transfer Rate</b>         | 0.01 lb (6 g) ~ 0.02 lb (10 g)           |
|  | <b>Seek Time</b>             |  |
|  | <b>Single Track</b>          | 1.5 ~ 2 ms                               |
|  | <b>Average</b>               | 11 ~ 13 ms                               |
|  | <b>Maximum</b>               | 18 ~ 22 ms                               |
|  | <b>Logical Blocks</b>        | 976,773,168                              |
|  | <b>Operating Temperature</b> | 976,773,168                              |
|  | <b>Security Features</b>     | 32° to 158°F (0° to 70°C) [ambient temp] |
|  | <b>Other Features</b>        | ATA Security, NCQ                        |

|   |                                |  |
|---|--------------------------------|--|
| <b>500 GB 5400 rpm SMART SATA Hybrid HDD/SSHD</b> | <b>Drive Weight</b>            | 0.20 lbs (92 g) ~ 0.21 lbs (95 g)        |
|   | <b>Rotation Speed</b>          | 5400 rpm                                 |
|   | <b>Cache Buffer</b>            | 64 MB                                    |
|   | <b>NAND Type/Size</b>          | TLC/8GB                                  |
|   | <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>Interface Transfer Rate</b> | 600 MB/s                                 |
|   | <b>Seek Time</b>               |  |
|   | <b>Single Track</b>            | 2 ~ 1.5 ms;                              |
|   | <b>Average</b>                 | 11 ~ 13 ms                               |
|   | <b>Maximum</b>                 | 18 ~ 22 ms                               |
|   | <b>Logical Blocks</b>          | 976,773,168                              |
|   | <b>Operating Temperature</b>   | 976,773,168                              |
|   | <b>Security Features</b>       | 32° to 158°F (0° to 70°C) [ambient temp] |
|   | <b>Other Features</b>          | ATA Security, NCQ                        |



### Technical Specifications

|   |                                |  |
|---|--------------------------------|--|
| <b>1TB 5400 rpm 7mm 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>NAND Type/Size</b>          | N/A  |
|   | <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>Interface Transfer Rate</b> | 600 MB/s                                     |
|   | <b>Seek Time</b>               |  |
|   | <b>Single Track</b>            | Single Track 2 ms                            |
|   | <b>Average</b>                 | Average 12 ~ 13 ms                           |
|   | <b>Maximum</b>                 | 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>Other Features</b>                   | S.M.A.R.T., NCQ, Ultra DMA     |  |

### SOLID STATE DRIVES

|   |                                 |  |
|---|---------------------------------|--|
| <b>128GB 2280 M2 SATA-3 TLC Solid State Drive</b> | <b>Form Factor</b>              | M.2 2280                                 |
|   | <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>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>256GB 2280 M2 SATA-3 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>Weight</b>                   | 0.02 lb (10 g)   |
|   | <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   |



### Technical Specifications

|                              |  |
|------------------------------|--|
| <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>512GB 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>Weight</b>                   | 0.02 lb (10 g)                           |
|  | <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                               |

## NETWORKING/COMMUNICATIONS

### WWAN

|   |                                    |   |
|---|------------------------------------|---|
| <b>HP lt4132 LTE/HSPA+ 4G Mobile Broadband Module<sup>1</sup></b> | <b>Technology/Operating bands</b>  | LTE: 2100 (Band 1), 1900 (Band 2), 1800 (Band 3) MHz, 850 (Band 5), 2600 (Band 7), 900 (Band 8) MHz, 800 (Band 20), 700 (Band 28) MHz.<br>HSPA+: 2100 (Band 1), 1900 (Band 2), 850 (Band 5), 900 (Band 8) MHz<br>E-GPRS: 1900 (Band 2), 1800 (Band 3), 850 (Band 5), 900 (Band 8) MHz |
|   | <b>Wireless protocol standards</b> | 3GPP Release 10 LTE Specification CAT.4, 20MHz BW<br>WCDMA R99, 3GPP Release 5, 6, 7 and 8 UMTS Specification<br>E-GPRS: Class B, Multi-slot class 12, coding schemes CS1 - CS4 and MSC1 - MSC9   |
|   | <b>GPS</b>                         | Standalone, A-GPS (MS-B and LTO)  |
|   | <b>GPS bands</b>                   | 1575.42 MHz ± 1.023 MHz, GLONASS 1596-1607MHz   |
|   | <b>Maximum data rates</b>          | LTE: 150 Mbps (Download), 50 Mbps (Upload)<br>DC-HSPA+: 42 Mbps (Download), 5.76 Mbps (Upload)<br>HSPA+: 21Mbps (Download), 5.76 Mbps (Upload)<br>EDGE: 236.8 kbps (Download), 236.8 kbps (Upload)<br>GPRS: 85.6 kbps(Download), 85.6 kbps (Upload)                                   |
|   | <b>Maximum output power</b>        | LTE: 23 dBm<br>HSPA+: 23.5 dBm<br>E-GPRS 1900/1800: 26 dBm<br>E-GPRS 900/850: 27 dBm<br>GPRS 1900/1800: 29.5 dBm<br>GPRS 900/850: 32.5 dBm  |
|   | <b>Maximum power consumption</b>   | LTE: 1,200 mA (peak); 900 mA (average)<br>HSPA+: 1,100 mA (peak); 800 mA (average)<br>E-GPRS: 2,600 mA (peak); 500 mA (average)   |



### Technical Specifications

|   |                    |
|---|--------------------|
| <b>Form Factor</b>                                | M.2, 3042-S3 Key B |
| <b>Weight</b>                                     | 6 g                |
| <b>Dimensions</b><br>(Length x Width x Thickness) | 42 x 30 x 2.3 mm   |

1. Mobile Broadband is an optional feature. 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>HP It4210 LTEHSPA+ 4G Mobile Broadband Module<sup>1</sup></b> | <b>Technology/Operating bands</b>                 | FDD LTE:<br>LTE: 2100 (Band 1), 1900 (Band 2), 1800 (Band 3), 1700 (Band 4), 850 (Band 5), 2600 (Band 7), 900 (Band 8), 1400 (Band 11), 700 (Band 12), 700 (Band 13)<br>700 (Band 17), 850 (Band 18), 850 (Band 19), 800 (Band 20), 1450 (Band 21), 850 (Band 26)<br>700 (Band 28) MHz, 700 (Band 29), 2300 (Band 30), 2100 (Band 66) MHz<br>TDD LTE:<br>2600 (Band 38), 1900 (Band 39), 2300 (Band 40), 2500 (Band 41) MHz<br>HSPA+: 2100 (Band 1), 1900 (Band 2), 1700 (Band 4), 850 (Band 5), 900 (Band 8) MHz |
|  | <b>Wireless protocol standards</b>                | 3GPP Release 11 LTE Specification CAT.9, MAX 60MHz aggregation BW<br>WCDMA R99, 3GPP Release 5, 6, 7 and 8 UMTS Specification   |
|  | <b>GPS</b>  | Standalone, A-GPS (MS-B and LTO)  |
|  | <b>GPS bands</b>                                  | GPS 1575.42 MHz ± 1.023 MHz, GLONASS 1596-1607MHz, Beidou 1561.098 ± 2.046 MHz  |
|  | <b>Maximum data rates</b>                         | LTE: 450 Mbps (DL 3CA), 50 Mbps (Upload)<br>DC-HSPA+: 42 Mbps (Download), 5.76 Mbps (Upload)<br>HSPA+: 21Mbps (Download), 5.76 Mbps (Upload)  |
|  | <b>Maximum output power</b>                       | LTE: 23 dBm<br>HSPA+: 23.5 dBm  |
|  | <b>Maximum power consumption</b>                  | LTE: 1,200 mA (peak); 900 mA (average)<br>HSPA+: 1,100 mA (peak); 800 mA (average)  |
|  | <b>Form Factor</b>                                | M.2, 3042-S3 Key B  |
|  | <b>Weight</b>                                     | 6 g   |
|  | <b>Dimensions</b><br>(Length x Width x Thickness) | 42 x 30 x 2.3 mm  |

1. Mobile Broadband is an optional feature. 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.

### WLAN

|  |                               |   |
|--|-------------------------------|---|
| <b>Intel 802.11 a/b/g/n/AC (2x2) WiFi and Bluetooth® Combo</b> | <b>Wireless LAN Standards</b> | IEEE 802.11a<br>IEEE 802.11b<br>IEEE 802.11g<br>IEEE 802.11n<br>IEEE 802.11ac |
|--|-------------------------------|---|



### Technical Specifications

|   |   |
|---|---|
| <b>Interoperability</b>                 | Wi-Fi certified   |
| <b>Frequency Band</b>                   | <p>802.11b/g/n</p> <ul style="list-style-type: none"> <li>• 2.402 – 2.482 GHz</li> </ul> <p>802.11a/n</p> <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 ~ MCS7, (1SS) (20MHz, 40MHz, and 80MHz)</li> </ul>   |
| <b>Modulation</b>                       | Direct Sequence Spread Spectrum<br>BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM   |
| <b>Security<sup>1</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)<br>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 : +16dBm minimum</li> <li>• 802.11g : +14dBm minimum</li> <li>• 802.11a : +14dBm minimum</li> <li>• 802.11n HT20(2.4GHz) : +14dBm minimum</li> <li>• 802.11n HT40(2.4GHz) : +12dBm minimum</li> <li>• 802.11n HT20(5GHz) : +14dBm minimum</li> <li>• 802.11n HT40(5GHz) : +12dBm minimum</li> <li>• 802.11ac 80MHz(5GHz) : +11dBm minimum</li> </ul>                     |
| <b>Power Consumption</b>                | <p>Transmit: 2.0 W (max)</p> <p>Receive: 1.6 W (max)</p> <p>Idle mode (PSP): 180 mW (WLAN Associated)</p> <p>Idle mode: 50 mW (WLAN unassociated)</p> <p>Connect Standby: 10 mW (WLAN+BT)</p> <p>Radio disabled: 5 mW</p>   |
| <b>Power Management</b>                 | ACPI and PCI Express compliant power management<br>802.11 compliant power saving mode   |
| <b>Receiver Sensitivity<sup>3</sup></b> | <p>802.11b, 1Mbps : -93.5dBm maximum</p> <p>802.11b, 11Mbps : -84dBm maximum</p> <p>802.11a/g, 6Mbps : -86dBm maximum</p>   |



### Technical Specifications

|                          |   |
|--------------------------|---|
|                          | 802.11a/g, 54Mbps : -72dBm maximum<br>802.11n, MCS07 : -67dBm maximum<br>802.11n, MCS15 : -64dBm maximum<br>802.11ac, MCS0 : -84dBm maximum<br>802.11ac, MCS9 : -59dBm maximum  |
| <b>Antenna type</b>      | High efficiency antenna with spatial diversity, mounted in the display enclosure<br>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)<br>Non-operating -40° to 176° F (-40° to 80° C)   |
| <b>Humidity</b>          | Operating 10% to 90% (non-condensing)<br>Non-operating 5% to 95% (non-condensing)   |
| <b>Altitude</b>          | Operating 0 to 10,000 ft (3,048 m)<br>Non-operating 0 to 50,000 ft (15,240 m)   |
| <b>LED Activity</b>      | LED Amber – Radio OFF; LED White – Radio ON   |
|                          | <ol style="list-style-type: none"> <li>1. <a href="#">Check latest software/driver release for updates on supported security features.</a></li> <li>2. <a href="#">Maximum output power may vary by country according to local regulations.</a></li> <li>3. <a href="#">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).</a></li> </ol> |

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

|   |  |
|---|--|
| <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)<br>BLE : 0~39 (2 MHz/CH)  |
| <b>Data Rates and Throughput</b>                  | Legacy : 3 Mbps data rate; throughput up to 2.17 Mbps<br>BLE : 1 Mbps data rate; throughput up to 0.2 Mbps<br>Legacy : Synchronous Connection Oriented links up to 3, 64 kbps, voice channels<br>Legacy : Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric (3-DH5) or 864 kbps symmetric (3-EV5) |
| <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<br>Peak (Rx) 230 mW<br>Selective Suspend 17 mW  |
| <b>Electrical Interface</b>                       | USB 2.0 compliant  |
| <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   |





### Technical Specifications

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

|  |                               |   |
|--|-------------------------------|---|
| <b>Intel 802.11 a/b/g/n/AC (1x1) WiFi and Bluetooth® Combo<sup>1</sup></b> | <b>Wireless LAN Standards</b> | IEEE 802.11a<br>IEEE 802.11b<br>IEEE 802.11g<br>IEEE 802.11n<br>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 ~ MCS7, (1SS) (20MHz, 40MHz, and 80MHz)</li> </ul> |
|  | <b>Modulation</b>             | Direct Sequence Spread Spectrum<br>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> </ul>   |



### Technical Specifications

|   |   |
|---|---|
|   | <ul style="list-style-type: none"> <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)<br>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: 2.0 W (max)<br>Receive: 1.6 W (max)<br>Idle mode (PSP): 180 mW (WLAN Associated)<br>Idle mode: 50 mW (WLAN unassociated)<br>Connect Standby: 10 mW (WLAN+BT)<br>Radio disabled: 8 mW  |
| <b>Power Management</b>                 | ACPI and PCI Express compliant power management<br>802.11 compliant power saving mode   |
| <b>Receiver Sensitivity<sup>3</sup></b> | 802.11b, 1Mbps : -93.5dBm maximum<br>802.11b, 11Mbps : -84dBm maximum<br>802.11a/g, 6Mbps : -86dBm maximum<br>802.11a/g, 54Mbps : -72dBm maximum<br>802.11n, MCS07 : -67dBm maximum<br>802.11n, MCS15 : -64dBm maximum<br>802.11ac, MCS0 : -84dBm maximum<br>802.11ac, MCS9 : -59dBm maximum  |
| <b>Antenna type</b>                     | High efficiency antenna with spatial diversity, mounted in the display enclosure<br>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)<br>Non-operating -40° to 176° F (-40° to 80° C)   |
| <b>Humidity</b>                         | Operating 10% to 90% (non-condensing)<br>Non-operating 5% to 95% (non-condensing)   |
| <b>Altitude</b>                         | Operating 0 to 10,000 ft (3,048 m)<br>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 \(CKK modulation\)](#)



### Technical Specifications

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

|                                     |  |
|-------------------------------------|--|
| <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)<br>BLE : 0~39 (2 MHz/CH)  |
| <b>Data Rates and Throughput</b>    | Legacy : 3 Mbps data rate; throughput up to 2.17 Mbps<br>BLE : 1 Mbps data rate; throughput up to 0.2 Mbps<br>Legacy : Synchronous Connection Oriented links up to 3, 64 kbps, voice channels<br>Legacy : Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric (3-DH5) or 864 kbps symmetric (3-EV5)   |
| <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<br>Peak (Rx) 230 mW<br>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</b>             | ETS 300 328, ETS 300 826   |
| <b>Certifications</b>               | Low Voltage Directive IEC950<br><br>UL, CSA, and CE Mark   |
| <b>Bluetooth Profiles Supported</b> | BT4.1-ESR 5/6/7 Compliance<br>LE Link Layer Ping<br>LE Dual Mode<br>LE Link Layer<br>LE Low Duty Cycle Directed Advertising<br>LE L2CAP Connection Oriented Channels<br>Train Nudging & Interlaced Scan<br>BT4.2 ESR08 Compliance<br>LE Secure Connection- Basic/Full<br>LE Privacy 1.2 –Link Layer Privacy<br>LE Privacy 1.2 –Extended Scanner Filter Policies<br>LE Data Packet Length Extension<br>FAX Profile (FAX)<br>Basic Imaging Profile (BIP)2<br>Headset Profile (HSP)<br>Hands Free Profile (HFP)<br>Advanced Audio Distribution Profile (A2DP) |



### Technical Specifications

|   |                                    |   |
|---|------------------------------------|---|
| <b>Realtek<br/>802.11a/b/g/n/AC (2x2)<br/>WiFi and Bluetooth® 4.2<br/>Combo<sup>1</sup></b> | <b>Wireless LAN Standards</b>      | IEEE 802.11a<br>IEEE 802.11b<br>IEEE 802.11g<br>IEEE 802.11n<br>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>• 5.15 – 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>                  | 802.11b: 1, 2, 5.5, 11 Mbps<br>802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps<br>802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps<br>802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)<br>802.11ac : MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, and 80MHz)  |
|   | <b>Modulation</b>                  | Direct Sequence Spread Spectrum<br>BPSK, QPSK, CCK, 16-QAM, 64-QAM,   |
|   | <b>Security<sup>1</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)<br>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 : +16dBm minimum</li> <li>• 802.11g : +14dBm minimum</li> <li>• 802.11a : +14dBm minimum</li> <li>• 802.11n HT20(2.4GHz) : +13dBm minimum</li> <li>• 802.11n HT40(2.4GHz) : +13dBm minimum</li> <li>• 802.11n HT20(5GHz) : +12dBm minimum</li> <li>• 802.11n HT40(5GHz) : +12dBm minimum</li> </ul>  |
|   | <b>Power Consumption</b>           | Transmit mode 2.0 W<br>Receive mode 1.6 W<br>Idle mode (PSP) 180 mW (WLAN Associated)<br>Idle mode 50 mW (WLAN unassociated)  |



### Technical Specifications

|   |   |                                |
|---|---|--------------------------------|
|   | Connected Standby   | 10mW                           |
|   | Radio disabled  | 8 mW                           |
| <b>Power Management</b>                 | ACPI and PCI Express compliant power management<br>802.11 compliant power saving mode   |                                |
| <b>Receiver Sensitivity<sup>3</sup></b> | 802.11b, 1Mbps : -94dBm maximum<br>802.11b, 11Mbps : -86dBm maximum<br>802.11g, 6Mbps : -88dBm maximum<br>802.11g, 54Mbps : -74dBm maximum<br>802.11a, 6Mbps : -86dBm maximum<br>802.11a, 54Mbps : -72dBm maximum<br>802.11n, MCS07 : -69dBm maximum<br>802.11n, MCS15 : -66dBm maximum   |                                |
| <b>Antenna type</b>                     | High efficiency antenna with spatial diversity, mounted in the display enclosure  |                                |
|   | Two embedded 2.4 GHz antennas are provided to the card to support WLAN and Bluetooth communications (Support Dual antenna or Single antenna, depend on platform requirement)  |                                |
| <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>                      | <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   |                                |
|   | <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> |                                |

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

|                                     |   |
|-------------------------------------|---|
| <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)<br>BLE : 0~39 (2 MHz/CH)   |
| <b>Data Rates and Throughput</b>    | Legacy : 3 Mbps data rate; throughput up to 2.17 Mbps<br>BLE : 1 Mbps data rate; throughput up to 0.2 Mbps<br>Legacy : Synchronous Connection Oriented links up to 3, 64 kbps, voice channels |



### Technical Specifications

|                                     |  |
|-------------------------------------|--|
| <b>Transmit Power</b>               | Legacy : Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric (3-DH5) or 864 kbps symmetric (3-EV5)<br>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<br>Peak (Rx) 230 mW<br>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</b>             | ETS 300 328, ETS 300 826   |
| <b>Certifications</b>               | Low Voltage Directive IEC950<br><br>UL, CSA, and CE Mark   |
| <b>Bluetooth Profiles Supported</b> | BT4.1-ESR 5/6/7 Compliance<br>LE Link Layer Ping<br>LE Dual Mode<br>LE Link Layer<br>LE Low Duty Cycle Directed Advertising<br>LE L2CAP Connection Oriented Channels<br>Train Nudging & Interlaced Scan<br>BT4.2 ESR08 Compliance<br>LE Secure Connection- Basic/Full<br>LE Privacy 1.2 –Link Layer Privacy<br>LE Privacy 1.2 –Extended Scanner Filter Policies<br>LE Data Packet Length Extension<br>FAX Profile (FAX)<br>Basic Imaging Profile (BIP)2<br>Headset Profile (HSP)<br>Hands Free Profile (HFP)<br>Advanced Audio Distribution Profile (A2DP) |



### Technical Specifications

|   |                                    |   |
|---|------------------------------------|---|
| <b>Realtek<br/>802.11a/b/g/n/ac (1x1)<br/>WiFi and Bluetooth® 4.2<br/>Combo<sup>1</sup></b> | <b>Wireless LAN Standards</b>      | IEEE 802.11a<br>IEEE 802.11b<br>IEEE 802.11g<br>IEEE 802.11n<br>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>• 5.15 – 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>                  | 802.11b: 1, 2, 5.5, 11 Mbps<br>802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps<br>802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps<br>802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)<br>802.11ac : MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, and 80MHz)  |
|   | <b>Modulation</b>                  | Direct Sequence Spread Spectrum<br>BPSK, QPSK, CCK, 16-QAM, 64-QAM,   |
|   | <b>Security<sup>1</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)<br>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<br>Receive mode 1.6 W<br>Idle mode (PSP) 180 mW (WLAN Associated)   |



### Technical Specifications

|   |   |                                |
|---|---|--------------------------------|
|   | Idle mode   | 50 mW (WLAN unassociated)      |
|   | Connected Standby   | 10mW                           |
|   | Radio disabled  | 8 mW                           |
| <b>Power Management</b>                 | ACPI and PCI Express compliant power management<br>802.11 compliant power saving mode   |                                |
| <b>Receiver Sensitivity<sup>3</sup></b> | 802.11b, 1Mbps : -93.5dBm maximum<br>802.11b, 11Mbps : -84dBm maximum<br>802.11a/g, 6Mbps : -86dBm maximum<br>802.11a/g, 54Mbps : -72dBm maximum<br>802.11n, MCS07 : -67dBm maximum<br>802.11n, MCS15 : -64dBm maximum<br>802.11ac, MCS0 : -84dBm maximum<br>802.11ac, MCS9 : -59dBm maximum  |                                |
| <b>Antenna type</b>                     | High efficiency antenna with spatial diversity, mounted in the display enclosure  |                                |
|   | Two embedded 2.4 GHz antennas are provided to the card to support WLAN and Bluetooth communications (Support Dual antenna or Single antenna, depend on platform requirement)  |                                |
| <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>                      | <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   |                                |
|   | <ol style="list-style-type: none"> <li>1. <a href="#">Check latest software/driver release for updates on supported security features.</a></li> <li>2. <a href="#">Maximum output power may vary by country according to local regulations.</a></li> <li>3. <a href="#">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).</a></li> </ol> |                                |

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

|                                     |  |
|-------------------------------------|--|
| <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)<br>BLE : 0~39 (2 MHz/CH)  |
| <b>Data Rates and Throughput</b>    | Legacy : 3 Mbps data rate; throughput up to 2.17 Mbps<br>BLE : 1 Mbps data rate; throughput up to 0.2 Mbps<br>Legacy : Synchronous Connection Oriented links up to 3, 64 kbps, voice |





### Technical Specifications

|                                     |  |
|-------------------------------------|--|
|                                     | 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<br>Peak (Rx) 230 mW<br>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</b>             | ETS 300 328, ETS 300 826   |
| <b>Certifications</b>               | Low Voltage Directive IEC950   |
| <b>Bluetooth Profiles Supported</b> | UL, CSA, and CE Mark<br>BT4.1-ESR 5/6/7 Compliance<br>LE Link Layer Ping<br>LE Dual Mode<br>LE Link Layer<br>LE Low Duty Cycle Directed Advertising<br>LE L2CAP Connection Oriented Channels<br>Train Nudging & Interlaced Scan<br>BT4.2 ESR08 Compliance<br>LE Secure Connection- Basic/Full<br>LE Privacy 1.2 –Link Layer Privacy<br>LE Privacy 1.2 –Extended Scanner Filter Policies<br>LE Data Packet Length Extension<br>FAX Profile (FAX)<br>Basic Imaging Profile (BIP)2<br>Headset Profile (HSP)<br>Hands Free Profile (HFP)<br>Advanced Audio Distribution Profile (A2DP) |



### Technical Specifications

#### 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  |
|                                | <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> 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° 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>EMI and Safety Certifications</b> | *CE Mark - full compliance with LVD and EMC directives<br>* 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.<br>* MTBF - over 200,000 hours at 25°C ambient condition. |

|                          |                             |   |
|--------------------------|-----------------------------|---|
| <b>HP 65W AC Adapter</b> | <b>Dimensions</b>           | 4.25 x 1.85 x 1.47 in (10.8 x 4.7 x 3.74 cm)  |
|                          | <b>Weight</b>               | 1.81 lb (250g) max  |
|                          | <b>Input</b>                | 100 to 240 VAC  |
|                          |                             | <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> 65W   |
|                          |                             | <b>DC output</b> 19.5V  |
|                          |                             | <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° to 104° F (0° to 40° C)                              |



### Technical Specifications

**Non-operating (storage) temperature** -4° to 149° F (-20° to 65° C)

**Altitude** 0 to 10,000 ft (0 to 3,048 m)

**Humidity** 20% to 80%

**Storage Humidity** 10% to 90%

#### 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 3-cell, Long Life 48 WHr Li-ion

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

7.0. x180.48x88.95 mm  
(0.273 x 7.09 x 3.49 inch)

##### Weight

0.22 kg (0.48lb)

##### Cells/Type

3cell Lithium-Ion

##### Energy

**Voltage** 11.4V/ 10.95V

**Amp-hour capacity** 4.212Ah /4.385Ah

**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)

**Non-operating** -4° to 122° F (-20° to 60° C)

##### Battery Re-Charge Time

**System in OFF or Standby Mode** <3 hours

##### Fuel Gauge LED

No

##### Warranty

3-years<sup>1</sup>

##### Optional Travel Battery Available

No

1. 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.

#### 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               | H1D24AA     |
|                        | HP Essential Messenger Case         | H1D25AA     |
| <b>Docking</b>         | HP 3005pr USB3 Port Replicator      | Y4H06AA     |
|                        | HP Thunderbolt Dock 120W G2         | TBD         |
|                        | HP USB-C Travel Dock                | TOK29AA     |
|                        | HP USB Travel Dock                  | TOK30AA     |
|                        | HP Elite USB-C Dock G3              | 2DW60AA     |
|                        | HP USB-C Mini Dock                  | 1PM64AA     |
|                        | HP USB-C Universal Dock             | 1MK33AA     |
| <b>Input/Output</b>    | HP Slim USB Keyboard and Mouse      | T6T83AA     |
|                        | HP Slim Wireless Keyboard and Mouse | T6L04AA     |
|                        | 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 USB-C to DP                      | N9K78AA     |
|                        | HP USB-C to USB-A Hub               | Z6A00AA     |
|                        | HP Stereo 3.5mm Headset             | T1A66AA     |
| HP Stereo USB Headset  | T1A67AA                             |             |
| <b>Memory</b>          | HP 4GB 2400MHz DDR4 Memory          | Z4Y84AA     |
|                        | HP 8GB 2400MHz DDR4 Memory          | Z4Y85AA     |
|                        | HP 16GB 2400MHz DDR4 Memory         | Z4Y86AA     |
| <b>Power</b>           | HP 45W Smart AC Adapter 4.5mm       | H6Y88AA     |
|                        | HP 65W Smart AC Adapter             | H6Y89AA     |
|                        | HP 65W Slim AC Adapter              | H6Y82AA     |
|                        | HP 45W USB-C Power Adapter          | 1HE07AA     |
|                        | HP 65W USB-C Power Adapter          | 1HE08AA     |
|                        | HP Power Bank                       | N9F71AA     |
|                        | HP USB-C Notebook Power Bank        | 1TZ86AA     |
| HP Notebook Power Bank | N9F71AA                             |             |
| <b>Storage</b>         | HP External USB Optical Drive       | F2B56AA     |
|                        | HP 500GB 7200rpm HDD                | F3B97AA     |
|                        | HP External Portable USB3.0 HDD     | K6A93AA     |
|                        | HP 256GB Value 2280 M.2 SATA3 SSD   | 1DE47AA     |
|                        | HP 512GB TLC PCI-e 3x4 NVMe M.2 SSD | 1FU88AA     |



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

|                 |   |         |
|-----------------|---|---------|
| <b>Security</b> | HP Essential Combination Lock                         | TOY16AA |
|                 | HP Combination Lock                                   | TOY15AA |
|                 | HP Keyed Cable lock                                   | TOY14AA |
|                 | HP Keyed Cable Lock 10mm                              | T1A62AA |
| <b>UCC</b>      | HP Conferencing Keyboard                              | K8P74AA |
|                 | HP USB Collaboration Keyboard                         | Z9N38AA |
|                 | HP Wireless Collaboration Keyboard                    | Z9N39AA |
|                 | HP UC Wireless Mono Headset                           | W3K08AA |
|                 | HP UC Wireless Duo Headset                            | W3K09AA |
|                 | HP UC Speaker Phone                                   | K7V16AA |
|                 | HP UC Wired Headset                                   | K7V17AA |
| <b>Displays</b> | HP EliteDisplay S140u USB Portable Monitor            | G8R65AA |
|                 | HP ProDisplay P240VA 23.8-inch Monitor                | N3H14AA |
|                 | HP ProDisplay P232 23-inch Monitor                    | K7X31AA |
|                 | HP ProDisplay P223 21.5-inch Monitor                  | X7R61AA |
|                 | HP EliteDisplay E230t 23-inch Touch Monitor           | W2Z50AA |
|                 | HP EliteDisplay E240c 23.8-inch Collaboration Monitor | M1P00A8 |



### Summary of Changes

| <b>Date of change:</b> | <b>Version History:</b> |        | <b>Description of change:</b>   |
|------------------------|-------------------------|--------|---|
| August 22, 2017        | From V1 to V2           | Update | Change battery life information TBD   |
| September 7, 2017      | From V2 to V3           | Update | Change battery life information to current  |
| October 6, 2017        | From V3 to V4           | Update | TPM 2.0 added to Client Security Software section   |
| December 20, 2017      | From V4 to V5           | Update | HP Elite USB-C Dock removed   |
| December 21, 2017      | From V5 to V6           | Update | Backlit keyboard available as an option removed   |
| February 13, 2018      | From V6 to V7           | Update | Anti-glare (AG) removed from touch panel in Displays section                                |
| February 23, 2018      | From V7 to V8           | Update | HP Elite USB-C Docking Station (X7W54AA) removed from options section                       |
| April 5, 2018          | From V8 to V9           | Update | Processors added to Processors and processors family<br>Dockings updated in options section |
| April 18, 2018         | From V9 to V10          | Update | At a Glance Section part 13   |
| May 7, 2018            | From V11 to V12         | Added  | Environmental tab   |
| May 25, 2018           | From V12 to V13         | Added  | Processors section updated  |
| May 29, 2018           | From V13 to V14         | Update | Warranty  |
| June 4, 2018           | From V14 to V15         | Update | Processors section  |
| July 6, 2018           | From V15 to V16         | Update | Energy star, Hard drive   |
| August 17, 2018        | From V16 to V17         | Update | Processors section  |

Copyright © 2018 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.

Bluetooth is a trademark of its proprietor and used by HP Inc. under license. Intel, Core, Celeron and Intel vPro are trademarks of Intel Corporation or its subsidiaries in the U.S. and/or other countries. NVIDIA, the NVIDIA logo, and GeForce are trademarks and/or registered trademarks of NVIDIA Corporation in the U.S. 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. All other trademarks are the property of their respective owners.

