

### 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. Standard 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 (select models) |

### 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 MX250 and 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, HP Fingerprint Sensor<sup>3</sup> (select models) and IR camera
  - Passed 19 items of MIL-STD 810G testing plus an additional 120,000 hours of reliability testing through HP's Total Test Process<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 with numeric keypad, and Clickpad with multi-touch gestures enabled, taps enabled as default.
  - Enjoy the rich conferencing experience of the Skype for Business™ Certified HP ProBook 450
1. MIL STD 810G testing is not intended to demonstrate fitness for U.S. Department of Defense contract requirements or for military use. Test results are not a guarantee of future performance under these test conditions. Damage under the MIL STD test conditions or any accidental damage requires an optional HP Accidental Damage Protection Care Pack.
  2. Recharges the battery up to 50% within 30 minutes when the system is off or in standby mode when used with the power adapter provided with the notebook. After charging has reached 50% capacity, charging speed will return to normal. Charging time may vary +/-10% due to System tolerance.
  3. HP Fingerprint Sensor is an optional feature and requires configuration at purchase.

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



## Technical Specifications

### PRODUCT NAMES

HP ProBook 450 G6 Notebook PC

### OPERATING SYSTEMS

|                     |                                                                                                                                                                                                                                       |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Preinstalled</b> | Windows 10 Pro 64 <sup>1</sup><br>Windows 10 Pro 64 (National Academic only) <sup>2</sup><br>Windows 10 Home 64 <sup>1</sup><br>Windows 10 Home Single Language 64 <sup>1</sup><br>Windows 10 China Government Edition<br>FreeDOS 3.0 |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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™ i7-8565U 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™ i5-8365U vPro™ processor with Intel® UHD Graphics 620 (1.6 GHz base frequency, up to 4.1 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>  
Intel® Celeron® 4205U processor with Intel® HD Graphics 610 (1.8 GHz base frequency, 2 MB L3 cache, 2 cores)<sup>3,4,5,6</sup>  
Intel® Pentium® 5405U processor with Intel® HD Graphics 610 (2.3 GHz base frequency, 2 MB L3 cache, 2 cores)<sup>3,4,5,6</sup>

#### Processors Family

8th Generation Intel® Core™ i7 processor (i7-8565U)<sup>6</sup>  
8th Generation Intel® Core™ i5 processor (i5-8265U, 8365U)<sup>6</sup>  
8th Generation Intel® Core™ i3 processor (i3-8145U)<sup>6</sup>  
Intel® Pentium® processor (5405U)<sup>6</sup>  
Intel® Celeron® processor (4205U)<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.



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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>.
  7. 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.
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### CHIPSET

Integrated with processor

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### GRAPHICS

#### Integrated

Intel® UHD graphics 620<sup>8</sup>

#### Discrete

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

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

#### Supports

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

Support CUDA, Optimus, PhysX, GPU Boost 2.0

8. HD content required to view HD images.
  9. Integrated graphics depends on processor. NVIDIA® Optimus™ technology requires an Intel processor, plus an NVIDIA® GeForce® discrete graphics configuration and is available on Windows 10 Pro OS. With NVIDIA® Optimus™ technology, full enablement of 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).
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### 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>



### Technical Specifications

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>

#### 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 Connectors                     | Technical limitations                                                            |
|-----------------------------|-----------------------------------------------------------------|-----------------------------------------------------|-------------------------------------|----------------------------------------------------------------------------------|
| HP Thunderbolt Dock 120W G2 | 3                                                               | Dual 4k @60Hz                                       | 2xDP, 1xVGA, 1xTB, 1xUSB-C alt-mode | Dual 4k only with one display in to DP and + TB port or USB-C alt mode + TB port |
| HP USB-C Dock G4            | 3                                                               | Dual 2K @ 60Hz<br>Single 4K @ 60Hz<br>(3840 x 1440) | 1xHDMI, 2xDP                        |                                                                                  |
| HP USB-C Universal Dock     | 3                                                               | Dual 4K @ 60Hz<br>Single 5K @ 60Hz                  | 2xDP                                |                                                                                  |
| HP USB-C Travel Dock        | 2                                                               | Single 2K @ 60Hz                                    | 1xHDMI, 1xVGA                       | Single external display<br>Only HDMI or VGA at the time                          |
| HP USB-C Mini Dock          | 2                                                               | Single 4K @ 30Hz                                    | 1xHDMI, 1xVGA                       | Single external display<br>Only HDMI or VGA at the time                          |

### STORAGE AND DRIVES

#### Primary Storage

500 GB 7200 rpm SATA<sup>12</sup>

1 TB 5400 rpm SATA<sup>12</sup>

1 TB 7200 rpm SATA (LA Only)<sup>12</sup>



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### 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>  
512 GB PCIe® NVMe™ M.2 Value Solid State Drive<sup>12</sup>  
1 TB PCIe® NVMe™ M.2 TLC Solid State Drive<sup>12</sup>

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

## 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.

## NETWORKING/COMMUNICATIONS

### WLAN

Intel® Dual Band Wireless-AC 9560 802.11a/b/g/n/ac (2x2) WLAN and Bluetooth® 5.0 Combo, non-vPro™<sup>14</sup>

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

Realtek RTL8822BE 802.11a/b/g/n/ac (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



### Technical 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.

### AUDIO/MULTIMEDIA

#### Audio

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

#### Speaker Power

2W/4ohm per Speaker

#### 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.

### 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





### Technical Specifications

#### 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>
- 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 Host Based MAC Address Manager
- Buy Office (sold separately)

##### Manageability Features

- HP Driver Packs<sup>23</sup>
- HP System Software Manager (SSM)
- HP BIOS Config Utility (BCU)
- HP Client Catalog
- HP Manageability Integration Kit Gen2<sup>24</sup>
- Ivanti Management Suite<sup>25</sup>
- HP Cloud Recovery<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 Device Access Manager<sup>29</sup>
  - HP Power On Authentication
  - HP Fingerprint Sensor (select models)<sup>34</sup>
  - Windows Defender<sup>30</sup>



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## Technical Specifications

### Security Management

Secure Erase<sup>19</sup>

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

SATA 0,1 port disablement (viaBIOS)

RAID configurations<sup>32</sup>

Serial, USB enable/disable (viaBIOS)

Power-on password (viaBIOS)

Setup password (viaBIOS)

Support for chassis padlocks and cable lock devices

Integrated hood sensor

HP Sure Click<sup>33</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 Driver Packs not preinstalled, however available for download at <http://www.hp.com/go/clientmanagement>.
24. HP Manageability Integration Kit can be downloaded from <http://www8.hp.com/us/en/ads/clientmanagement/overview.html>.
25. Ivanti Management Suite subscription required.
26. HP Cloud Recovery is available for HP Elite and Pro desktops and laptops PCs with Intel® or AMD processors and requires an open, wired network connection. Note: You must back up important files, data, photos, videos, etc. before use to avoid loss of data. Detail please refer to: <https://support.hp.com/us-en/document/c05115630>
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 Device Access Manager requires HP Client Security Suite Gen4.
30. Windows Defender Opt in and internet connection required for updates.
31. Firmware TPM is version 2.0. Hardware TPM is v1.2, which is a subset of the TPM 2.0 specification version v0.89 as implemented by Intel Platform Trust Technology (PTT).
32. RAID configuration is optional and does require a second hard drive.
33. 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.
34. HP Fingerprint Sensor is an optional feature and requires configuration at purchase.



### Technical Specifications

#### 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

HP Long Life 3-cell, 45 Wh Polymer<sup>36</sup>

##### 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™ 1.2)  
1 USB 2.0 (Powered port)  
2 USB 3.1  
1 HDMI 1.4b<sup>39</sup>  
1 RJ-45  
1 AC power



### Technical Specifications

1 Headphone/microphone combo jack

#### Expansion Slots

1 SD

Supports SD, SDHC, SDXC

39. HDMI cable sold separately.

### SERVICE AND SUPPORT

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

### ENVIRONMENTAL & INDUSTRY

#### HP Probook 450 G6 Notebook PC

|                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |                     |
|----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------|
| <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:<br><ul style="list-style-type: none"> <li>•IT ECO declaration</li> <li>•US ENERGY STAR®</li> <li>•EPEAT® Silver registered in the United States. See <a href="http://www.epeat.net">http://www.epeat.net</a> for registration status in your country.</li> <li>•TCO or TCO Certified Edge</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)                                              | 5.97 W                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 5.86 W              | 5.96 W              |
| Normal Operation (Long idle)                                               | 2.96 W                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 3.14 W              | 3.00 W              |
| Sleep                                                                      | 0.79 W                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0.81 W              | 0.79 W              |
| Off                                                                        | 0.39 W                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0.42 W              | 0.39 W              |
|                                                                            | 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> |



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|------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|----------------------------------------------|
| Normal Operation (Short idle)                                                                                    | 20 BTU/hr                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 20 BTU/hr                               | 18 BTU/hr                                    |
| Normal Operation (Long idle)                                                                                     | 10 BTU/hr                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 11 BTU/hr                               | 10 BTU/hr                                    |
| Sleep                                                                                                            | 3 BTU/hr                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3 BTU/hr                                | 3 BTU/hr                                     |
| Off                                                                                                              | 1 BTU/hr                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1 BTU/hr                                | 1 BTU/hr                                     |
| Heat dissipation is calculated based on the measured watts, assuming the service level is attained for one hour. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                         |                                              |
| <b>Declared Noise Emissions (in accordance with ISO 7779 and ISO 9296)</b>                                       | Sound Power (L <sub>WAd</sub> , bels)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                         | Sound Pressure (L <sub>pAm</sub> , decibels) |
|                                                                                                                  | Typically Configured – Idle                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                         | 26.6                                         |
|                                                                                                                  | Fixed Disk – Random writes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                         | 26.7                                         |
| Longevity and Upgrading                                                                                          | <p>This product can be upgraded, possibly extending its useful life by several years. Upgradeable features and/or components contained in the product may include:</p> <ul style="list-style-type: none"> <li>• 3 USB ports</li> <li>• 2 SODIMM memory slots</li> <li>• Interchangeable HDD</li> </ul> <p>Spare parts are available throughout the warranty period and or for up to “5” years after the end of production.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                         |                                              |
| Batteries                                                                                                        | <p>This battery(s) in this product comply with EU Directive 2006/66/EC</p> <p>Batteries used in the product do not contain:<br/>Mercury greater the 1ppm by weight<br/>Cadmium greater than 20ppm by weight</p> <p>Battery size: CR2016 (coin cell)<br/>Battery type: lithium/manganese dioxide</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 1680.1 (EPEAT) standard at the Silver level, see <a href="http://www.epeat.net">http://www.epeat.net</a></li> <li>• Plastics parts weighing over 25 grams used in the product are marked per ISO11469 and ISO1043.</li> <li>• This product contains 12.7% post-consumer recycled plastic (by wt.)</li> <li>• This product is 96.2% recycle-able when properly disposed of at end of life.</li> </ul> |                                         |                                              |
| <b>Packaging Materials</b>                                                                                       | <b>External:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | PAPER/Corrugated                        | 295 g                                        |
|                                                                                                                  | <b>Internal:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | PLASTIC/Polyethylene Expanded - EPE     | 68 g                                         |
|                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | PLASTIC/Polyethylene low density – LDPE | 10 g                                         |
| <b>Material Usage</b>                                                                                            | <p>This product does not contain any of the following substances in excess of regulatory limits (refer to the HP General Specification for the Environment at <a href="http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/gse.pdf">http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/gse.pdf</a>):</p> <ul style="list-style-type: none"> <li>• Asbestos</li> <li>• Certain Azo Colorants</li> <li>• Certain Brominated Flame Retardants – may not be used as flame retardants in plastics</li> <li>• Cadmium</li> <li>• Chlorinated Hydrocarbons</li> <li>• Chlorinated Paraffins</li> </ul>                                                                                                                                                                                                                                                                                           |                                         |                                              |



### Technical Specifications

|                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                    | <ul style="list-style-type: none"> <li>• Formaldehyde</li> <li>• Halogenated Diphenyl Methanes</li> <li>• Lead carbonates and sulfates</li> <li>• Lead and Lead compounds</li> <li>• Mercuric Oxide Batteries</li> <li>• Nickel – finishes must not be used on the external surface designed to be frequently handled or carried by the user.</li> <li>• Ozone Depleting Substances</li> <li>• Polybrominated Biphenyls (PBBs)</li> <li>• Polybrominated Biphenyl Ethers (PBBEs)</li> <li>• Polybrominated Biphenyl Oxides (PBBOs)</li> <li>• Polychlorinated Biphenyl (PCB)</li> <li>• Polychlorinated Terphenyls (PCT)</li> <li>• Polyvinyl Chloride (PVC) – except for wires and cables, and certain retail packaging has been voluntarily removed from most applications.</li> <li>• Radioactive Substances</li> <li>• Tributyl Tin (TBT), Triphenyl Tin (TPT), Tributyl Tin Oxide (TBTO)</li> </ul>     |
| <b>Packaging Usage</b>                             | <p>HP follows these guidelines to decrease the environmental impact of product packaging:</p> <ul style="list-style-type: none"> <li>• Eliminate the use of heavy metals such as lead, chromium, mercury and cadmium in packaging materials.</li> <li>• Eliminate the use of ozone-depleting substances (ODS) in packaging materials.</li> <li>• Design packaging materials for ease of disassembly.</li> <li>• Maximize the use of post-consumer recycled content materials in packaging materials.</li> <li>• Use readily recyclable packaging materials such as paper and corrugated materials.</li> <li>• Reduce size and weight of packages to improve transportation fuel efficiency.</li> <li>• Plastic packaging materials are marked according to ISO 11469 and DIN 6120 standards.</li> </ul>                                                                                                      |
| <b>End-of-life Management and Recycling</b>        | <p>HP Inc. offers end-of-life HP product return and recycling programs in many geographic areas. To recycle your product, please go to: <a href="http://www.hp.com/go/reuse-recycle">http://www.hp.com/go/reuse-recycle</a> or contact your nearest HP sales office. Products returned to HP will be recycled, recovered or disposed of in a responsible manner.</p> <p>The EU WEEE directive (2002/95/EC) requires manufacturers to provide treatment information for each product type for use by treatment facilities. This information (product disassembly instructions) is posted on the Hewlett Packard web site at: <a href="http://www.hp.com/go/recyclers">http://www.hp.com/go/recyclers</a>. These instructions may be used by recyclers and other WEEE treatment facilities as well as HP OEM customers who integrate and re-sell HP equipment.</p>                                             |
| <b>HP Inc. Corporate Environmental Information</b> | <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><br/>         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><br/>         ISO 14001 certificates:<br/> <a href="http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/PC_GBU_Product_Design_ISO_14K_Certificate.pdf">http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/PC_GBU_Product_Design_ISO_14K_Certificate.pdf</a><br/>         and<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> |



### 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<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®                    | Selected models <sup>41</sup>     |
| EPEAT® 2019                     | Yes, Silver in U.S. <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>.
- Based on US EPEAT® registration according to IEEE 1680.1-2018 EPEAT®. Status varies by country. Visit <http://www.epeat.net> for more information.

### 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 14 inch diagonal FHD (1920 x 1080) Anti-Glare WLED UWVA 45% NTSC 250 nits eDP slim</b> | <b>Outline Dimensions (W x H x D)</b>  | 316.17 x 197.98 (max)  |
|                                                                                                     | <b>Active Area</b>                     | 309.37 x 174.02 (typ.) |
|                                                                                                     | <b>Weight</b>                          | 285 g (max)            |
|                                                                                                     | <b>Diagonal Size</b>                   | 14.0 inch              |
|                                                                                                     | <b>Thickness</b>                       | 3.0 mm (max)           |
|                                                                                                     | <b>Interface</b>                       | eDP 1.2 (2 lane)       |
|                                                                                                     | <b>Surface Treatment</b>               | Anti-glare             |
|                                                                                                     | <b>Touch Enabled</b>                   | No                     |
|                                                                                                     | <b>Contrast Ratio</b>                  | 600:1 (typ)            |
|                                                                                                     | <b>Refresh Rate</b>                    | 60 Hz                  |
|                                                                                                     | <b>Brightness</b>                      | 250 nits               |
|                                                                                                     | <b>Pixel Resolution</b>                | 1920 x 1080 (FHD)      |
|                                                                                                     | <b>Format of LCD Pixel Arrangement</b> | RGB                    |
|                                                                                                     | <b>Backlight</b>                       | LED                    |
| <b>Color Gamut Coverage</b>                                                                         | 45% of NTSC                            |                        |
| <b>Color Depth</b>                                                                                  | 6 bits                                 |                        |
| <b>Viewing Angle</b>                                                                                | UWVA 85/85/85/85                       |                        |

|                                                                                                                 |                                       |                        |
|-----------------------------------------------------------------------------------------------------------------|---------------------------------------|------------------------|
| <b>Panel LCD 15.6 inch diagonal FHD (1920 x 1080) Anti-Glare WLED UWVA 45% 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>                         | <370 g max.            |
|                                                                                                                 | <b>Diagonal Size</b>                  | 15.6"                  |
|                                                                                                                 | <b>Thickness</b>                      | 3.2 mm max.            |
|                                                                                                                 | <b>Interface</b>                      | eDP 1.2                |
|                                                                                                                 | <b>Surface Treatment</b>              | Anti-glare             |
|                                                                                                                 | <b>Touch Enabled</b>                  | No                     |





### Technical Specifications

|                             |                               |
|-----------------------------|-------------------------------|
| <b>Contrast Ratio</b>       | 600:1 (typ) - AG              |
| <b>Refresh Rate</b>         | 60 Hz                         |
| <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              |

**Panel LCD 15.6 inch diagonal HD (1366 x 768) Anti-Glare WLED SVA 45% cg 220nits eDP 1.2 w/o PSR slim NB non-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>                         | <370 g max.                   |
| <b>Diagonal Size</b>                  | 15.6"                         |
| <b>Thickness</b>                      | 3.2 mm max.                   |
| <b>Interface</b>                      | eDP 1.2                       |
| <b>Surface Treatment</b>              | Anti-glare                    |
| <b>Touch Enabled</b>                  | No                            |
| <b>Contrast Ratio</b>                 | 300:1 (typ)                   |
| <b>Refresh Rate</b>                   | 60 Hz                         |
| <b>Brightness</b>                     | 220 nits typical (Panel Only) |
| <b>Pixel Resolution</b>               | 1366 x 768 (HD)               |
| <b>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 (1366 x 768) 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>                         | <568 g max.                   |
| <b>Diagonal Size</b>                  | 15.6"                         |
| <b>Thickness</b>                      | 3.4 mm 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>                   | 60 Hz                         |
| <b>Brightness</b>                     | 220 nits typical (Panel Only) |
| <b>Pixel Resolution</b>               | 1366 x 768 (HD)               |



### Technical Specifications

|                             |                 |
|-----------------------------|-----------------|
| <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;<br>Average: 11 ~ 13 ms;<br>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                                               |

#### 1 TB 5400 rpm SATA Hard Drive

|                              |                                                               |
|------------------------------|---------------------------------------------------------------|
| <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<br>Average 12 ~ 13 ms<br>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                                    |

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

|                    |          |
|--------------------|----------|
| <b>Form Factor</b> | M.2 2280 |
| <b>Capacity</b>    | 128GB    |
| <b>NAND Type</b>   | TLC      |

Not all configuration components are available in all regions/countries.  
c06142921 — DA 16312 - Worldwide — Version 20 — March 11, 20204



### Technical Specifications

|                                 |                                          |
|---------------------------------|------------------------------------------|
| <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                       |

#### 256 GB 2280 PCIe NVMe Value Solid State Drive

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

#### 512 GB 2280 M2 PCIe NVMe TLC Solid State Drive

|                                 |                                          |
|---------------------------------|------------------------------------------|
| <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                               |

#### 16 GB 2280 PCIe-3x2 NVMe 3D Xpoint Solid State Drive

|                    |                  |
|--------------------|------------------|
| <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 |



### Technical Specifications

|                                 |                                          |
|---------------------------------|------------------------------------------|
| <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                                     |

#### 512 GB 2280 PCIe NVMe Value Solid State Drive

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



## 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).<br>TDD LTE: 2600 (Band 38), 1900 (Band 39), 2400 (Band 40), 2500 (Band 41).<br>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<br>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)<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>                                     | 5.8 g                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                                       | <b>Dimensions</b><br>(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),<br>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<br>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)<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); 830 mA (average)<br>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><br>(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<br>IEEE 802.11b<br>IEEE 802.11g<br>IEEE 802.11n<br>IEEE 802.11ac<br>IEEE 802.11d<br>IEEE 802.11e<br>IEEE 802.11h<br>IEEE 802.11i<br>IEEE 802.11k<br>IEEE 802.11r<br>IEEE 802.11v                                                                                                                                                                                                                              |
| <b>Interoperability</b>       | Wi-Fi® certified                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Frequency Band</b>         | 802.11b/g/n<br>• 2.402 – 2.482 GHz<br><br>802.11a/n/ac<br>• 4.9 – 4.95 GHz (Japan)<br>• 5.15 – 5.25 GHz<br>• 5.25 – 5.35 GHz<br>• 5.47 – 5.725 GHz<br>• 5.825 – 5.850 GHz                                                                                                                                                                                                                                                  |
| <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, , 80MHz & 160MHz)                                                                                                                                                                |
| <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> <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)<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: +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<br>Receive mode: 1.6 W<br>Idle mode (PSP)180 mW (WLAN Associated)<br>Idle mode: 50 mW (WLAN unassociated)<br>Connected Standby/Modern Standby: 10mW<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 with CNVi Interface                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Dimensions</b>                       | 1. Type 2230: 2.3 x 22.0 x 30.0 mm<br>2. Type 1216: 1.67 x 12.0 x 16.0 mm                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Weight</b>                           | 1. Type 2230: 2.8g<br>2. Type 126: 1.3g                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <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) 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)<br>BLE: 0~39 (2 MHz/CH)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Signaling Data Rate</b>             | Legacy: 3 Mbps signaling data rate <sup>1</sup><br>BLE: 1 Mbps signaling data rate <sup>1</sup><br><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<br>Peak (Rx) 230 mW<br>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<br>Low Voltage Directive IEC950UL, 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) |

**Realtek  
802.11a/b/g/n/ac (2x2)  
WLAN and Bluetooth® 4.2  
Combo<sup>1</sup>**

|                               |                                                                               |
|-------------------------------|-------------------------------------------------------------------------------|
| <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                                                              |





### Technical Specifications

|                                         |                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Frequency Band</b>                   | 802.11b/g/n<br>• 2.402 – 2.482 GHz                                                                                                                                                                                                                                                                                                                                                                                         |
|                                         | 802.11a/n/ac<br>• 4.9 – 4.95 GHz (Japan)<br>• 5.15 – 5.25 GHz<br>• 5.25 – 5.35 GHz<br>• 5.47 – 5.725 GHz<br>• 5.825 – 5.850 GHz                                                                                                                                                                                                                                                                                            |
| <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<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> <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)<br>Idle mode 50 mW (WLAN unassociated)<br>Connected Standby 10 mW<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> | <ul style="list-style-type: none"> <li>802.11b, 1Mbps: -93.5dBm maximum</li> <li>802.11b, 11Mbps: -84dBm maximum</li> <li>802.11a/g, 6Mbps: -86dBm maximum</li> <li>802.11a/g, 54Mbps: -72dBm maximum</li> <li>802.11n, MCS07: -67dBm maximum</li> <li>802.11n, MCS15: -64dBm maximum</li> </ul>                                                                                                                           |



### Technical Specifications

|                          |                                                                                                                                                                                                                         |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                          | 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) and a packet error rate of 10% for 802.11a/g (OFDM modulation).

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

|                                                   |                                                                                                                                                                                                      |
|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Bluetooth Specification</b>                    | 4.0/4.2 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>Signaling Data Rate</b>                        | Legacy: 3 Mbps signaling data rate <sup>1</sup><br>BLE: 1 Mbps signaling data rate <sup>1</sup><br>1. Actual throughput may vary.                                                                    |
|                                                   | 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 Certifications</b>            | Microsoft Windows ACPI, and USB Bus Support<br>FCC (47 CFR) Part 15C, Section 15.247 & 15.249                                                                                                        |
| <b>Power Management Certifications</b>            | ETS 300 328, ETS 300 826<br>Low Voltage Directive IEC950UL, CSA, and CE Mark                                                                                                                         |



### Technical Specifications

|                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Bluetooth Profiles Supported</b> | <p>BT4.1-ESR 5/6/7 Compliance</p> <p>LE Link Layer Ping</p> <p>LE Dual Mode</p> <p>LE Link Layer</p> <p>LE Low Duty Cycle Directed Advertising</p> <p>LE L2CAP Connection Oriented Channels</p> <p>Train Nudging &amp; Interlaced Scan</p> <p>BT4.2 ESR08 Compliance</p> <p>LE Secure Connection- Basic/Full</p> <p>LE Privacy 1.2 –Link Layer Privacy</p> <p>LE Privacy 1.2 –Extended Scanner Filter Policies</p> <p>LE Data Packet Length Extension</p> <p>FAX Profile (FAX)</p> <p>Basic Imaging Profile (BIP)2</p> <p>Headset Profile (HSP)</p> <p>Hands Free Profile (HFP)</p> <p>Advanced Audio Distribution Profile (A2DP)</p> |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                                                 |                                    |                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------------------------------------------|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Realtek 802.11a/b/g/n/ac (1x1) WLAN and Bluetooth® 4.2 Combo<sup>1</sup></b> | <b>Wireless LAN Standards</b>      | <p>IEEE 802.11a</p> <p>IEEE 802.11b</p> <p>IEEE 802.11g</p> <p>IEEE 802.11n</p> <p>IEEE 802.11ac</p>                                                                                                                                                                                                                                                                                                                      |
|                                                                                 | <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 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, and 80MHz)</li> </ul>                                                                                             |
|                                                                                 | <b>Modulation</b>                  | <p>Direct Sequence Spread Spectrum</p> <p>BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM</p>                                                                                                                                                                                                                                                                                                                                    |
|                                                                                 | <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> | <p>Ad-hoc (Peer to Peer)</p> <p>Infrastructure (Access Point Required)</p>                                                                                                                                                                                                                                                                                                                                                |

Not all configuration components are available in all regions/countries.  
c06142921 — DA 16312 - Worldwide — Version 20— March 11, 20204



## Technical Specifications

|                                         |                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Roaming</b>                          | IEEE 802.11 compliant roaming between access points                                                                                                                                                                                                                                                                                                                                           |
| <b>Output Power<sup>2</sup></b>         | <ul style="list-style-type: none"> <li>• 802.11b: +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)<br>Idle mode 50 mW (WLAN unassociated)<br>Connected Standby 10 mW<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) 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</b>     | Legacy: 0~79 (1 MHz/CH) |

Not all configuration components are available in all regions/countries.  
c06142921 — DA 16312 - Worldwide — Version 20— March 11, 20204



## Technical Specifications

|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Channels</b>                        | BLE: 0~39 (2 MHz/CH)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Signaling Data Rate</b>             | Legacy: 3 Mbps signaling data rate <sup>1</sup><br>BLE: 1 Mbps signaling data rate <sup>1</sup><br><a href="#">1. Actual throughput may vary.</a><br><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 Certifications</b> | ETS 300 328, ETS 300 826                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Bluetooth Profiles Supported</b>    | Low Voltage Directive IEC950UL, 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) <sup>2</sup><br>Headset Profile (HSP)<br>Hands Free Profile (HFP)<br>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                         |
|                                | <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                                 |



## Technical Specifications

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

|                                      |                                                                                                                                                                                                                                                           |                                           |  |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|--|
| <b>HP 65W Smart AC adapter</b>       | <b>Dimensions</b>                                                                                                                                                                                                                                         | 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>Operating temperature</b>                                                                                                                                                                                                                              | 32°F to 95°F (0° to 35°C)                 |  |
|                                      | <b>Non-operating (storage) temperature</b>                                                                                                                                                                                                                | -4°F to 185°F (-20° to 85°C)              |  |
|                                      | <b>Altitude</b>                                                                                                                                                                                                                                           | 0 to 16,400 ft (0 to 5000m)               |  |
|                                      | <b>Humidity</b>                                                                                                                                                                                                                                           | 20% to 95%                                |  |
|                                      | <b>Storage Humidity</b>                                                                                                                                                                                                                                   | 10% to 95%                                |  |
| <b>EMI and Safety Certifications</b> | <p>*CE Mark - full compliance with LVD and EMC directives</p> <p>* Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, SELV; Agency approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CISPR22 Class B, CCC, NOM-1 NYCE.</p> |                                           |  |



### Technical Specifications

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

|                                      |                                                                                                                                                                                                                                                                                                                         |                              |                                                                     |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|---------------------------------------------------------------------|
| <b>HP 65W EM Smart AC adapter</b>    | <b>Dimensions</b>                                                                                                                                                                                                                                                                                                       | 102x55x30mm                  |                                                                     |
|                                      | <b>Weight</b>                                                                                                                                                                                                                                                                                                           | 270g +/- 10g                 |                                                                     |
|                                      | <b>Input</b>                                                                                                                                                                                                                                                                                                            | <b>Input Efficiency</b>      | 87% min at 115V/230V                                                |
|                                      |                                                                                                                                                                                                                                                                                                                         | <b>Input frequency range</b> | 47 to 63 Hz                                                         |
|                                      |                                                                                                                                                                                                                                                                                                                         | <b>Input AC current</b>      | 1.7 A at 90 VAC and maximum load                                    |
|                                      |                                                                                                                                                                                                                                                                                                                         | <b>DC output</b>             | 65W(19.5V/3.33A)                                                    |
|                                      |                                                                                                                                                                                                                                                                                                                         | <b>Hold-up time</b>          | 5 msec at 115 VAC input                                             |
|                                      |                                                                                                                                                                                                                                                                                                                         | <b>Output current limit</b>  | <11A, Over voltage protection- 29V max automatic shutdown           |
|                                      |                                                                                                                                                                                                                                                                                                                         | <b>Connector</b>             | 4.5mm Barrel Type, 3 pin/grounded, mates with interchangeable cords |
|                                      |                                                                                                                                                                                                                                                                                                                         | <b>Environmental Design</b>  | <b>Operating temperature</b>                                        |
|                                      | <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> | <p>*CE Mark - full compliance with LVD and EMC directives</p> <p>* Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, SELV; Agency approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CISPR22 Class B, CCC, NOM-1 NYCE.</p> <p>* MTBF - over 200,000 hours at 25°C ambient condition.</p> |                              |                                                                     |

|                                           |                              |                              |                                        |
|-------------------------------------------|------------------------------|------------------------------|----------------------------------------|
| <b>AC Adapter 65 Watt nPFC USB type C</b> | <b>Dimensions</b>            | 74x74x28.5mm                 |                                        |
|                                           | <b>Weight</b>                | unit: 245g +/- 10g           |                                        |
|                                           | <b>Input</b>                 | <b>Input Efficiency</b>      | 81.5% min at 115 Vac/ 230Vac @ 5V/3A   |
|                                           |                              |                              | 86.7% min at 115 Vac/ 230Vac @ 9V/3A   |
|                                           |                              |                              | 88% min at 115 Vac/ 230Vac @ 10V/5A    |
|                                           |                              |                              | 88% min at 115 Vac/ 230Vac @ 12V/5A    |
|                                           |                              |                              | 89% min at 115 Vac/ 230Vac @ 15V/4.33A |
|                                           |                              |                              | 89% min at 115 Vac/ 230Vac @ 20V/3.25A |
|                                           |                              | <b>Input frequency range</b> | 47 to 63 Hz                            |
|                                           |                              | <b>Input AC current</b>      | 1.7 A at 90 VAC and maximum load       |
|                                           |                              | <b>Output power</b>          | 65W                                    |
|                                           |                              | <b>DC output</b>             | 5V/9V/10V/12V/15V/20V                  |
|                                           | <b>Hold-up time</b>          | 5ms at 115 Vac input         |                                        |
| <b>Output current limit</b>               | <8.0A                        |                              |                                        |
| <b>Connector</b>                          | Type C                       |                              |                                        |
| <b>Environmental Design</b>               | <b>Operating temperature</b> | 0° to 35° C                  |                                        |



### Technical Specifications

|                                                                                                                                                                                      |                                                        |               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|---------------|
| <b>EMI and Safety Certifications</b>                                                                                                                                                 | <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%     |
|                                                                                                                                                                                      | *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. |                              |                                                                                                                                               |
|                                           | * MTBF - over 200,000 hours at 25°C ambient condition.                                                                                                                               |                              |                                                                                                                                               |





### Technical Specifications

|                                                                                |                                |                               |
|--------------------------------------------------------------------------------|--------------------------------|-------------------------------|
| <b>3 Cell WHr 45 Long Life - Polymer HP Fast Charge Technology<sup>1</sup></b> | <b>Dimensions (H x W x L)</b>  | 6.0. 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     |
|                     | HP 45W LC USB-C Power Adapter                         | 1MZ01AA#ABA |
| <b>Storage</b>      | 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

| <b>Date of change:</b> | <b>Version History:</b> |         | <b>Description of change:</b>                            |
|------------------------|-------------------------|---------|----------------------------------------------------------|
| December 10, 2018      | V1 to V2                | Removed | Dock UltraSlim                                           |
| December 12, 2018      | V2 to V3                | Removed | Phonewise Software                                       |
| December 17, 2018      | V3 to V4                | Added   | Environmental Section                                    |
| December 21, 2018      | V4 to V5                | Added   | Skype in at a glance section                             |
| March 7, 2019          | V5 to v6                | Updated | Passed MIL-STD                                           |
| March 15, 2019         | V6 to V7                | Added   | Processors                                               |
| March 27, 2019         | V7 to V8                | Updated | Storage and drives and Graphic section                   |
| April 17, 2019         | V8 to V9                | Updated | MIL-STD                                                  |
| May 7, 2019            | V9 to V10               | Updated | At a glance section                                      |
| June 11, 2019          | V10 to V11              | Added   | HP Cloud Recovery                                        |
| July 22, 2019          | V11 to V12              | Added   | Speaker Power                                            |
| September 20, 2019     | V12 to V13              | Updated | 1TB 7200 rpm SATA (LA Only), Lock Slot and 250nits Panel |
| September 24, 2019     | V13 to V14              | Added   | 1TB PCIe® to Storage and Drives Section                  |
| October 11, 2019       | V14 to V15              | Added   | DisplayPort™ 1.2 and i5-8365U Processor                  |
| November 21, 2019      | V15 to V16              | Updated | Longevity and Upgrading section                          |
| January 13, 2020       | V16 to V17              | Updated | Primary Battery                                          |
| February 27, 2020      | V17 to V18              | Updated | Copyright and footnote for fingerprint sensor.           |
| April 22, 2020         | V18 to V19              | Updated | Networking / Communications section                      |
| March 11, 2024         | V19 to V20              | Updated | Environmental & Industry Section                         |
|                        |                         |         |                                                          |
|                        |                         |         |                                                          |
|                        |                         |         |                                                          |

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