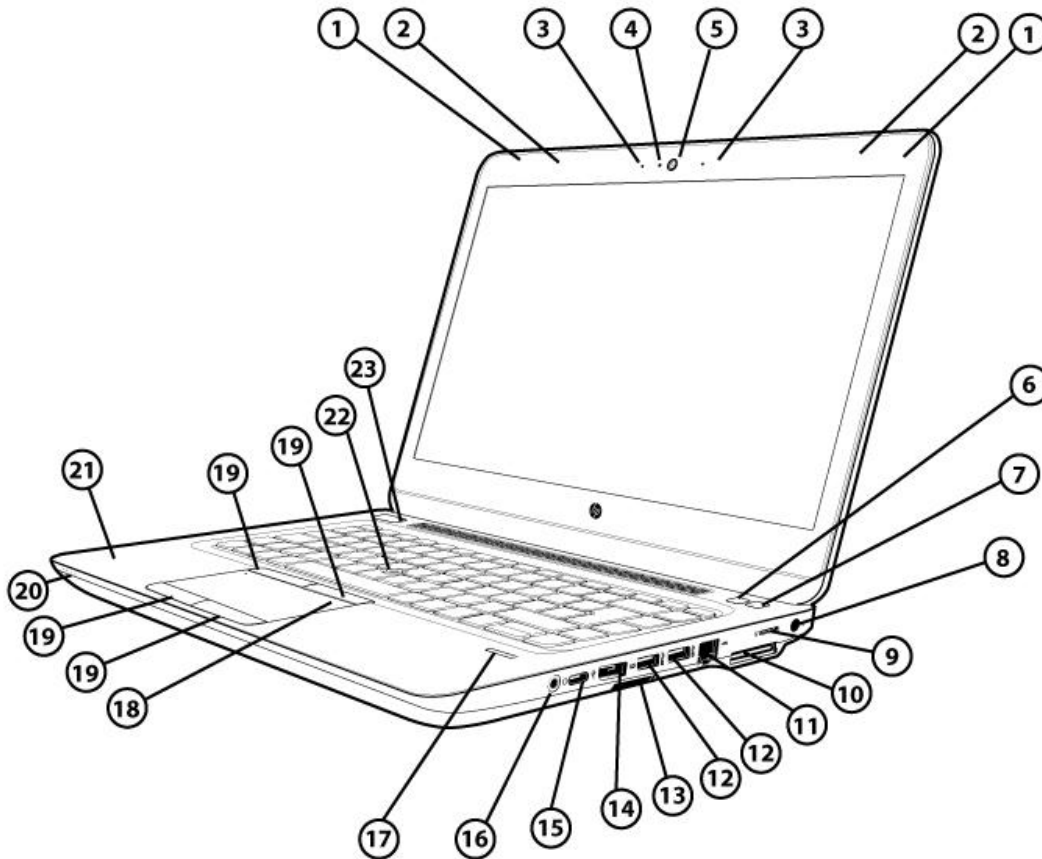


### Overview

#### HP ProBook 640 G2 Notebook PC

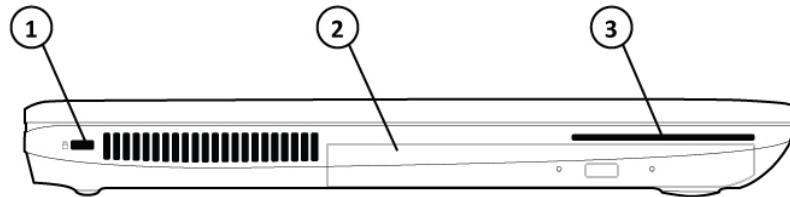


#### Front/Right

- |                                      |  |
|--------------------------------------|--|
| 1. WLAN antennas (2)                 | 13. SD card slot   |
| 2. WWAN antennas (2) (select models) | 14. Display port   |
| 3. Internal microphones (2)          | 15. USB-C™ port  |
| 4. Webcam LED (select models)        | 16. Microphone/ headphones combo jack  |
| 5. Webcam (select models)            | 17. Fingerprint reader (select models)   |
| 6. Wireless on/off button            | 18. Touchpad   |
| 7. Speaker mute button               | 19. Touchpad buttons (4)   |
| 8. Power connector                   | 20. Indicator LEDs: Wireless Light, Power Light, AC Adapter/Battery Light, Storage Usage Light |
| 9. SIM card slot                     | 21. NFC (select models)  |
| 10. Docking connector                | 22. Pointstick   |
| 11. Ethernet port                    | 23. Power button   |
| 12. USB 3.0 ports (2)                |  |



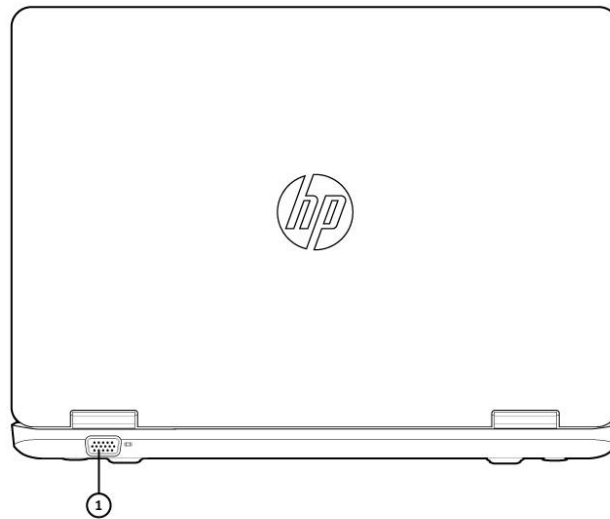
## Overview



1. Security lock slot
2. Optical drive

### Left

3. Smart Card Reader



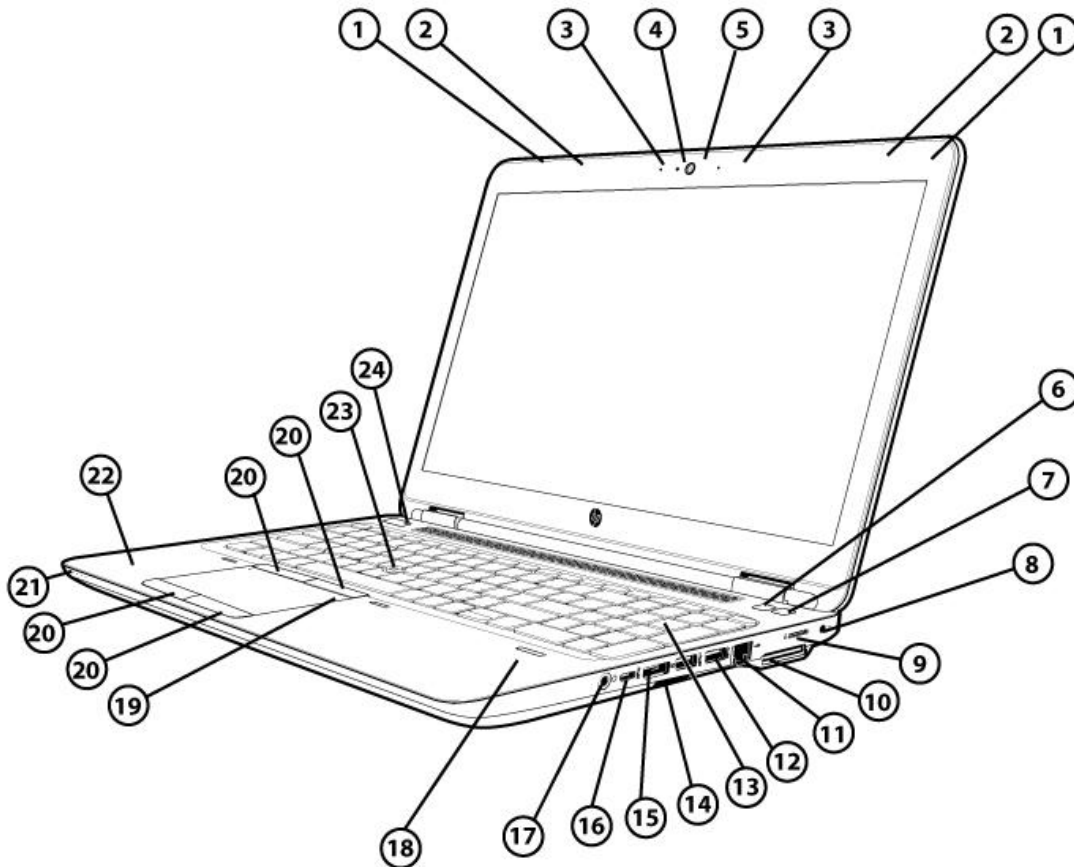
1. VGA port

### Back



### Overview

#### HP ProBook 650 G2 Notebook PC

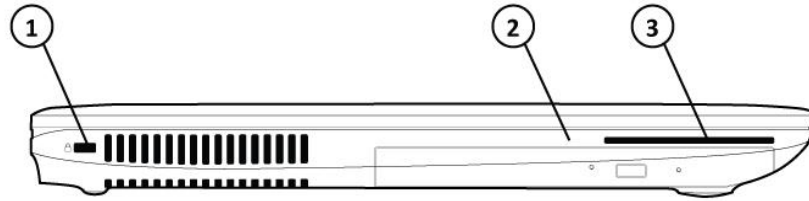


#### Front/Right

- |                                      |  |
|--------------------------------------|--|
| 1. WLAN antennas (2)                 | 13. Numeric keypad   |
| 2. WWAN antennas (2) (select models) | 14. SD card slot   |
| 3. Internal microphones (2)          | 15. Display port   |
| 4. Webcam LED (select models)        | 16. USB-C™ port  |
| 5. Webcam (select models)            | 17. Microphone/ headphones combo jack  |
| 6. Wireless on/off button            | 18. Fingerprint reader (select models)   |
| 7. Speaker mute button               | 19. Touchpad   |
| 8. Power connector                   | 20. Touchpad buttons (4)   |
| 9. SIM card slot                     | 21. Indicator LEDs: Wireless Light, Power Light, AC Adapter/Battery Light, Storage Usage Light |
| 10. Docking connector                | 22. NFC (select models)  |
| 11. Ethernet port                    | 23. Pointstick   |
| 12. USB 3.0 ports (2)                | 24. Power button   |



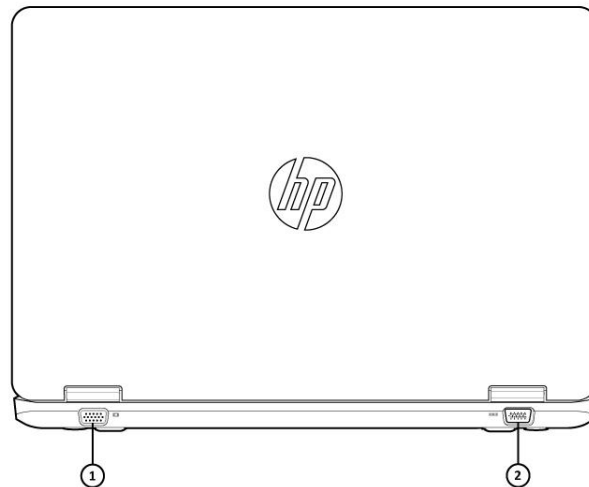
## Overview



- 1. Security lock slot
- 2. Optical drive

### Left

- 3. Smart card reader



- 1. VGA port

### Back

- 2. Serial port optional (650 only)



## Overview

### AT A GLANCE

- Windows 10 versions, Windows 8.1 versions, Windows 7 versions, NeoKylin Linux 64, FreeDOS 2.0
- Choice of 6th Generation Intel® Core™ processors
- Thin and light design— PC-ABS (Polycarbonate–Acrylnitrile/Butadiene/Styrene) durable material is nearly 20% thinner; soft-touch, more durable 4-step paint process; larger buttons (power), revamped keyboard (arrow keys); latch/hook removal for clean palmrest design; top mounted speakers for optimized audio experience (compared to previous generation)
- The HP Premium keyboard is spill-resistant and offered with optional backlit design
- Large Touchpad with gestures support, on/off button with LED indicator
- Enhanced security features including TPM 1.2/2.02, SmartCard Reader, HP Biosphere, HP Client Security, Self-Encrypting storage drives, and optional Fingerprint reader
- LED-backlit display
  - HP ProBook 640: 14.0" diagonal HD and FHD or Touch FHD with camera and with WWAN
  - HP ProBook 650: 15.6" diagonal HD and FHD or Touch FHD with camera and with WWAN
- Optional HD webcam with dual-microphone array for video conferencing
- DisplayPort 1.2 now native with integrated graphics
- Three USB 3.0 ports for fast data transfer from devices: 1 standard, 1 charging, and one USB-C™ charging port
- HD Audio with DTS Sound+™ optimized for high fidelity audio
- Wireless and speaker mute button to conveniently manage the connectivity and speaker.
- Flexible wireless connectivity options:
  - - Broadband Wireless (WWAN)
  - - Wireless LAN (WLAN)
  - - Personal area network (WPAN Bluetooth®)
  - - Near Field Communication (NFC)
- Choice of hard drives up to 1 TB or solid state drives up to 512 GB
- Passed MIL STD testing<sup>1</sup>

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. This product ships with TPM 1.2 with option to upgrade to TPM 2.0. Upgrade utility is expected to be available by the second half of 2016 via HP Customer Support.

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



## Technical Specifications

### PRODUCT NAMES

HP ProBook 640 G2 Notebook PC

HP ProBook 650 G2 Notebook PC

### OPERATING SYSTEM

#### Preinstalled

Windows 10 Pro 64<sup>1</sup>  
Windows 10 Home 64<sup>1</sup>  
Windows 10 Home Single Language 64<sup>1</sup>  
Windows 10 Home64 (National Academic only)<sup>1</sup>  
Windows 10 Pro 64 (National Academic only)<sup>1</sup>  
Windows 8.1 Pro 64<sup>3</sup>  
Windows 8.1 Pro 64 (National Academic only)<sup>3</sup>  
Windows 8.1 64<sup>3</sup>  
Windows 7 Professional 64 (Available through downgrade rights from Windows 10 Pro 64)<sup>2</sup>  
Windows 7 Professional 32 (Available through downgrade rights from Windows 10 Pro 64)<sup>2</sup>  
Windows 7 Professional 32 (Available through downgrade rights from Windows 10 Pro 64)  
(National Academic only)<sup>2</sup>  
Windows 7 Professional 64 (Available through downgrade rights from Windows 10 Pro 64)  
(National Academic only)<sup>2</sup>  
Windows 7 Professional 64<sup>3</sup>  
Windows 7 Professional 32<sup>3</sup>  
Windows 7 Professional 32 (National Academic only)<sup>3</sup>  
Windows 7 Professional 64 (National Academic only)<sup>3</sup>  
NeoKylin Linux 64  
FreeDOS 2.0

#### Web-only Support

Windows 10 Enterprise 64<sup>1</sup>  
Windows 8.1 Enterprise 64<sup>1</sup>  
Windows 7 Enterprise 64<sup>1</sup>  
Windows 7 Enterprise 32<sup>1</sup>

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://http://www.microsoft.com>.
2. This system is preinstalled with Windows 7 Professional software and also comes with a license and media for Windows 10 Pro software. You may only use one version of the Windows software at a time. Switching between versions will require you to uninstall one version and install the other version. You must back up all data (files, photos, etc.) before uninstalling and installing operating systems to avoid loss of your data
3. 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. See <http://http://www.microsoft.com>.



## Technical Specifications

### PROCESSORS

#### ProBook 640 G2

Intel® Core™ i7-6600U with Intel® HD Graphics 520

(2.6 GHz, up to 3.4 GHz with Intel® Turbo Boost Technology, 4 MB cache, 2 cores)<sup>1,2</sup> – Integrated with Chipset

Intel® Core™ i5-6300U with Intel® HD Graphics 520

(2.4 GHz, up to 3 GHz with Intel® Turbo Boost Technology, 3 MB cache, 2 cores)<sup>1,2</sup> – Integrated with Chipset

Intel® Core™ i5-6200U with Intel® HD Graphics 520

(2.3 GHz, up to 2.8 GHz with Intel® Turbo Boost Technology, 3 MB cache, 2 cores)<sup>1,2</sup> – Integrated with Chipset

Intel® Core™ i3-6100U with Intel® HD Graphics 520

(2.3 GHz, 3 MB cache, 2 cores)<sup>1,2</sup> – Integrated with Chipset

#### ProBook 650 G2

Intel® Core™ i7-6820HQ with Intel® HD Graphics 530

(2.7 GHz, up to 3.6 GHz with Intel® Turbo Boost Technology, 8 MB cache, 4 cores)<sup>1,2</sup> – QM170 Chipset

Intel® Core™ i5-6440HQ with Intel® HD Graphics 530

(2.6 GHz, up to 3.5 GHz with Intel® Turbo Boost Technology, 6 MB cache, 4 cores)<sup>1,2</sup> – QM170 Chipset

Intel® Core™ i7-6600U with Intel® HD Graphics 520

(2.6 GHz, up to 3.4 GHz with Intel® Turbo Boost Technology, 4 MB cache, 2 cores)<sup>1,2</sup> – Integrated with Chipset

Intel® Core™ i5-6300U with Intel® HD Graphics 520

(2.4 GHz, up to 3 GHz with Intel® Turbo Boost Technology, 3 MB cache, 2 cores)<sup>1,2</sup> – Integrated with Chipset

Intel® Core™ i5-6200U with Intel® HD Graphics 520

(2.3 GHz, up to 2.8 GHz with Intel® Turbo Boost Technology, 3 MB cache, 2 cores)<sup>1,2</sup> – Integrated with Chipset

Intel® Core™ i3-6100U with Intel® HD Graphics 520

(2.3 GHz, 3 MB cache, 2 cores)<sup>1,2</sup> – Integrated with Chipset

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

2. Some vPro™ functionality, such as Intel® Active management technology and Intel Virtualization technology, requires additional 3rd party software in order to run. Availability of future "virtual appliances" applications for Intel vPro technology is dependent on 3rd party software providers. Microsoft Windows required.

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

### CHIPSET

Integrated with processor or QM170



## Technical Specifications

### GRAPHICS

#### HP ProBook 640

**Integrated:**

Intel® HD<sup>1</sup> Graphics 520

**Discrete:**

AMD Radeon™ R7 M365X (2 GB GDDR5 dedicated)<sup>2</sup>

#### HP ProBook 650

**Integrated:**

Intel® HD<sup>1</sup> Graphics 520

Intel® HD<sup>1</sup> Graphics 530

**Discrete:**

AMD Radeon™ R7 M365X (2 GB GDDR5 dedicated)<sup>2</sup>

1. HD content required to view HD images.
2. AMD Dynamic Switchable Graphics technology requires an Intel processor, plus an AMD Radeon™ discrete graphics configuration and is not available on FreeDOS and Linux OS. With AMD Dynamic Switchable Graphics 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). Planned to be available in February 2016.

### DISPLAY

#### HP ProBook 640

**Internal****Non-Touch**

14.0" diagonal LED backlight HD<sup>1</sup> Anti-glare 45% CG 220 nits (1366x768)

14.0" diagonal LED backlight HD<sup>1</sup> Anti-glare 45% CG 220 nits (1366x768) with camera

14.0" diagonal LED backlight HD<sup>1</sup> Anti-glare 45% CG 220 nits (1366x768) with WWAN

14.0" diagonal LED backlight HD<sup>1</sup> Anti-glare 45% CG 220 nits (1366x768) with camera and with WWAN

14.0" diagonal LED backlight FHD Anti-glare 60% CG 300 nits (1920x1080)

14.0" diagonal LED backlight FHD Anti-glare 60% CG 300 nits (1920x1080) with camera

14.0" diagonal LED backlight FHD Anti-glare 60% CG 300 nits (1920x1080) with WWAN

14.0" diagonal LED backlight FHD Anti-glare 60% CG 300 nits (1920x1080) with camera & WWAN

**Touch**

14.0" diagonal LED backlight FHD 60% CG 300 nits (1920x1080) with camera and with WWAN

**External**

Up to 32-bit per pixel color depth

**VGA**

Port supports resolutions up to 1920 x 1200 external resolution @60 Hz

**DisplayPort 1.2**

Supports resolutions up to 2560 x 1600, 30-bit color depth at 60 Hz, and full HD (1920 x 1080) monitors, 24-bit color depth at 120 Hz

**Number of Displays Supported**

Supports 3 independent displays if used with optional HP Ultralim Docking Station<sup>2</sup>

1. HD content required to view HD images.
2. Sold separately or as an optional feature





## Technical Specifications

**NOTE:** Resolutions are dependent upon monitor capability, and resolution and color depth settings.

### HP ProBook 650

#### Internal

##### Non-Touch

- 15.6" diagonal LED backlight HD<sup>1</sup> Anti-glare 45% CG 220 nits (1366 x 768)
- 15.6" diagonal LED backlight HD<sup>1</sup> Anti-glare 45% CG 220 nits (1366 x 768) with camera
- 15.6" diagonal LED backlight HD<sup>1</sup> Anti-glare 45% CG 220 nits (1366 x 768) with WWAN
- 15.6" diagonal LED backlight HD<sup>1</sup> Anti-glare 45% CG 220 nits (1366 x 768) with camera and with WWAN
- 15.6" diagonal LED backlight FHD Anti-glare 60% CG 300 nits (1920 x 1080)
- 15.6" diagonal LED backlight FHD Anti-glare 60% CG 300 nits (1920 x 1080) with camera
- 15.6" diagonal LED backlight FHD Anti-glare 60% CG 300 nits (1920 x 1080) with WWAN
- 15.6" diagonal LED backlight FHD Anti-glare 60% CG 300 nits (1920 x 1080) with camera & WWAN

##### Touch

- 15.6" diagonal LED backlight FHD 60% CG 300 nits (1920 x 1080) with camera with WWAN

#### External

Up to 32-bit per pixel color depth

##### VGA

Port supports resolutions up to 1920 x 1200 external resolution @60 Hz

##### DisplayPort 1.2

Supports resolutions up to 2560 x 1600, 30-bit color depth at 60 Hz, and full HD (1920 x 1080) monitors, 24-bit color depth at 120 Hz

##### Number of Displays Supported

Supports 3 independent displays if used with optional HP Ultralim Docking Station<sup>2</sup>

1. HD content required to view HD images.
2. Sold separately or as an optional feature.

**NOTE:** Resolutions are dependent upon monitor capability, and resolution and color depth settings.

## STORAGE AND DRIVES

### Primary Storage Bay

#### Hard Drives<sup>1</sup>

Supports SATA3, 7 mm

#### 2.5" Hard Drives<sup>1</sup>

- 500 GB 7200 rpm
- 500 GB 7200 rpm Self-Encrypting Drive (Opal 2)
- 500 GB 7200 rpm Self Encrypting Drive (Opal 2) (FIPS)
- 1 TB 5400 rpm
- 500 GB Hybrid

#### 2.5" Solid State Drive<sup>1</sup>

- 128 GB SATA TLC (Brazil only)
- 256 GB SATA TLC (Brazil only)

#### M.2 (NGFF) Solid State Drive<sup>1</sup>



## Technical Specifications

128 GB SATA-3 TLC  
180 GB SATA-3 MLC  
180 GB SATA-3 MLC ( Opal 2 )  
240 GB SATA-3 MLC  
256 GB PCIe-3x4 DS NVMe  
256 GB SATA-3 MLC ( Opal 2 )  
256 GB SATA-3 TLC  
512 GB SATA-3 TLC

For hard drives and solid state drives, GB = 1 billion bytes. Actual formatted capacity is less.

Up to 16 GB (for Windows 7) and up to 30 GB (for Windows 8 and 10) of system disk is reserved for the system recovery software.

## OPTICAL DRIVES

### Fixed 9.5 mm SATA

DVD-ROM Drive

DVD+/-RW SuperMulti DL<sup>1</sup>

Blu-ray ROM DVD+/-RW SuperMulti DL<sup>1</sup>

Weight saver<sup>2</sup>

1. For Blu-ray drives, certain disc, digital connection, compatibility and/or performance issues may arise, and do not constitute defects in the product. Flawless playback on all systems is not guaranteed. In order for some Blu-ray titles to play, they may require an HDMI digital connection and your display may require HDCP support. HD-DVD disks cannot be played on this drive. Note that DVD-RAM cannot read or write to 2.6 GB Single Sided/5.2 GB Double Sided – Version 1.0 media. Actual speeds may vary. Don't copy copyright-protected materials. Double Layer discs can store more data than single layer discs; discs burned with this drive may not be compatible with many existing single-layer DVD drives and players.

2. Not available on with Touch panel.

## MEMORY

### Standard

DDR4-2133 SDRAM (Transfer rates up to 2133 MT/s)

Two SODIMM slots supporting dual-channel memory

4096 MB Total System Memory (4096 MB x 1)

8192 MB Total System Memory (4096 MB x 2)

8192 MB Total System Memory (8192 MB x 1)

16384 MB Total System Memory (8192 MB x 2)

32768 MB Total System Memory (16384 MB x 2) (Available with 650 G2, planned to be available with 640 G2 2Q17)

### Maximum

Up to 32768 MB with optional 16384 MB SODIMMs in slots 1 and 2

### Dual-channel



## Technical Specifications

Maximized dual-channel performance requires SODIMMs of the same size and speed in both memory slots.

**NOTE:** 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

### Intel® Pro Wireless Display (WiDi Pro)<sup>1</sup>

1. Integrated Intel Wi-Di software is available on select models only and requires separately purchased projector, tv or computer monitor with an integrated or external Wi-Di receiver. External Wi-Di receivers connect to the projector, tv or computer monitor via a standard VGA, HDMI cable, also sold separately.

### Broadband Wireless (WWAN)<sup>2,3</sup>

HP Lt4120 Qualcomm® Snapdragon™ X5 LTE Mobile Broadband Module  
HP hs3110 HSPA+ Mobile Broadband Module

### Wireless LAN (WLAN)<sup>1,2</sup>

Options via Minicard

Intel® 802.11 a/b/g/n/ac (2x2) and Bluetooth® 4.2 Combo

Intel® 802.11 a/b/g/n/ac (2x2) and Bluetooth® 4.0 Combo

Broadcom 802.11 a/b/g/n (2x2) and Bluetooth® 4.0 Combo

Broadcom 802.11 b/g/n (1x1) WiFi and Bluetooth® 4.0 Combo

Realtek 802.11 b/g/n (1x1) Wi-Fi

### Personal area network (WPAN Bluetooth)<sup>1,2</sup>

Bluetooth® 4.0 supported via all combo cards (except for Intel® 802.11 ac Non-vPro)

Bluetooth® 4.1 supported via (Intel® 802.11 ac Non-vPro only)

### Near Field Communication (NFC) Optional<sup>2</sup>

HP Module with NXP NFC Controller NPC100

### Support for Miracast (Windows 8.1 and Windows 10)

#### Intel® Pro Wireless Display (WiDi Pro)

1. Wireless access point and Internet service is required and is not included. Availability of public wireless access points limited.

2. Sold separately or as an optional feature.

3. WWAN module is optional 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.

### Communications<sup>1</sup>

Intel® I219LM 10/100/1000 Ethernet

Intel® I219V 10/100/1000 Ethernet

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



## Technical Specifications

### AUDIO/MULTIMEDIA

#### Audio

HD Audio with DTS Sound+™

(2) Integrated stereo speakers

Integrated digital microphone (Dual-microphone array when equipped with optional webcam)

Function keys for microphone mute, volume up, volume down

Stereo headphone/line out

Stereo microphone in

#### Webcam

Optional 720p HD webcam <sup>1,2</sup>

- HD format (widescreen)
- Supports videoconferencing (non-HD) and still image capture
- High quality fixed focus lens
- Video capture at various resolutions up to 1280x720 resolution (720p) and up to 30fps
- M-JPEG compression supports higher frame rates for video capture and videoconferencing
- Improved low light sensitivity
- Improved dynamic range
- Skype-ready (subscription required and sold separately)

1. Sold separately or as an optional feature.
2. HD content required to view HD images.

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

#### HP Premium Keyboard

The HP spill-resistant keyboard is designed using a thin layer of Mylar film under the keyboard. The 101/102-key compatible keyboard features a full-pitch key layout with desktop keyboard features, such as editing keys, both left and right control and alt keys, and function keys. DuraKeys only available with Backlit option.

#### Three Keyboard options:

Touchpad, Spill-resistant with drain

Touchpad, Spill-resistant with drain, DuraKeys & Backlit

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

#### Touchpad

On/Off button

Enabled by default

2F Scrolling – On

2F Zoom (Pinch) – On

OSD (enable / disable) – On

Win 8 2F tap = right click – On

Win 8 Edge Swipes – On

#### Buttons and Function Keys

F1 – Sleep

F2 – Blank



## Technical Specifications

F3 – Backlit  
F4 - Display Switch  
F5 - Brightness down  
F6 - Brightness up  
F7 – Blank  
F8 - Volume down  
F9 - Volume up  
F10 - Mic Mute  
F11 – Bank  
F12 - Num lock

## SOFTWARE AND SECURITY

### Preinstalled Software with Windows Operating System

#### BIOS

HP BIOSphere<sup>1</sup>  
HP DriveLock | HP Automatic DriveLock  
HP BIOS Protection<sup>2</sup>  
BIOS Update via Network  
Master Boot Record Security  
Power On Authentication  
Pre-Boot Security  
Secure Erase<sup>3</sup>  
Hybrid Boot  
Measure Boot  
Secure Boot  
Absolute Persistence Module<sup>4</sup>  
Pre-boot Authentication

#### Multi Media

Cyberlink Power DVD, BD  
Cyberlink Power2Go (Secure Burn)  
Cyberlink YouCam BE (Windows 7 only)

#### Communication

HP GPS and Location (Windows 7 only)<sup>5</sup>  
HP Connection Manager with support for HP Mobile Connect (Windows 7 only)<sup>6</sup>  
HP Mobile Connect Pro (Windows 8.1 and Windows 10 only)<sup>6</sup>  
Intel® Wireless Display (WiDi) Software for Windows<sup>7</sup>  
Native Miracast Support<sup>8</sup>

#### HP Value Add Software

HP 3D DriveGuard (requires Windows)  
HP ePrint Driver<sup>9</sup>



## Technical Specifications

HP Hotkey  
HP Recovery Manager  
HP Recovery Disc Creator  
HP Registration App (Windows 8.1 only)  
HP Support Assistant  
HP Noise Reduction Software

### 3<sup>rd</sup> Party

Foxit PhantomPDF Express for HP

### Microsoft Products

Buy Office  
Bing Search  
Skype<sup>10</sup>

### Manageability

HP Driver Packs<sup>11</sup>  
HP SoftPaq Download Manager (SDM)  
HP System Software Manager (SSM)<sup>11</sup>  
HP BIOS Config Utility (BCU)<sup>11</sup>  
HP Client Catalog<sup>11</sup>  
HP CIK for Microsoft SCCM<sup>11</sup>  
LANDESK Management<sup>12</sup>

For more information on HP Client Management Solutions refer to: <http://www.hp.com/go/clientmanagement>.

### Client Security Software

HP Client Security

- HP Security Manager (including Credential Manager and Password Manager)
- HP Drive Lock
- HP Fingerprint Sensor
- HP Password Manager
- Absolute Persistence Module
- Power On Authentication

Microsoft Security Essentials<sup>13</sup>

Microsoft Defender

### Security

Trusted Platform Module (TPM) 1.2 (Infineon SLB9670). Common Criteria EAL4+ Certified.  
Upgradable to TPM 2.0. Convertible to FIPS 140-2 Certified mode. (TPM 2.0 is not available for Win 7 32-bit.)<sup>14</sup>

HP Fingerprint reader

Security lock slot

Integrated Smart Card Reader

For more information on HP Client Security Software Suite, refer to <http://www.hp.com/go/clientsecurity>.



## Technical Specifications

1. Available only on business PCs with HP BIOS.
2. May require a manual recovery step if all copies of BIOS are compromised or deleted
3. For the methods outlined in the National Institute of Standards and Technology Special Publication 800-88.
4. 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.
5. GPS access requires an unobstructed path to multiple satellites. Performance may be affected if/when used inside of buildings, bridges or heavily congested metropolitan areas. Requires separately purchased GPS navigation software available from multiple GPS applications.
6. HP Mobile Connect Pro is only available on preconfigured devices with WWAN. For geographic availability refer to <http://www.hp.com/go/mobileconnect>
7. Integrated Intel Wi-Di feature is available on select configurations only and requires separately purchased projector, TV or computer monitor with an integrated or external Wi-Di receiver. External Wi-Di receivers connect to the projector, TV or computer monitor via a standard HDMI cable, also sold separately.
8. Miracast is a wireless technology your PC can use to project your screen to TVs, projectors, and streaming media players that also support Miracast. You can use Miracast to share what you're doing on your PC and present a slide show. For more information: <http://windows.microsoft.com/en-us/windows-8/project-wireless-screen-miracast>
9. Requires an Internet connection to HP web-enabled printer and HP ePrint account registration (for a list of eligible printers, supported documents and image types and other HP ePrint details, see <http://www.hp.com/go/eprintcenter>). Requires optional broadband module. Broadband use requires separately purchased service contract. Check with service provider for coverage and availability in your area. Separately purchased data plans or usage fees may apply. Print times and connection speeds may vary.
10. Skype is not offered in China.
11. Not preinstalled, however available for download at <http://www.hp.com/go/clientmanagement>
12. Subscription required.
13. Opt in and internet connection required for updates.
14. This product ships with TPM 1.2 with option to upgrade to TPM 2.0. Upgrade utility is expected to be available by the second half of 2016 via HP Customer Support.

## POWER

### Power Supply

- HP 45W Smart AC Adapter (UMA only)
- HP 45W Smart AC Adapter (Only available for Japan and England)
- HP 65W Smart AC Adapter
- HP 65W Smart EM Adapter (only available for Asia, China and India)
- Power cord included is 1.8 m (+/- 0.1 m) or 1.0 m (+/- 0.1 m).

### Primary Battery

HP 3-cell Long Life Prismatic (48 WHr)

### Battery Life<sup>1</sup>

HP ProBook 640 Notebook PC	UMA Graphics	Discrete Graphics



## Technical Specifications

3-cell (48 Whr) with SSD	Up to 12 hrs 30 mins	Up to 12 hrs 15 mins
3-cell (48 Whr) with HDD	Up to 10 hrs	Up to 9 hrs 45 mins
<b>HP ProBook 650 Notebook PC</b>	<b>UMA Graphics</b>	<b>Discrete Graphics</b>
3-cell (48 Whr) with SSD	Up to 12 hrs 30 mins	Up to 12 hrs 15 mins
3-cell (48 Whr) with HDD	Up to 9 hrs 45 mins	Up to 9 hrs 45 mins

### System Standby Time<sup>2</sup>

	<b>UMA Graphics</b>	<b>Discrete Graphics</b>
<b>HP ProBook 640 Notebook PC</b>	Up to 249 hrs	Up to 190 hrs
<b>HP ProBook 650 Notebook PC</b>	Up to 249 hrs	Up to 190 hrs

### Battery recharge times

	<b>ProBook 640 G2</b>	<b>ProBook 650 G2</b>
Time to 90 <sup>3</sup> % Charge (minutes)	113	113
Time to 100 <sup>4</sup> % Charge (minutes)	163	163

1. 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.
2. Standby life will vary depending on various factors including battery, Memory, CPU, EC and LAN chip. The maximum capacity of the battery will naturally decrease with time and usage.
3. Recharges your battery up to 90% within 113 minutes when the system is off. Applies to 3-cell 48Whr battery only. When the PC is powered on, charge time may increase and will vary based on the workload of the notebook PC.
4. Recharges your battery up to 100% within 163 minutes when the system is off. Applies to 3-cell 48Whr battery only. When the PC is powered on, charge time may increase and will vary based on the workload of the notebook PC.

## WEIGHTS & DIMENSIONS

### HP ProBook 640 Notebook PC

#### Weight

Starting at 4.30 lbs (1.95 kg)<sup>1</sup>

(3-cell battery, ODD weight saver, UMA, no FPR, 1 SODIMM, WLAN only, SSD, touchpad only, no camera, no WWAN)





## Technical Specifications

### Dimensions (w x d x h)

13.39 x 9.33 x 1.06 in (Front and rear)<sup>2</sup>

34.0 x 23.7 x 2.70 cm (Front and rear)<sup>2</sup>

### HP ProBook 650 Notebook PC

#### Weight

Starting at 5.10 lbs ( 2.31 kg)<sup>1</sup>

(3-cell battery, ODD weight saver, UMA, no FPR, 1 SODIMM, WLAN only, SSD, touchpad only, no camera, no WWAN)

### Dimensions (w x d x h)

14.88 x 10.11 x 27.40 in ) (Front and rear)<sup>2</sup>

37.8 x 25.70 x 2.74 cm ) (Front and rear)<sup>2</sup>

1. Weight varies by configuration and components.
2. Height varies depending upon where on the notebook the measurement is made.

## PORTS/SLOTS

### Ports

USB Type-C™ - One

USB 3.0 port – One

USB 3.0 port charging – One

RJ-45 / Ethernet - One

Docking connector – One

Headphone / Microphone (Combo jack ) – One

AC port ( 4.5mm ) – One

DisplayPort 1.2 -One

VGA port – One

Serial port optional – One (only available on HP ProBook 650)<sup>1</sup>

1. Sold separately or as an optional feature.

### SD Media Reader Slot

Supports SD, SDHC, SDXC

## SERVICE AND SUPPORT

Limited 3-year, 1-year or 90-day limited warranty options available, 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. Optional<sup>1</sup> HP Care Pack Services<sup>2</sup> are extended service contracts which go beyond your 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>.

1. Sold separately or as an optional feature.
2. 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. Consult the HP Customer Support Center for details. <http://h20000.www2.hp.com/bizsupport/TechSupport/ProductRoot.jsp>





## Technical Specifications

### SYSTEM UNIT

TBD

### DISPLAYS\*

#### 14.0 FHD AG WLED SVA 60%cg 300nits eDP Slim

##### Panel

<b>Active Area (W x H)</b>	309.40 x 173.95 (mm)
<b>Dimensions (W x H)</b>	320.9 x 205.6 (mm) max
<b>Diagonal Size</b>	14 (inch)
<b>Thickness</b>	3.0 (mm) max
<b>Weight</b>	270 g max
<b>Interface</b>	eDP 1.2
<b>Surface Treatment</b>	Anti-Glare (AG)
<b>Contrast Ratio</b>	300:1 (typical)
<b>Refresh Rate</b>	60 Hz
<b>Brightness</b>	300 nits
<b>Pixel Resolution - Format</b>	1920 x 1080 (FHD)
<b>PPI</b>	157
<b>Pixel Resolution - Configuration</b>	RGB
<b>Backlight</b>	LED
<b>Color Gamut Coverage</b>	60%
<b>Color Depth</b>	6 bits
<b>Viewing Angle</b>	SVA 45/45/25/35



## Technical Specifications

### 14.0 HD AG WLED SVA 45%cg 220nits eDP Flat

#### Panel

<b>Active Area (W x H)</b>	309.40 x 173.95 (mm)
<b>Dimensions (W x H)</b>	320.9 x 205.6 (mm) max
<b>Diagonal Size</b>	14 (inch)
<b>Thickness</b>	3.6 (mm) max
<b>Weight</b>	320 g max
<b>Interface</b>	eDP 1.2
<b>Surface Treatment</b>	Anti-Glare (AG)
<b>Contrast Ratio</b>	300:1 (typical)
<b>Refresh Rate</b>	60 Hz
<b>Brightness</b>	220 nits
<b>Pixel Resolution - Format</b>	1280 x 768 (HD)
<b>PPI</b>	112
<b>Pixel Resolution - Configuration</b>	RGB
<b>Backlight</b>	LED
<b>Color Gamut Coverage</b>	45%
<b>Color Depth</b>	6 bits + Hi FRC
<b>Viewing Angle</b>	SVA 45/45/25/35

### 14.0 FHD WLED SVA 60%cg 300nits eDP Slim Touch



## Technical Specifications

### Panel

<b>Active Area (W x H)</b>	309.40 x 173.95 (mm)
<b>Dimensions (W x H)</b>	320.9 x 205.6 (mm) max
<b>Diagonal Size</b>	14 (inch)
<b>Thickness</b>	3.0 (mm) max
<b>Weight</b>	270 g max
<b>Interface</b>	eDP 1.2
<b>Contrast Ratio</b>	300:1 (typical)
<b>Refresh Rate</b>	60 Hz
<b>Brightness</b>	300 nits
<b>Pixel Resolution - Format</b>	1920 x 1080 (FHD)
<b>PPI</b>	157
<b>Pixel Resolution - Configuration</b>	RGB
<b>Backlight</b>	LED
<b>Color Gamut Coverage</b>	60%
<b>Color Depth</b>	6 bits
<b>Viewing Angle</b>	SVA 45/45/25/35
<b>Touch Enabled</b>	Optional
<b>Other Features</b>	AS
<b>Pen Enabled</b>	No

### 15.6 FHD AG WLED SVA 60%cg 300nits eDP Slim 3.2mm

### Panel



## Technical Specifications

<b>Active Area (W x H)</b>	344.2 x 193.5 (mm)
<b>Dimensions (W x H)</b>	360 x 224.3 (mm) max
<b>Diagonal Size</b>	15.6 (inch)
<b>Thickness</b>	3.2 (mm) max
<b>Weight</b>	360 g max
<b>Interface</b>	eDP 1.2
<b>Surface Treatment</b>	Anti-Glare (AG)
<b>Contrast Ratio</b>	400:1 (typical)
<b>Refresh Rate</b>	60 Hz
<b>Brightness</b>	300 nits
<b>Pixel Resolution - Format</b>	1920 x 1080 (FHD)
<b>PPI</b>	142
<b>Pixel Resolution - Configuration</b>	RGB
<b>Backlight</b>	LED
<b>Color Gamut Coverage</b>	60%
<b>Color Depth</b>	6 bits
<b>Viewing Angle</b>	SVA 45/45/25/35

### 15.6 HD AG WLED SVA 45%cg 220nits eDP Flat

#### Panel



## Technical Specifications

<b>Active Area (W x H)</b>	344.2 x 193.5 (mm)
<b>Dimensions (W x H)</b>	360 x 224.3 (mm) max
<b>Diagonal Size</b>	15.6 (inch)
<b>Thickness</b>	3.8 (mm) max
<b>Weight</b>	420 g max
<b>Interface</b>	eDP 1.2
<b>Surface Treatment</b>	Anti-Glare (AG)
<b>Contrast Ratio</b>	300:1 (typical)
<b>Refresh Rate</b>	60 Hz
<b>Brightness</b>	220 nits
<b>Pixel Resolution - Format</b>	1280 x 768 (HD)
<b>PPI</b>	101
<b>Pixel Resolution - Configuration</b>	RGB
<b>Backlight</b>	LED
<b>Color Gamut Coverage</b>	45%
<b>Color Depth</b>	6 bits + Hi FRC
<b>Viewing Angle</b>	SVA 45/45/25/35

### 15.6 FHD WLED SVA 60%cg 300nits eDP Slim 3.2mm Touch

#### Panel



### Technical Specifications

<b>Active Area (W x H)</b>	344.2 x 193.5 (mm)
<b>Dimensions (W x H)</b>	360 x 224.3 (mm) max
<b>Diagonal Size</b>	15.6 (inch)
<b>Thickness</b>	3.2 (mm) max
<b>Weight</b>	360 g max
<b>Interface</b>	eDP 1.2
<b>Contrast Ratio</b>	400:1 (typical)
<b>Refresh Rate</b>	60 Hz
<b>Brightness</b>	300 nits
<b>Pixel Resolution - Format</b>	1920 x 1080 (FHD)
<b>PPI</b>	142
<b>Pixel Resolution - Configuration</b>	RGB
<b>Backlight</b>	LED
<b>Color Gamut Coverage</b>	60%
<b>Color Depth</b>	6 bits
<b>Viewing Angle</b>	SVA 45/45/25/35
<b>Touch Enabled</b>	Optional
<b>Other Features</b>	AS
<b>Pen Enabled</b>	No

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

### SECURITY

<b>HP Fingerprint Reader</b> (optional)	<b>Mobile Voltage Operation</b> 3.0V-3.6V
	<b>Operating Temperature</b> 14° – 167°F (-10° – 75°C)
	<b>Current Consumption</b> 36 mA peak





### Technical Specifications

#### Image

<b>Low Latency Wait for Finger</b>	950 uA
<b>Capture Rate</b>	59000 lines/sec
<b>ESD Resistance</b>	IEC 61000-4-2 4B (±15KV)
<b>Detection Matrix</b>	200*1 (plus another secondary line) 508 dpi 10*1 mm sensor area

#### Smart Card Reader

<b>Smart card standard</b>	PC/SC 2.0 for Windows smart card standard				
<b>Dimensions (L x W x H)</b>	0.41x 0.08 x 0.32 in (10.5 x 2 x 8.2 mm)				
<b>Smart Card support</b>	ISO 7816 Class A and AB smart cards				
<b>Smart Card Interface</b>	Smart Card Interface with T = 0 and T = 1 support Support I2C memory card, SLE4418, SLE4428, SLE4432, SLE4442, SLE4436, SLE5536, SLE6636, AT88SC1608, AT45D041 card and AT45DB041 card via external EEPROM				
<b>Operating systems</b>	No driver is required for this device. Native support is provided by the operating system.				
<b>Power</b>	<table> <tr> <td><b>Normal Mode</b></td> <td>With card present, before being suspended: 40.9 mA Without card present, before being suspended: 33.16 mA After being suspended with smart card present: 380 µA After being suspended without smart card present: 380 µA</td> </tr> <tr> <td><b>Power Saving Mode</b></td> <td>With card present, before being suspended: 40.6 mA Without card present: 380 µA After being suspended with smart card present: 380 µA</td> </tr> </table>	<b>Normal Mode</b>	With card present, before being suspended: 40.9 mA Without card present, before being suspended: 33.16 mA After being suspended with smart card present: 380 µA After being suspended without smart card present: 380 µA	<b>Power Saving Mode</b>	With card present, before being suspended: 40.6 mA Without card present: 380 µA After being suspended with smart card present: 380 µA
<b>Normal Mode</b>	With card present, before being suspended: 40.9 mA Without card present, before being suspended: 33.16 mA After being suspended with smart card present: 380 µA After being suspended without smart card present: 380 µA				
<b>Power Saving Mode</b>	With card present, before being suspended: 40.6 mA Without card present: 380 µA After being suspended with smart card present: 380 µA				
<b>Features</b>	<ul style="list-style-type: none"> <li>• Support single slot</li> <li>• Support T0, T1 protocol</li> <li>• Support I2C memory card, SLE4418, SLE4428, SLE4432, SLE4442, SLE4436,</li> <li>• SLE5536, SLE6636, AT88SC1608, AT45D041 card and AT45DB041 card via external EEPROM</li> <li>• Support ISO7816 Class A, B and C (5V/3V/1.8V) card</li> <li>• Implemented as an USB full speed device with bulk transfer endpoint, Mass</li> <li>• Storage endpoint</li> <li>• Built-in PLL for USB and Smart Card clocks requirement</li> <li>• Support EEPROM for USB descriptors customization (PID/VID/iManufacturer/iProduct/Serial Number), Direct Web Page Link, and accessing memory card module.</li> <li>• EEPROM programmable via USB interface</li> <li>• Support software update for memory card module</li> <li>• Support Direct Web Page Link via configuration in external EEPROM</li> </ul>				



## Technical Specifications

- Support short APDU and extended APDU
- Compatible with Microsoft USB-CCID driver
- Support remote wake up through inserting card/removing card
- Support USB selective suspend
- Support Power Saving Mode (Using one pin to select between Normal/PWR Saving Mode)
- Support card power over current protection mechanism
- Built in resonator.
- Support USB LPM (Link Power Management) features.
- Embedded clock source.

## NETWORKING/COMMUNICATIONS

### HP It4120 Qualcomm® Snapdragon™ X5 LTE Mobile Broadband Module\*

<b>Technology/Operating bands</b>	LTE: 2100 (Band 1), 1900 (Band 2), 1800 (Band 3), 1700/2100 (Band 4), 850 (Band 5), 2600 (Band 7), 900 (Band 8), 700 (Band 12 lower), 700 (Band 13 upper), 700 (Band 17 lower), 800 (Band 20), 700 (Band 28). HSPA+: 2100 (Band 1), 1900 (Band 2), 1700/2100 (Band 4), 850 (Band 5), 900 (Band 8) MHz EV-DO: 850 (BC0), 1900 (BC1) MHz (Only work with Verizon network) E-GPRS: 1900 (Band 2), 1800 (Band 3), 850 (Band 5), 900 (Band 8) MHz
<b>Wireless protocol standards</b>	3GPP Release 10 LTE Specification CAT.4, 20MHz BW WCDMA R99, 3GPP Release 5, 6, 7 and 8 UMTS Specification 1xEVDO Release 0, A and B. E-GPRS: Class B, Multi-slot class 12, coding schemes CS1 - CS4 and MSC1 - MSC9
<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: 150 Mbps (Download), 50 Mbps (Upload) DC-HSPA+: 42 Mbps (Download), 5.76 Mbps (Upload) HSPA+: 21Mbps (Download), 5.76 Mbps (Upload) CDMA 1xRTT: 153.6 kbps (Download), 153.6 kbps (Upload) EVDO Rel.A: 3.1 Mbps (Download), 1.8 Mbps (Upload) EVDO Rel.B: 14.7 Mbps (Download), 5.4Mbps (Upload) EDGE: 236.8 kbps (Download), 236.8 kbps (Upload) GPRS: 85.6 kbps(Download), 85.6 kbps (Upload)
<b>Maximum output power</b>	LTE: 23 dBm HSPA+: 23.5 dBm 1xRTT/EVDO: 24dBm E-GPRS 1900/1800: 26 dBm E-GPRS 900/850: 27 dBm GPRS 1900/1800: 29.5 dBm GPRS 900/850: 32.5 dBm



## Technical Specifications

**Maximum power consumption** LTE: 1,200 mA (peak); 900 mA (average)  
 HSPA+: 1,100 mA (peak); 800 mA (average)  
 1xRTT/EVDO: 1,000 mA (peak); 700 mA (average)  
 E-GPRS: 2,800 mA (peak); 500 mA (average)

**Form Factor** M.2, 3042-S3 Key B

**Weight** 6.2 g

**Dimensions** 42 x 30 x 2.3 mm  
 (Length x Width x Thickness)

\* Mobile Broadband is an optional feature. Connection requires wireless data service contract, network support, and is not available in all areas. Contact service provider to determine the coverage area and availability. Connection speeds will vary due to location, environment, network conditions, and other factors.

**Technology/Operating bands** **HP hs3110 HSPA+ Intel® Mobile Broadband Module\***  
 HSPA+: 2100 (Band 1), 1900 (Band 2), 1700 (Band 4), 850 (Band 5), 900 (Band 8) MHz  
 E-GPRS: 1900 (Band 2), 1800 (Band 3), 850 MHz (Band 5), 900 (Band 8) MHz

**Wireless protocol standards** WCDMA R99, 3GPP Release 5, 6 and 7 UMTS Specification  
 E-GPRS: Class B, Multi-slot class 33, coding schemes CS1 - CS4 and MSC1 - MSC9

**GPS** Standalone, A-GPS

**GPS bands** 1575.42 MHz ± 1.023 MHz

**Maximum data rates** HSPA+: 21.6 Mbps (Download), 5.76 Mbps (Upload)  
 E-GPRS: 296 kbps (Download), 236.8 kbps (Upload)  
 GPRS: 107 kbps (Download), 85.6 kbps (Upload)

**Maximum output power** HSPA+: 24 dBm  
 E-GPRS 1800/1900: 26 dBm  
 E-GPRS 850/900: 27 dBm  
 GPRS 1800/1900: 30 dBm  
 GPRS 850/900: 33 dBm

**Maximum power consumption** HSPA+: 1,100 mA (peak); 800 mA (average)  
 E-GPRS: 2,800 mA (peak); 700 mA (average)

**Form Factor** M.2, 3042-S3 Key B

**Weight** 6 g

**Dimensions** 1.65 x 1.18 x 0.09 in (42 x 30 x 2.3 mm)  
 (Length x Width x Thickness)

\* Mobile Broadband is an optional feature. Connection requires wireless data service contract, network support, and is not available in all areas. Contact service provider to determine the coverage area and availability. Connection speeds will vary due to location, environment, network conditions, and other factors.

### Intel® 802.11a/b/g/n/ac (2x2) and Bluetooth® 4.1 Combo

**Wireless LAN Standards** IEEE 802.11a



### Technical Specifications

	IEEE 802.11b
	IEEE 802.11g
	IEEE 802.11n
	IEEE 802.11ac
<b>Interoperability</b>	Wi-Fi certified
<b>Frequency Band</b>	802.11b/g/n <ul style="list-style-type: none"><li>• 2.402 – 2.482 GHz</li></ul> Note: <p>The FCC has declared as of January 1, 2015 products that utilize passive scanning on channel 12/13 and are capable of transmitting must fully comply with requirements of 15.247 or otherwise disable those channels.</p>
	802.11a/n <ul style="list-style-type: none"><li>• 4.9 – 4.95 GHz (Japan)</li><li>• 5.15 – 5.25 GHz</li><li>• 5.25 – 5.35 GHz</li><li>• 5.47 – 5.725 GHz</li><li>• 5.825 – 5.850 GHz</li></ul> Note: Indonesia no support this band)
<b>Data Rates</b>	<ul style="list-style-type: none"><li>• 802.11b: 1, 2, 5.5, 11 Mbps</li><li>• 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li><li>• 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li><li>• 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)</li><li>• 802.11ac : MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, and 80MHz)</li></ul>
<b>Modulation</b>	Direct Sequence Spread Spectrum BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM
<b>Security<sup>1</sup></b>	<ul style="list-style-type: none"><li>• IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only</li><li>• AES-CCMP: 128 bit in hardware</li><li>• 802.1x authentication</li><li>• WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES.</li><li>• WPA2 certification</li><li>• IEEE 802.11i</li><li>• Cisco Certified Extensions, all versions through CCX4 and CCX Lite</li></ul>



## Technical Specifications

<b>Network Architecture Models</b>	<ul style="list-style-type: none"> <li>• WAPI</li> </ul> Ad-hoc (Peer to Peer) Infrastructure (Access Point Required)
<b>Roaming</b>	IEEE 802.11 compliant roaming between access points
<b>Output Power<sup>2</sup></b>	<ul style="list-style-type: none"> <li>• 802.11b : +16dBm minimum</li> <li>• 802.11g : +14dBm minimum</li> <li>• 802.11a : +14dBm minimum</li> <li>• 802.11n HT20(2.4GHz) : +14dBm minimum</li> <li>• 802.11n HT40(2.4GHz) : +12dBm minimum</li> <li>• 802.11n HT20(5GHz) : +14dBm minimum</li> <li>• 802.11n HT40(5GHz) : +12dBm minimum</li> </ul>
<b>Power Consumption</b>	Transmit: 2.0 W (max) Receive: 1.6 W (max) Idle mode (PSP): 180 mW (WLAN Associated) Idle mode: 50 mW (WLAN unassociated) Connect Standby: 10 mW (WLAN+BT) Radio disabled: 5 mW
<b>Power Management</b>	ACPI and PCI Express compliant power management 802.11 compliant power saving mode
<b>Receiver Sensitivity<sup>3</sup></b>	802.11b, 1Mbps : -94dBm maximum 802.11b, 11Mbps : -86dBm maximum 802.11g, 6Mbps : -88dBm maximum 802.11g, 54Mbps : -74dBm maximum 802.11a, 6Mbps : -88dBm maximum 802.11a, 54Mbps : -74dBm maximum 802.11n, MCS07 : -69dBm maximum 802.11n, MCS15 : -66dBm maximum



## Technical Specifications

	802.11ac, 1SS, MCS-0 : -86dBm maximum
	802.11ac, 1SS, MCS-9 : -61dBm maximum
	802.11ac, 2SS, MCS-0 : -83dBm maximum
	802.11ac, 2SS, MCS-9 : -58dBm maximum
<b>Antenna type</b>	High efficiency antenna with spatial diversity, mounted in the display enclosure
	Two embedded dual band 2.4/5 GHz antennas are provided to the card to support WLAN MIMO communications and Bluetooth communications
<b>Form Factor</b>	PCI-Express M.2 MiniCard
<b>Dimensions</b>	Type 2230 : 2.3 x 22.0 x 30.0 mm
	Or
	Type 1630 : 2.3 x 16.0 x 30.0 mm
<b>Weight</b>	Type 2230 : 2.8g
	Or
	Type 1630 : 2g
<b>Operating Voltage</b>	3.3v +/- 9%
<b>Temperature</b>	Operating 14° to 158° F (-10° to 70° C) Non-operating -40° to 176° F (-40° to 80° C)
<b>Humidity</b>	Operating 10% to 90% (non-condensing) Non-operating 5% to 95% (non-condensing)
<b>Altitude</b>	Operating 0 to 10,000 ft (3,048 m) Non-operating 0 to 50,000 ft (15,240 m)
<b>LED Activity</b>	LED Amber – Radio OFF; LED White – Radio ON
	<ol style="list-style-type: none"> <li>1. Check latest software/driver release for updates on supported security features.</li> <li>2. Maximum output power may vary by country according to local regulations.</li> <li>3. Receiver sensitivity is measured at a packet error rate of 8% for 802.11b (CKK modulation) and a packet error rate of 10% for 802.11a/g (OFDM modulation).</li> </ol>

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

<b>Bluetooth Specification</b>	4.0/4.1/4.2 Compliant
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## Technical Specifications

<b>Frequency Band</b>	2402 to 2480 MHz												
<b>Number of Available Channels</b>	Legacy : 0~79 (1 MHz/CH) BLE : 0~39 (2 MHz/CH)												
<b>Data Rates and Throughput</b>	Legacy : 3 Mbps data rate; throughput up to 2.17 Mbps  BLE : 1 Mbps data rate; throughput up to 0.2 Mbps  Legacy : Synchronous Connection Oriented links up to 3, 64 kbps, voice channels  Legacy : Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric (3-DH5) or 864 kbps symmetric (3-EV5)												
<b>Transmit Power</b>	The Bluetooth component shall operate as a Class II Bluetooth device with a maximum transmit power of + 4 dBm for BR and EDR.												
<b>Receiver Sensitivity</b>	<table border="1"> <thead> <tr> <th><b>Modulation</b></th> <th><b>0.01% BER</b></th> <th><b>0.001% BER</b></th> </tr> </thead> <tbody> <tr> <td>GFSK</td> <td>-80 dBm</td> <td>-70 dBm</td> </tr> <tr> <td><math>\pi/4</math>-DQPSK</td> <td>-80 dBm</td> <td>-70 dBm</td> </tr> <tr> <td>8DPSK</td> <td>-80 dBm</td> <td>-70 dBm</td> </tr> </tbody> </table>	<b>Modulation</b>	<b>0.01% BER</b>	<b>0.001% BER</b>	GFSK	-80 dBm	-70 dBm	$\pi/4$ -DQPSK	-80 dBm	-70 dBm	8DPSK	-80 dBm	-70 dBm
<b>Modulation</b>	<b>0.01% BER</b>	<b>0.001% BER</b>											
GFSK	-80 dBm	-70 dBm											
$\pi/4$ -DQPSK	-80 dBm	-70 dBm											
8DPSK	-80 dBm	-70 dBm											
<b>Legacy</b>													
<b>Power Consumption</b>	Peak (Tx) 330 mW Peak (Rx) 230 mW Selective Suspend 17 mW												
<b>Range</b>	Legacy Up to 33 ft (10 m)  BLE Up to 99 ft (30 m)												
<b>Electrical Interface</b>	USB 2.0 compliant												
<b>Bluetooth Software Supported</b>	Microsoft Windows Bluetooth Software												
<b>Link Topology</b>													
<b>Electrical Interface</b>	Point to Point, Multipoint Pico Nets up to 7 slaves												
<b>Bluetooth Software Supported</b>	Full support of Bluetooth Security Provisions												
<b>Security</b>													



## Technical Specifications

<b>Power Management</b>	Microsoft Windows ACPI, and USB Bus Support
<b>Certifications</b>	Self-configurable to optimize power conservation in all operating modes, including Standby, Hold, Park, and Sniff
<b>Security</b>	All necessary regulatory approvals for supported countries, including:
<b>Certifications</b>	FCC (47 CFR) Part 15C, Section 15.247 & 15.249
<b>Bluetooth Profiles Supported</b>	
<b>Power Management</b>	ETS 300 328, ETS 300 826
<b>Certifications</b>	Low Voltage Directive IEC950 UL, CSA, and CE Mark
<b>Certifications</b>	Serial Port Profile (SPP) <sup>1</sup> Service Discovery Application Profile (SDAP) Dial-Up Networking (DUN) <sup>1,2</sup> Generic Object Exchange Profile (GOEP) <sup>1,2</sup> Object Push Profile (OPP) <sup>1,2</sup> Hard Copy Cable Replacement (HCRP) <sup>1,2</sup> Personal Area Networking Profile (PAN) <sup>1,2</sup> Human Interface Device Profile (HID) <sup>1,2</sup> Hands Free Profile (HFP) Advanced Audio Distribution Profile (A2DP)  Audio Video Remote Control Profile (AVRCP)
<b>Bluetooth Profiles Supported</b>	
<b>Bluetooth V4.1/V4.2 support feature</b>	V4.1: ESR5/6/7 compliant  V4.2: ESR8 compliant, LE Secure Connection – Basic.

### Intel® 802.11a/b/g/n (2x2) and Bluetooth® 4.0 Combo

<b>Wireless LAN Standards</b>	IEEE 802.11a IEEE 802.11b IEEE 802.11g
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### Technical Specifications

	IEEE 802.11n
<b>Interoperability</b>	Wi-Fi certified
<b>Frequency Band</b>	802.11b/g/n <ul style="list-style-type: none"><li>• 2.402 – 2.482 GHz</li></ul> <p>Note:</p> <p>The FCC has declared as of January 1, 2015 products that utilize passive scanning on channel 12/13 and are capable of transmitting must fully comply with requirements of 15.247 or otherwise disable those channels.</p>
	802.11a <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> <p>Note:</p> <p>Indonesia only supports 5.725 - 5.825 GHz (CH149 - CH161)</p>
<b>Antenna Structure</b>	2 transmit; 2 receive (2x2)
<b>Data Rates</b>	802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11b: 1, 2, 5.5, 11 Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)
<b>Modulation</b>	Direct Sequence Spread Spectrum CCK, BPSK, QPSK, 16-QAM, 64-QAM
<b>Security<sup>1</sup></b>	<ul style="list-style-type: none"><li>• IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only</li><li>• AES-CCMP: 128 bit in hardware</li><li>• 802.1x authentication</li><li>• WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES.</li><li>• WPA2 certification</li><li>• IEEE 802.11i</li><li>• Cisco Certified Extensions, all versions through CCX4 and CCX Lite</li></ul>



## Technical Specifications

<b>Sub-channels</b>	<ul style="list-style-type: none"> <li>WAPI</li> </ul> <p>Multinational support with frequency bands and channels compliant to local regulations.</p>
<b>Network Architecture Models</b>	<p>Ad-hoc (Peer to Peer)            Infrastructure (Access Point Required)</p>
<b>Roaming</b>	IEEE 802.11 compliant roaming between band Access Points
<b>Output Power<sup>2</sup></b>	<ul style="list-style-type: none"> <li>802.11b : +16dBm minimum</li> <li>802.11g : +14dBm minimum</li> <li>802.11a : +14dBm minimum</li> <li>802.11n HT20(2.4GHz) : +13dBm minimum</li> <li>802.11n HT40(2.4GHz) : +13dBm minimum</li> <li>802.11n HT20(5GHz) : +12dBm minimum</li> <li>802.11n HT40(5GHz) : +12dBm minimum</li> </ul>
<b>Power Consumption</b>	<p>Transmit: 2.0 W (max)</p> <p>Receive: 1.6 W (max)</p> <p>Idle mode (PSP): 180 mW (WLAN Associated)</p> <p>Idle mode: 60 mW (WLAN unassociated)</p> <p>Radio disabled: 30 mW</p>
<b>Power Management</b>	<p>ACPI and PCI Express compliant power management            802.11 compliant power saving mode</p>
<b>Receiver Sensitivity<sup>3</sup></b>	<p>802.11b, 1Mbps : -94dBm maximum            802.11b, 11Mbps : -86dBm maximum            802.11g, 6Mbps : -88dBm maximum            802.11g, 54Mbps : -74dBm maximum            802.11a, 6Mbps : -86dBm maximum            802.11a, 54Mbps : -72dBm maximum            802.11n, MCS07 : -69dBm maximum            802.11n, MCS15 : -66dBm maximum</p>
<b>Antenna type</b>	<p>High efficiency antenna with spatial diversity, mounted in the display enclosure</p> <p>Two embedded dual band 2.4/5 GHz antennas are provided to the card to support WLAN MIMO and Bluetooth communications</p>
<b>Form Factor</b>	PCI-Express M.2 MiniCard
<b>Dimensions</b>	<p>Type 2230 : 2.3 x 22.0 x 30.0 mm</p> <p>Or</p>



### Technical Specifications

	Type 1630 : 2.3 x 16.0 x 30.0 mm	
<b>Weight</b>	Type 2230 : 2.8g	
	Or	
	Type 1630 : 2g	
<b>Operating Voltage</b>	3.3v +/- 9%	
<b>Temperature</b>	Operating	14° to 158° F (-10° to 70° C)
	Non-operating	-40° to 176° F (-40° to 80° C)
<b>Humidity</b>	Operating	10% to 90% (non-condensing)
	Non-operating	5% to 95% (non-condensing)
<b>Altitude</b>	Operating	0 to 10,000 ft (3,048 m)
	Non-operating	0 to 50,000 ft (15,240 m)
<b>LED Activity</b>	LED Amber - Radio OFF; LED White - Radio ON	

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

#### HP Integrated Module with Bluetooth 4.0+EDR Wireless Technology

<b>Bluetooth Specification</b>	4.0+EDR Compliant	
<b>Frequency Band</b>	2402 to 2480 MHz	
<b>Number of Available Channels</b>	79 (1 MHz) available channels	
<b>Data Rates and Throughput</b>	3 Mbps data rate; throughput up to 2.17 Mbps	
	Synchronous Connection Oriented links up to 3, 64 kbps, voice channels	
	Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric or 1306.9 kbps symmetric	
<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>Receiver Sensitivity</b>	<b>Modulation</b>	<b>0.01% BER</b>	<b>0.001% BER</b>
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## Technical Specifications

GFSK	-80 dBm	-70 dBm
$\pi/4$ -DQPSK	-80 dBm	-70 dBm
8DPSK	-80 dBm	-70 dBm

<b>Power Consumption</b>	Peak (Tx) 330 mW Peak (Rx) 230 mW Selective Suspend 17 mW
<b>Range</b>	Up to 33 ft (10 m)
<b>Electrical Interface</b>	USB 2.0 compliant
<b>Bluetooth Software Supported</b>	Microsoft Windows Bluetooth Software
<b>Link Topology</b>	
<b>Electrical Interface</b>	Point to Point, Multipoint Pico Nets up to 7 slaves
<b>Bluetooth Software Supported</b>	Full support of Bluetooth Security Provisions
<b>Security</b>	
<b>Power Management</b>	Microsoft Windows ACPI, and USB Bus Support
<b>Power Management</b>	Self-configurable to optimize power conservation in all operating modes, including Standby, Hold, Park, and Sniff
<b>Certifications</b>	
<b>Security</b>	All necessary regulatory approvals for supported countries, including:
<b>Certifications</b>	FCC (47 CFR) Part 15C, Section 15.247 & 15.249
<b>Bluetooth Profiles Supported</b>	
<b>Power Management</b>	ETS 300 328, ETS 300 826
<b>Certifications</b>	Low Voltage Directive IEC950  UL, CSA, and CE Mark
<b>Certifications</b>	Serial Port Profile (SPP) <sup>1</sup> Service Discovery Application Profile (SDAP) Dial-Up Networking (DUN) <sup>1,2</sup> Generic Object Exchange Profile (GOEP) <sup>1,2</sup> Object Push Profile (OPP) <sup>1,2</sup> File Transfer Profile (FTP) Synchronization Profile (SYNC)
<b>Bluetooth Profiles Supported</b>	



## Technical Specifications

Hard Copy Cable Replacement (HCRP)<sup>1,2</sup>  
 Personal Area Networking Profile (PAN)<sup>1,2</sup>  
 Human Interface Device Profile (HID)<sup>1,2</sup>  
 FAX Profile (FAX)  
 Basic Imaging Profile (BIP)<sup>2</sup>  
 Headset Profile (HSP)  
 Hands Free Profile (HFP)  
 Advanced Audio Distribution Profile (A2DP)

**Bluetooth V4.1/V4.2 support feature**

V4.1: ESR5/6/7 compliant

V4.2: ESR8 compliant, LE Secure Connection – Basic.

**Broadcom 802.11a/b/g/n (2x2) and Bluetooth® 4.0 Combo**

**Wireless LAN Standards**

IEEE 802.11a  
 IEEE 802.11b  
 IEEE 802.11g  
 IEEE 802.11n

**Interoperability**

Wi-Fi certified

**Frequency Band**

802.11b/g/n

- 2.402 – 2.482 GHz

Note:

The FCC has declared as of January 1, 2015 products that utilize passive scanning on channel 12/13 and are capable of transmitting must fully comply with requirements of 15.247 or otherwise disable those channels.

802.11a



## Technical Specifications

- 4.9 – 4.95 GHz (Japan)
- 5.15 – 5.25 GHz
- 5.25 – 5.35 GHz
- 5.47 – 5.725 GHz
- 5.825 – 5.850 GHz

Note:

Indonesia only supports 5.725 - 5.825 GHz (CH149 - CH161)

<b>Antenna Structure</b>	2 transmit; 2 receive (2x2)
<b>Data Rates</b>	802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11b: 1, 2, 5.5, 11 Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)
<b>Modulation</b>	Direct Sequence Spread Spectrum CCK, BPSK, QPSK, 16-QAM, 64-QAM
<b>Security<sup>1</sup></b>	<ul style="list-style-type: none"> <li>• IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only</li> <li>• AES-CCMP: 128 bit in hardware</li> <li>• 802.1x authentication</li> <li>• WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES.</li> <li>• WPA2 certification</li> <li>• IEEE 802.11i</li> <li>• Cisco Certified Extensions, all versions through CCX4 and CCX Lite</li> <li>• WAPI</li> </ul>
<b>Sub-channels</b>	Multinational support with frequency bands and channels compliant to local regulations.
<b>Network Architecture Models</b>	Ad-hoc (Peer to Peer) Infrastructure (Access Point Required)
<b>Roaming</b>	IEEE 802.11 compliant roaming between band Access Points
<b>Output Power<sup>2</sup></b>	<ul style="list-style-type: none"> <li>• 802.11b : +16dBm minimum</li> <li>• 802.11g : +14dBm minimum</li> <li>• 802.11a : +14dBm minimum</li> <li>• 802.11n HT20(2.4GHz) : +13dBm minimum</li> <li>• 802.11n HT40(2.4GHz) : +13dBm minimum</li> <li>• 802.11n HT20(5GHz) : +12dBm minimum</li> <li>• 802.11n HT40(5GHz) : +12dBm minimum</li> </ul>
<b>Power Consumption</b>	Transmit: 2.0 W (max)



## Technical Specifications

	Receive: 1.6 W (max)	
	Idle mode (PSP): 180 mW (WLAN Associated)	
	Idle mode: 60 mW (WLAN unassociated)	
	Radio disabled: 30 mW	
<b>Power Management</b>	ACPI and PCI Express compliant power management 802.11 compliant power saving mode	
<b>Receiver Sensitivity<sup>3</sup></b>	802.11b, 1Mbps : -94dBm maximum 802.11b, 11Mbps : -86dBm maximum 802.11g, 6Mbps : -88dBm maximum 802.11g, 54Mbps : -74dBm maximum 802.11a, 6Mbps : -86dBm maximum 802.11a, 54Mbps : -72dBm maximum 802.11n, MCS07 : -69dBm maximum 802.11n, MCS15 : -66dBm maximum	
<b>Antenna type</b>	High efficiency antenna with spatial diversity, mounted in the display enclosure	
	Two embedded dual band 2.4/5 GHz antennas are provided to the card to support WLAN MIMO 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	
	Or	
	Type 1630 : 2.3 x 16.0 x 30.0 mm	
<b>Weight</b>	Type 2230 : 2.8g	
	Or	
	Type 1630 : 2g	
<b>Operating Voltage</b>	3.3v +/- 9%	
<b>Temperature</b>	Operating	14° to 158° F (-10° to 70° C)
	Non-operating	-40° to 176° F (-40° to 80° C)
<b>Humidity</b>	Operating	10% to 90% (non-condensing)
	Non-operating	5% to 95% (non-condensing)



### Technical Specifications

<b>Altitude</b>	Operating	0 to 10,000 ft (3,048 m)
	Non-operating	0 to 50,000 ft (15,240 m)

**LED Activity** 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+EDR Wireless Technology

**Bluetooth Specification** 4.0+EDR Compliant

**Frequency Band** 2402 to 2480 MHz

**Number of Available Channels** 79 (1 MHz) available channels

**Data Rates and Throughput** 3 Mbps data rate; throughput up to 2.17 Mbps

Synchronous Connection Oriented links up to 3, 64 kbps, voice channels

Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric or 1306.9 kbps symmetric

**Transmit Power** The Bluetooth component shall operate as a Class II Bluetooth device with a maximum transmit power of +4 dBm for BR and EDR.

**Receiver Sensitivity**

<b>Modulation</b>	<b>0.01% BER</b>	<b>0.001% BER</b>
GFSK	-80 dBm	-70 dBm
$\pi/4$ -DQPSK	-80 dBm	-70 dBm
8DPSK	-80 dBm	-70 dBm

**Power Consumption** Peak (Tx) 330 mW  
Peak (Rx) 230 mW  
Selective Suspend 17 mW

**Range** Up to 33 ft (10 m)

**Electrical Interface** USB 2.0 compliant

**Bluetooth Software Supported** Microsoft Windows Bluetooth Software





## Technical Specifications

### Link Topology

**Electrical Interface** Point to Point, Multipoint Pico Nets up to 7 slaves

**Bluetooth Software Supported** Full support of Bluetooth Security Provisions

### Security

**Power Management** Microsoft Windows ACPI, and USB Bus Support

**Power Management** Self-configurable to optimize power conservation in all operating modes, including Standby, Hold, Park, and Sniff

### Certifications

**Security** All necessary regulatory approvals for supported countries, including:

**Certifications** FCC (47 CFR) Part 15C, Section 15.247 & 15.249

### Bluetooth Profiles Supported

**Power Management** ETS 300 328, ETS 300 826

**Certifications** Low Voltage Directive IEC950

UL, CSA, and CE Mark

Serial Port Profile (SPP)<sup>1</sup>

Service Discovery Application Profile (SDAP)

Dial-Up Networking (DUN)<sup>1,2</sup>

Generic Object Exchange Profile (GOEP)<sup>1,2</sup>

Object Push Profile (OPP)<sup>1,2</sup>

File Transfer Profile (FTP)

### Certifications

### Bluetooth Profiles Supported

Synchronization Profile (SYNC)

Hard Copy Cable Replacement (HCRP)<sup>1,2</sup>

Personal Area Networking Profile (PAN)<sup>1,2</sup>

Human Interface Device Profile (HID)<sup>1,2</sup>

FAX Profile (FAX)

Basic Imaging Profile (BIP)<sup>2</sup>

Headset Profile (HSP)

Hands Free Profile (HFP)

Advanced Audio Distribution Profile (A2DP)

## Broadcom 802.11b/g/n (1x1) WiFi and Bluetooth® 4.0 Combo

### Wireless LAN Standards

IEEE 802.11b



## Technical Specifications

	IEEE 802.11g
	IEEE 802.11n
<b>Interoperability</b>	Wi-Fi certified
<b>Frequency Band</b>	802.11b/g/n <ul style="list-style-type: none"> <li>• 2.402 – 2.482 GHz</li> </ul> <p>Note:          The FCC has declared as of September 1, 2014 products that utilize passive scanning on channel 12/13 and are capable of transmitting must fully comply with requirements of 15.247 or otherwise disable those channels.</p>
<b>Data Rates</b>	802.11b: 1, 2, 5.5, 11 Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11n: MCS 0 ~ MCS 07, (20MHz)
<b>Modulation</b>	Direct Sequence Spread Spectrum BPSK, QPSK, CCK, 16-QAM, 64-QAM,
<b>Security<sup>1</sup></b>	<ul style="list-style-type: none"> <li>• IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only</li> <li>• AES-CCMP: 128 bit in hardware</li> <li>• 802.1x authentication</li> <li>• WPA, WPA2: 802.1x, WPA-PSK, WPA2-PSK, TKIP, and AES.</li> <li>• WPA2 certification</li> <li>• IEEE 802.11i</li> <li>• Cisco Certified Extensions, all versions through CCX4 and CCX Lite</li> <li>• WAPI</li> </ul>
<b>Network Architecture Models</b>	Ad-hoc (Peer to Peer) Infrastructure (Access Point Required)
<b>Roaming</b>	IEEE 802.11 compliant roaming between access points
<b>Output Power<sup>2</sup></b>	<ul style="list-style-type: none"> <li>• 802.11b : +16dBm minimum</li> <li>• 802.11g : +14dBm minimum</li> <li>• 802.11n HT20(2.4GHz) : +13dBm minimum</li> <li>• 802.11n HT40(2.4GHz) : +13dBm minimum</li> <li>• 802.11n HT20(5GHz) : +12dBm minimum</li> <li>• 802.11n HT40(5GHz) : +12dBm minimum</li> </ul>
<b>Power Consumption</b>	Transmit: 2.0 W (max) Receive: 1.6 W (max)



## Technical Specifications

	Idle mode (PSP): 180 mW (WLAN Associated)	
	Idle mode: 60 mW (WLAN unassociated)	
	Radio disabled: 30 mW	
<b>Power Management</b>	ACPI and PCI Express compliant power management 802.11 compliant power saving mode	
<b>Receiver Sensitivity<sup>3</sup></b>	802.11b, 1Mbps : -94dBm maximum	
	802.11b, 11Mbps : -86dBm maximum	
	802.11g, 6Mbps : -88dBm maximum	
	802.11g, 54Mbps : -74dBm maximum	
	802.11n, MCS07 : -69dBm maximum	
	802.11n, MCS15 : -66dBm maximum	
<b>Antenna type</b>	High efficiency antenna with spatial diversity, mounted in the display enclosure	
	Two embedded antennas for 2.4GHz are provided to the card to support WLAN and Bluetooth communications. (Support Dual antenna or Single antenna, depend on platform requirement)	
<b>Form Factor</b>	PCI-Express M.2 MiniCard	
<b>Dimensions</b>	Type 2230 : 2.3 x 22.0 x 30.0 mm	
	Or	
	Type 1630 : 2.3 x 16.0 x 30.0 mm	
<b>Weight</b>	Type 2230 : 2.8g	
	Or	
	Type 1630 : 2g	
<b>Operating Voltage</b>	3.3v +/- 9%	
<b>Temperature</b>	Operating	14° to 158° F (-10° to 70° C)
	Non-operating	-40° to 176° F (-40° to 80° C)
<b>Humidity</b>	Operating	10% to 90% (non-condensing)
	Non-operating	5% to 95% (non-condensing)



### Technical Specifications

<b>Altitude</b>	Operating	0 to 10,000 ft (3,048 m)
	Non-operating	0 to 50,000 ft (15,240 m)

**LED Activity** LED Amber – Radio OFF; LED White – Radio ON

4. Check latest software/driver release for updates on supported security features.
5. Maximum output power may vary by country according to local regulations.
6. 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+EDR Wireless Technology

<b>Bluetooth Specification</b>	4.0+EDR Compliant												
<b>Frequency Band</b>	2402 to 2480 MHz												
<b>Number of Available Channels</b>	79 (1 MHz) available channels												
<b>Data Rates and Throughput</b>	3 Mbps data rate; throughput up to 2.17 Mbps  Synchronous Connection Oriented links up to 3, 64 kbps, voice channels  Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric or 1306.9 kbps symmetric												
<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>Receiver Sensitivity</b>	<table border="1"> <thead> <tr> <th>Modulation</th> <th>0.01% BER</th> <th>0.001% BER</th> </tr> </thead> <tbody> <tr> <td>GFSK</td> <td>-80 dBm</td> <td>-70 dBm</td> </tr> <tr> <td><math>\pi/4</math>-DQPSK</td> <td>-80 dBm</td> <td>-70 dBm</td> </tr> <tr> <td>8DPSK</td> <td>-80 dBm</td> <td>-70 dBm</td> </tr> </tbody> </table>	Modulation	0.01% BER	0.001% BER	GFSK	-80 dBm	-70 dBm	$\pi/4$ -DQPSK	-80 dBm	-70 dBm	8DPSK	-80 dBm	-70 dBm
Modulation	0.01% BER	0.001% BER											
GFSK	-80 dBm	-70 dBm											
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8DPSK	-80 dBm	-70 dBm											
<b>Power Consumption</b>	Peak (Tx) 330 mW Peak (Rx) 230 mW Selective Suspend 17 mW												
<b>Range</b>	Up to 33 ft (10 m)												
<b>Electrical Interface</b>	USB 2.0 compliant												
<b>Bluetooth Software Supported</b>	Microsoft Windows Bluetooth Software												



## Technical Specifications

### Link Topology

**Electrical Interface** Point to Point, Multipoint Pico Nets up to 7 slaves

**Bluetooth Software Supported** Full support of Bluetooth Security Provisions

### Security

**Power Management** Microsoft Windows ACPI, and USB Bus Support

**Power Management** Self-configurable to optimize power conservation in all operating modes, including Standby, Hold, Park, and Sniff

### Certifications

**Security** All necessary regulatory approvals for supported countries, including:

**Certifications** FCC (47 CFR) Part 15C, Section 15.247 & 15.249

### Bluetooth Profiles Supported

**Power Management** ETS 300 328, ETS 300 826

**Certifications** Low Voltage Directive IEC950

UL, CSA, and CE Mark

Serial Port Profile (SPP)<sup>1</sup>

Service Discovery Application Profile (SDAP)

Dial-Up Networking (DUN)<sup>1,2</sup>

Generic Object Exchange Profile (GOEP)<sup>1,2</sup>

Object Push Profile (OPP)<sup>1,2</sup>

File Transfer Profile (FTP)

### Certifications

### Bluetooth Profiles Supported

Synchronization Profile (SYNC)

Hard Copy Cable Replacement (HCRP)<sup>1,2</sup>

Personal Area Networking Profile (PAN)<sup>1,2</sup>

Human Interface Device Profile (HID)<sup>1,2</sup>

FAX Profile (FAX)

Basic Imaging Profile (BIP)<sup>2</sup>

Headset Profile (HSP)

Hands Free Profile (HFP)

Advanced Audio Distribution Profile (A2DP)

## Realtek 802.11b/g/n (1x1) Wi-Fi

### Wireless LAN Standards

IEEE 802.11b



## Technical Specifications

	IEEE 802.11g
	IEEE 802.11n
<b>Interoperability</b>	Wi-Fi certified
<b>Frequency Band</b>	802.11b/g/n <ul style="list-style-type: none"> <li>• 2.402 – 2.482 GHz</li> </ul> <p>Note:              The FCC has declared as of September 1, 2014 products that utilize passive scanning on channel 12/13 and are capable of transmitting must fully comply with requirements of 15.247 or otherwise disable those channels.</p>
<b>Data Rates</b>	802.11b: 1, 2, 5.5, 11 Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11n: MCS 0 ~ MCS 07, (20MHz)
<b>Modulation</b>	Direct Sequence Spread Spectrum BPSK, QPSK, CCK, 16-QAM, 64-QAM,
<b>Security<sup>1</sup></b>	<ul style="list-style-type: none"> <li>• IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only</li> <li>• AES-CCMP: 128 bit in hardware</li> <li>• 802.1x authentication</li> <li>• WPA, WPA2: 802.1x, WPA-PSK, WPA2-PSK, TKIP, and AES.</li> <li>• WPA2 certification</li> <li>• IEEE 802.11i</li> <li>• Cisco Certified Extensions, all versions through CCX4 and CCX Lite</li> <li>• WAPI</li> </ul>
<b>Network Architecture Models</b>	Ad-hoc (Peer to Peer) Infrastructure (Access Point Required)
<b>Roaming</b>	IEEE 802.11 compliant roaming between access points
<b>Output Power<sup>2</sup></b>	<ul style="list-style-type: none"> <li>• 802.11b : +16dBm minimum</li> <li>• 802.11g : +14dBm minimum</li> <li>• 802.11n HT20(2.4GHz) : +13dBm minimum</li> <li>• 802.11n HT40(2.4GHz) : +13dBm minimum</li> <li>• 802.11n HT20(5GHz) : +12dBm minimum</li> <li>• 802.11n HT40(5GHz) : +12dBm minimum</li> </ul>
<b>Power Consumption</b>	Transmit: 2.0 W (max) Receive: 1.6 W (max)



## Technical Specifications

	Idle mode (PSP): 180 mW (WLAN Associated)	
	Idle mode: 60 mW (WLAN unassociated)	
	Radio disabled: 30 mW	
<b>Power Management</b>	ACPI and PCI Express compliant power management 802.11 compliant power saving mode	
<b>Receiver Sensitivity<sup>3</sup></b>	802.11b, 1Mbps : -94dBm maximum	
	802.11b, 11Mbps : -86dBm maximum	
	802.11g, 6Mbps : -88dBm maximum	
	802.11g, 54Mbps : -74dBm maximum	
	802.11n, MCS07 : -69dBm maximum	
	802.11n, MCS15 : -66dBm maximum	
<b>Antenna type</b>	High efficiency antenna with spatial diversity, mounted in the display enclosure	
	Two embedded antennas for 2.4GHz are provided to the card to support WLAN and Bluetooth communications. (Support Dual antenna or Single antenna, depend on platform requirement)	
<b>Form Factor</b>	PCI-Express M.2 MiniCard	
<b>Dimensions</b>	Type 2230 : 2.3 x 22.0 x 30.0 mm	
	Or	
	Type 1630 : 2.3 x 16.0 x 30.0 mm	
<b>Weight</b>	Type 2230 : 2.8g	
	Or	
	Type 1630 : 2g	
<b>Operating Voltage</b>	3.3v +/- 9%	
<b>Temperature</b>	Operating	14° to 158° F (-10° to 70° C)
	Non-operating	-40° to 176° F (-40° to 80° C)
<b>Humidity</b>	Operating	10% to 90% (non-condensing)
	Non-operating	5% to 95% (non-condensing)



### Technical Specifications

<b>Altitude</b>	Operating	0 to 10,000 ft (3,048 m)
	Non-operating	0 to 50,000 ft (15,240 m)

**LED Activity** LED Amber – Radio OFF; LED White – Radio ON

7. Check latest software/driver release for updates on supported security features.
8. Maximum output power may vary by country according to local regulations.
9. 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+EDR Wireless Technology

**Bluetooth Specification** 4.0+EDR Compliant

**Frequency Band** 2402 to 2480 MHz

**Number of Available Channels** 79 (1 MHz) available channels

**Data Rates and Throughput** 3 Mbps data rate; throughput up to 2.17 Mbps

Synchronous Connection Oriented links up to 3, 64 kbps, voice channels

Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric or 1306.9 kbps symmetric

**Transmit Power** The Bluetooth component shall operate as a Class II Bluetooth device with a maximum transmit power of +4 dBm for BR and EDR.

**Receiver Sensitivity**

Modulation	0.01% BER	0.001% BER
GFSK	-80 dBm	-70 dBm
$\pi/4$ -DQPSK	-80 dBm	-70 dBm
8DPSK	-80 dBm	-70 dBm

**Power Consumption** Peak (Tx) 330 mW  
Peak (Rx) 230 mW  
Selective Suspend 17 mW

**Range** Up to 33 ft (10 m)

**Electrical Interface** USB 2.0 compliant

**Bluetooth Software Supported** Microsoft Windows Bluetooth Software





## Technical Specifications

### Link Topology

**Electrical Interface** Point to Point, Multipoint Pico Nets up to 7 slaves

**Bluetooth Software Supported** Full support of Bluetooth Security Provisions

### Security

**Power Management** Microsoft Windows ACPI, and USB Bus Support

**Power Management** Self-configurable to optimize power conservation in all operating modes, including Standby, Hold, Park, and Sniff

### Certifications

**Security** All necessary regulatory approvals for supported countries, including:

**Certifications** FCC (47 CFR) Part 15C, Section 15.247 & 15.249

### Bluetooth Profiles Supported

**Power Management** ETS 300 328, ETS 300 826

**Certifications** Low Voltage Directive IEC950

UL, CSA, and CE Mark

Serial Port Profile (SPP)<sup>1</sup>

Service Discovery Application Profile (SDAP)

Dial-Up Networking (DUN)<sup>1,2</sup>

Generic Object Exchange Profile (GOEP)<sup>1,2</sup>

Object Push Profile (OPP)<sup>1,2</sup>

File Transfer Profile (FTP)

### Certifications

Synchronization Profile (SYNC)

Hard Copy Cable Replacement (HCRP)<sup>1,2</sup>

Personal Area Networking Profile (PAN)<sup>1,2</sup>

Human Interface Device Profile (HID)<sup>1,2</sup>

FAX Profile (FAX)

Basic Imaging Profile (BIP)<sup>2</sup>

Headset Profile (HSP)

Hands Free Profile (HFP)

Advanced Audio Distribution Profile (A2DP)

### Bluetooth Profiles Supported

## STORAGE AND DRIVES

**500 GB 7200rpm Self  
Encrypting Drive (FIPS-  
140-2) (Opal 2)**

**Drive Weight** 0.21 lbs (95 g)

**Capacity** 500 GB

**Height** 0.28 in (7 mm)



## Technical Specifications

<b>Width</b>	2.75 in (69.85 mm)
<b>Interface</b>	ATA-8, SATA 3.0
<b>Transfer Rate</b>	<b>Synchronous</b> (maximum) 600 MB/s
<b>Seek Time</b> (typical reads, including settling)	<b>Single Track</b> 1.5 ms <b>Average</b> 12ms <b>Maximum</b> 18mm-22ms
<b>Cache</b>	32GB
<b>Rotational Speed</b>	7200 rpm
<b>Logical Blocks</b>	976,773,168
<b>Operating Temperature</b>	32° to 140° F (0° to 60° C) [top cover temp]
<b>Features</b>	ATA Security; TCG Opal 2.x, FIPS, S.M.A.R.T., NCQ, Ultra DMA ,

### 500 GB 7200rpm Hard Drive

<b>Drive Weight</b>	0.20 lbs (92 g)-0.21 lbs (95 g)
<b>Capacity</b>	500 GB
<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>	<b>Synchronous</b> (maximum) 600 MB/s
<b>Seek Time</b> (typical reads, including settling)	<b>Single Track</b> 1.5ms-2.0ms <b>Average</b> 11ms-13ms <b>Maximum</b> 18ms-22ms
<b>Cache</b>	32 MB
<b>Rotational Speed</b>	7200 rpm
<b>Logical Blocks</b>	976,773,168
<b>Operating Temperature</b>	32° to 140° F (0° to 60° C) [case temp]
<b>Features</b>	ATA Security

### 500 GB 7200rpm Self-Encrypting Drive (Opal 2)

<b>Drive Weight</b>	0.21 lbs (95 g)
<b>Capacity</b>	500GB
<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>	<b>Synchronous</b> (maximum) 600 MB/s
<b>Seek Time</b> (typical reads, including settling)	<b>Single Track</b> 1.5ms <b>Average</b> 12ms <b>Maximum</b> 18ms- 22ms
<b>Cache</b>	32 MB
<b>Rotational Speed</b>	7200 rpm
<b>Logical Blocks</b>	976,773,168
<b>Operating Temperature</b>	32° to 140° F (0° to 60° C) [top cover temp]
<b>Features</b>	ATA Security; TCG Opal 2.x, S.M.A.R.T., NCQ, Ultra DMA



## Technical Specifications

<b>1 TB 5400rpm Hard Drive</b>	<b>Drive Weight</b>	0.21 lbs (94 g)- 0.21 lbs (99 g)		
	<b>Capacity</b>	1TB		
	<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>	<b>Synchronous (maximum)</b>	600 MB/s	
	<b>Seek Time</b> (typical reads, including settling)	<b>Single Track</b>	2ms	
		<b>Average</b>	12ms-13ms	
		<b>Maximum</b>	18ms-23ms	
	<b>Cache</b>	Up to 32GB		
	<b>Rotational Speed</b>	5400rpm		
	<b>Logical Blocks</b>	1,953,525,168		
	<b>Operating Temperature</b>	32° to 140° F (0° to 60° C) [case temp]		
	<b>Features</b>	S.M.A.R.T., NCQ, Ultra DMA		
<b>500 GB Hybrid, 8 GB cache</b>	<b>Drive Weight</b>	0.21 lb (95 g)		
	<b>Capacity</b>	500 GB		
	<b>Height</b>	0.276 in (7 mm)		
	<b>Width</b>	2.76 in (70.1 mm)		
	<b>Interface</b>	ATA-8, SATA 2.6, 6.0 Gb/s, NCQ		
	<b>Transfer Rate</b>	<b>Synchronous (maximum)</b>	600 MB/s (Drive Capability)	
	<b>Seek Time</b> (typical reads, including settling)	<b>Single Track</b>	2 ms	
		<b>Average</b>	12 ms	
		<b>Maximum</b>	NIL ms	
	<b>Cache</b>	64GB		
	<b>Rotational Speed</b>	5400 rpm		
	<b>Logical Blocks</b>	976,773,168		
	<b>Operating Temperature</b>	32° to 140° F (0° to 60° C) [case temp]		
	<b>Features</b>	ATA Security		
<b>128 GB M2 2280 SATA-3 TLC Solid State Drive</b>	<b>Drive Weight</b>	0.019 lb (8.5 g)-0.022 lb (10 g)		
	<b>Capacity</b>	128 GB		
	<b>Height</b>	0.09 in (2.23 mm)- 0.14 in (3.58 mm)		
	<b>Width</b>	0.87 in (22 mm)		
	<b>Interface</b>	ATA-8, SATA 3.0		
	<b>Performance</b>	<b>Maximum Sequential Read</b>	500 ~ 540 MB/s	
		<b>Maximum Sequential Write</b>	130 ~ 450 MB/s	
	<b>Logical Blocks</b>	250,069,680		
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]		



## Technical Specifications

	<b>Features</b>	ATA Security, DIPM; TRIM; DEVSLP		
<b>180 GB M2 2280 SATA-3 MLC Solid State Drive</b>	<b>Drive Weight</b>	0.022 lb (<10 g)		
	<b>Capacity</b>	180 GB		
	<b>Height</b>	0.09 in (2.23 mm)		
	<b>Width</b>	0.87 in (22 mm)		
	<b>Interface</b>	ATA-8, SATA 3.0		
	<b>Performance</b>	<b>Maximum Sequential Read</b>	<b>Maximum Sequential Write</b>	
		540 MB/s	490 MB/s	
	<b>Logical Blocks</b>	351,651,888		
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]		
	<b>Features</b>	ATA Security, DIPM; TRIM; DEVSLP		
<b>180 GB M2 2280 SATA-3 Self-Encrypting Drive (Opal 2) MLC Solid State Drive</b>	<b>Drive Weight</b>	0.022 lb (<10 g)		
	<b>Capacity</b>	180GB		
	<b>Height</b>	0.09 in (2.23 mm)		
	<b>Width</b>	0.87 in (22 mm)		
	<b>Interface</b>	ATA-8, SATA 3.0		
	<b>Performance</b>	<b>Maximum Sequential Read</b>	<b>Maximum Sequential Write</b>	
		540 MB/s	490 MB/s	
	<b>Logical Blocks</b>	351,651,888		
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]		
	<b>Features</b>	ATA Security, TCG OPAL 2.x, DIPM; TRIM; DEVSLP		
<b>240 GB SATA-3 MLC Solid State Drive</b>	<b>Drive Weight</b>	0.02 lb (10 g)		
	<b>Capacity</b>	240 GB		
	<b>Height</b>	0.14 in (3.58 mm)		
	<b>Width</b>	0.87 in (22 mm)		
	<b>Interface</b>	ACS-3, SATA 3.2		
	<b>Performance</b>	<b>Maximum Sequential Read</b>	<b>Maximum Sequential Write</b>	
		540 MB/s	490 MB/s	
	<b>Logical Blocks</b>	468,862,128		
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]		
	<b>Features</b>	ATA Security, DIPM; TRIM; DEVSLP		
<b>256 GB 2280 SATA-3 TLC Solid State Drive</b>	<b>Drive Weight</b>	0.019 lb (8.5 g)- 0.022 lb (10 g)		
	<b>Capacity</b>	256GB		
	<b>Height</b>	0.09 in (2.3 mm)- 0.14 in (3.58 mm)		
	<b>Width</b>	0.87 in (22 mm)		
	<b>Interface</b>	ATA-8, SATA 3.0		



## Technical Specifications

<b>Performance</b>	<b>Maximum Sequential Read</b>	<b>Maximum Sequential Write</b>
	515 ~ 540 MB/s	260 ~ 515 MB/s
<b>Logical Blocks</b>	500,118,192	
<b>Operating Temperature Features</b>	32° to 158°F (0° to 70°C) [ambient temp] ATA Security, DIPM; TRIM; DEVSLP	

<b>256 GB PCIe-3x4 NVMe Solid State Drive</b>	<b>Drive Weight</b>	0.02 lb (10 g)	
	<b>Capacity</b>	256 GB	
	<b>Height</b>	0.09 in (2.3 mm)	
	<b>Width</b>	0.87 in (22 mm)	
	<b>Interface</b>	PCIe NVMe Gen3X4	
	<b>Performance</b>	<b>Maximum Sequential Read</b>	<b>Maximum Sequential Write</b>
	2260 ~3100 MB/s	1100 ~ 1400 MB/s	
<b>Logical Blocks</b>	500,118,192		
<b>Operating Temperature Features</b>	32° to 158°F (0° to 70°C) [ambient temp] ATA Security, TRIM; L1.2		

<b>256 GB M2 2280 SATA-3 Self-Encrypting Drive (Opal 2) MLC Solid State Drive</b>	<b>Drive Weight</b>	0.02 lb (10 g)	
	<b>Capacity</b>	256 GB	
	<b>Height</b>	0.14 in (3.58 mm)- 0.09 in (2.23 mm)	
	<b>Width</b>	0.87 in (22 mm)	
	<b>Interface</b>	ATA-8, SATA 3.0	
	<b>Performance</b>	<b>Maximum Sequential Read</b>	<b>Maximum Sequential Write</b>
	450 ~ 540 MB/s	370 ~ 500 MB/s	
<b>Logical Blocks</b>	500,118,192		
<b>Operating Temperature Features</b>	32° to 158°F (0° to 70°C) [ambient temp] ATA Security; TCG Opal 2.0, DIPM; TRIM; DEVSLP		

<b>512 GB M2 2280 TLC Solid State Drive</b>	<b>Drive Weight</b>	0.019 lb (8.5 g)- 0.02 lb (10 g)	
	<b>Capacity</b>	512 GB	
	<b>Height</b>	0.09 in (2.3 mm)	
	<b>Width</b>	0.87 in (22 mm)	
	<b>Interface</b>	ATA-8, SATA 3.0	
	<b>Performance</b>	<b>Maximum Sequential Read</b>	<b>Maximum Sequential Write</b>
	500 ~ 540 MB/s	440 ~ 515 MB/s	
<b>Logical Blocks</b>	1,000,215,216		
<b>Operating Temperature Features</b>	32° to 158°F (0° to 70°C) [ambient temp] ATA Security, DIPM; TRIM; DEVSLP		

**512 GB M2 2280 SATA-3 Drive Weight** 0.019 lb (8.5 g)- 0.02 lb (10 g)



## Technical Specifications

<b>Self-Encrypting Drive (Opal 2) MLC Solid State Drive</b>	<b>Capacity</b>	512 GB	
	<b>Height</b>	0.09 in (2.3 mm)	
	<b>Width</b>	0.87 in (22 mm)	
	<b>Interface</b>	ATA-8, SATA 3.0	
	<b>Performance</b>	<b>Maximum Sequential Read</b>	<b>Maximum Sequential Write</b>
		500 ~ 540 MB/s	440 ~ 515 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>	ATA Security, DIPM; TRIM; DEVSLP; TCG Opal 2.0		

## ENVIRONMENTAL

### HP ProBook 640 G2 Notebook PC

**Eco-Label Certifications & declarations** 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:

- IT ECO declaration
- US ENERGY STAR®
- EPEAT <Gold> registered in the United States. See <http://www.epeat.net> for registration status in your country.

**System Configuration** The configuration used for the Energy Consumption and Declared Noise Emissions data for the Notebook model is based on a “Typically Configured Notebook”.

### Energy Consumption (in accordance with US ENERGY STAR® test method)

		<b>115VAC, 60Hz</b>	<b>230VAC, 50Hz</b>	<b>100VAC, 60Hz</b>
Normal Operation (Sort idle)		7.17 W	7.43 W	7.16 W
Normal Operation (Long idle)		4.76 W	5.21 W	4.95 W
Sleep		0.8 W	0.91 W	0.79 W
Off		0.39 W	0.49 W	0.38 W

**Note:**

Energy efficiency data listed is for an ENERGY STAR® compliant product if offered within the model family. HP computers marked with the ENERGY STAR® Logo are compliant with the applicable U.S. Environmental Protection Agency (EPA) ENERGY STAR® specifications for computers. If a model family does not offer ENERGY STAR® compliant configurations, then energy efficiency data listed is for a typically configured PC featuring a hard disk drive, a high efficiency power supply, and a Microsoft Windows® operating system.

<b>Heat Dissipation*</b>	<b>115VAC, 60Hz</b>	<b>230VAC, 50Hz</b>	<b>100VAC, 60Hz</b>
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### Technical Specifications

Normal Operation (Short idle)	25 BTU/hr	25 BTU/hr	24 BTU/hr
Normal Operation (Long idle)	16 BTU/hr	18 BTU/hr	17 BTU/hr
Sleep	3 BTU/hr	3 BTU/hr	3 BTU/hr
Off	1 BTU/hr	2 BTU/hr	1 BTU/hr

\*NOTE: Heat dissipation is calculated based on the measured watts, assuming the service level is attained for one hour.

Declared Emissions (in accordance with ISO 7779 and ISO 9296)	Noise	Sound Power (L <sub>WAd</sub> , bels)	Sound Pressure (L <sub>pAm</sub> , decibels)
Typically Configured – Idle		3.1	24
Fixed Disk – Random writes		3.2	24

**Batteries** This battery(s) in this product comply with EU Directive 2006/66/EC

Batteries used in the product do not contain:  
Mercury greater the 1ppm by weight  
Cadmium greater than 20ppm by weight

Battery size: CR2032 (coin cell)  
Battery type: Lithium

- Additional Information**
- This product is in compliance with the Restrictions of Hazardous Substances (RoHS) directive - 2011/65/EC.
  - This HP product is designed to comply with the Waste Electrical and Electronic Equipment (WEEE) Directive – 2002/96/EC.
  - This product is in compliance with California Proposition 65 (State of California; Safe Drinking Water and Toxic Enforcement Act of 1986).
  - This product is in compliance with the IEEE 1680 (EPEAT) standard at the <Gold> level, see [www.epeat.net](http://www.epeat.net)
  - Plastics parts weighing over 25 grams used in the product are marked per ISO11469 and ISO1043.
  - This product contains 0.0% post-consumer recycled plastic (by wt.)
  - This product is 96.0% recycle-able when properly disposed of at end of life.

<b>Packaging Materials</b>	<b>External:</b>	PAPER/Corrugated	366 g
	<b>Internal:</b>	PLASTIC/EPE (Expanded Polyethylene)	42 g
		PLASTIC/Polyethylene low density	14.5 g
		PLASTIC/Polypropylene	3.2 g

The plastic packaging material contains at least 50% recycled content.  
The corrugated paper packaging materials contains at least 70% recycled content.

**Material Usage** This product does not contain any of the following substances in excess of regulatory limits (refer to the



### Technical Specifications

HP General Specification for the Environment at <http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/gse.pdf>:

- Asbestos
- Certain Azo Colorants
- Certain Brominated Flame Retardants – may not be used as flame retardants in plastics
- Cadmium
- Chlorinated Hydrocarbons
- Chlorinated Paraffins
- Formaldehyde
- Halogenated Diphenyl Methanes
- Lead carbonates and sulfates
- Lead and Lead compounds
- Mercuric Oxide Batteries
- Nickel – finishes must not be used on the external surface designed to be frequently handled or carried by the user.
- Ozone Depleting Substances
- Polybrominated Biphenyls (PBBs)
- Polybrominated Biphenyl Ethers (PBBEs)
- Polybrominated Biphenyl Oxides (PBBOs)
- Polychlorinated Biphenyl (PCB)
- Polychlorinated Terphenyls (PCT)
- Polyvinyl Chloride (PVC) – except for wires and cables, and certain retail packaging has been voluntarily removed from most applications.
- Radioactive Substances
- Tributyl Tin (TBT), Triphenyl Tin (TPT), Tributyl Tin Oxide (TBTO)

#### Packaging Usage

HP follows these guidelines to decrease the environmental impact of product packaging:

- Eliminate the use of heavy metals such as lead, chromium, mercury and cadmium in packaging materials.
- Eliminate the use of ozone-depleting substances (ODS) in packaging materials.
- Design packaging materials for ease of disassembly.
- Maximize the use of post-consumer recycled content materials in packaging materials.
- Use readily recyclable packaging materials such as paper and corrugated materials.
- Reduce size and weight of packages to improve transportation fuel efficiency.
- Plastic packaging materials are marked according to ISO 11469 and DIN 6120 standards.

#### End-of-life Management and Recycling

Hewlett-Packard offers end-of-life HP product return and recycling programs in many geographic areas. To recycle your product, please go to: <http://www.hp.com/go/reuse-recycle> or contact your nearest HP sales office. Products returned to HP will be recycled, recovered or disposed of in a responsible manner.

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: <http://www.hp.com/go/recyclers>. 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.





## Technical Specifications

**Hewlett-Packard  
Corporate  
Environmental  
Information**

For more information about HP's commitment to the environment:

- Global Citizenship Report  
<http://www.hp.com/hpinfo/globalcitizenship/gcreport/index.html>
- Eco-label certifications  
<http://www8.hp.com/us/en/hp-information/environment/ecolabels.html>
- ISO 14001 certificates:  
<http://h20195.www2.hp.com/V2/GetDocument.aspx?docname=c04755842>  
 and  
<http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/cert.pdf>

## HP ProBook 650 G2 Notebook PC

**Eco-Label Certifications & declarations**

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:

- IT ECO declaration
- US ENERGY STAR®
- EPEAT <Gold> registered in the United States. See <http://www.epeat.net> for registration status in your country.

**System Configuration**

The configuration used for the Energy Consumption and Declared Noise Emissions data for the Notebook model is based on a “Typically Configured Notebook”.

**Energy Consumption  
(in accordance with US  
ENERGY STAR® test  
method)**

	115VAC, 60Hz	230VAC, 50Hz	100VAC, 60Hz
Normal Operation (Sort idle)	8.44 W	9.26 W	8.62 W
Normal Operation (Long idle)	5.69 W	5.73 W	5.61 W
Sleep	0.62 W	0.74 W	0.6 W
Off	0.41 W	0.54 W	0.4 W

**Note:**

Energy efficiency data listed is for an ENERGY STAR® compliant product if offered within the model family. HP computers marked with the ENERGY STAR® Logo are



## Technical Specifications

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.

Heat Dissipation*	115VAC, 60Hz	230VAC, 50Hz	100VAC, 60Hz
Normal Operation (Short idle)	29 BTU/hr	32 BTU/hr	29 BTU/hr
Normal Operation (Long idle)	19 BTU/hr	20 BTU/hr	19 BTU/hr
Sleep	2 BTU/hr	3 BTU/hr	2 BTU/hr
Off	1 BTU/hr	2 BTU/hr	1 BTU/hr

\*NOTE: Heat dissipation is calculated based on the measured watts, assuming the service level is attained for one hour.

Declared Emissions (in accordance with ISO 7779 and ISO 9296)	Noise	Sound Power (L <sub>WAd</sub> , bels)	Sound Pressure (L <sub>pAm</sub> , decibels)
Typically Configured – Idle		3.0	19
Fixed Disk – Random writes		3.0	20

**Longevity and Upgrading** This product can be upgraded, possibly extending its useful life by several years. Upgradeable features and/or components contained in the product may include:

- 3 USB ports
- 1 PC card slot (type I/II)
- 1 ExpressCard/54 slot
- 1 IEEE 1394 Port
- 2 SODIMM memory slots
- Optional expansion base docking station
- 1 multi-bay II storage port
- Interchangeable HDD



## Technical Specifications

Spare parts are available throughout the warranty period and or for up to “5” years after the end of production.

### Batteries

This battery(s) in this product comply with EU Directive 2006/66/EC

Batteries used in the product do not contain:

- Mercury greater than 1ppm by weight
- Cadmium greater than 20ppm by weight

Battery size: CR2032 (coin cell)

Battery type: Lithium

### Additional Information

- This product is in compliance with the Restrictions of Hazardous Substances (RoHS) directive - 2011/65/EC.
- This HP product is designed to comply with the Waste Electrical and Electronic Equipment (WEEE) Directive – 2002/96/EC.
- This product is in compliance with California Proposition 65 (State of California; Safe Drinking Water and Toxic Enforcement Act of 1986).
- This product is in compliance with the IEEE 1680 (EPEAT) standard at the <gold> level, see [www.epeat.net](http://www.epeat.net)
- Plastics parts weighing over 25 grams used in the product are marked per ISO11469 and ISO1043.
- This product contains 0% post-consumer recycled plastic (by wt.)
- This product is 96.5% recycle-able when properly disposed of at end of life.

### Packaging Materials

<b>External:</b>	PAPER/Paper	360.2g
<b>Internal:</b>	PLASTIC/EPE (Expanded Polyethylene)	23.6 g
	PLASTIC/Polyethylene low density	13.6 g

The plastic packaging material contains at least 50% recycled content.

The corrugated paper packaging materials contains at least 70% recycled content.

### Material Usage

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 <http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/gse.pdf>):

- Asbestos
- Certain Azo Colorants
- Certain Brominated Flame Retardants – may not be used as flame retardants in plastics
- Cadmium
- Chlorinated Hydrocarbons
- Chlorinated Paraffins
- Formaldehyde
- Halogenated Diphenyl Methanes
- Lead carbonates and sulfates



## Technical Specifications

- Lead and Lead compounds
- Mercuric Oxide Batteries
- Nickel – finishes must not be used on the external surface designed to be frequently handled or carried by the user.
- Ozone Depleting Substances
- Polybrominated Biphenyls (PBBs)
- Polybrominated Biphenyl Ethers (PBBEs)
- Polybrominated Biphenyl Oxides (PBBOs)
- Polychlorinated Biphenyl (PCB)
- Polychlorinated Terphenyls (PCT)
- Polyvinyl Chloride (PVC) – except for wires and cables, and certain retail packaging has been voluntarily removed from most applications.
- Radioactive Substances
- Tributyl Tin (TBT), Triphenyl Tin (TPT), Tributyl Tin Oxide (TBTO)

### Packaging Usage

HP follows these guidelines to decrease the environmental impact of product packaging:

- Eliminate the use of heavy metals such as lead, chromium, mercury and cadmium in packaging materials.
- Eliminate the use of ozone-depleting substances (ODS) in packaging materials.
- Design packaging materials for ease of disassembly.
- Maximize the use of post-consumer recycled content materials in packaging materials.
- Use readily recyclable packaging materials such as paper and corrugated materials.
- Reduce size and weight of packages to improve transportation fuel efficiency.
- Plastic packaging materials are marked according to ISO 11469 and DIN 6120 standards.

### End-of-life Management and Recycling

Hewlett-Packard offers end-of-life HP product return and recycling programs in many geographic areas. To recycle your product, please go to: <http://www.hp.com/go/reuse-recycle> or contact your nearest HP sales office. Products returned to HP will be recycled, recovered or disposed of in a responsible manner.

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: <http://www.hp.com/go/recyclers>. 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.



## Technical Specifications

**Hewlett-Packard  
Corporate  
Environmental  
Information**

For more information about HP's commitment to the environment:

Global Citizenship Report

<http://www.hp.com/hpinfo/globalcitizenship/gcreport/index.html>

Eco-label certifications

<http://www8.hp.com/us/en/hp-information/environment/ecolabels.html>

ISO 14001 certificates:

[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)

and

<http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/cert.pdf>

## COUNTRY OF ORIGIN

China



Options and Accessories (Sold separately and availability may vary by country.)

<b>Type</b>	<b>Description</b>	<b>Part Number</b>
<b>Docking</b>	HP 3001pr USB 3.0 Port Replicator	F3S42AA
	HP 3005pr USB 3.0 Port Replicator	H1L08AA#xxx
	HP Display and Notebook Stand II	E8G00AA#xxx
	Universal Port Replicator	E6D70AA#xxx
	HP UltraSlim Docking Station	D9Y32AA#xxx
<b>Input/Output/Audio</b>	HP USB Travel Mouse	G1K28AA#xxx
	HP Ultrathin Wireless Mouse SE	L9V77AA
	HP Ultrathin Wireless Mouse	L9V78AA
	HP Stereo USB Headset	T1A67AA
	DisplayPort to HDMI Adapter	F3W43AA
	DisplayPort to DVI Adapter	F7W96AA
<b>Power</b>	HP 45W Smart AC Adapter (4.5mm)	H6Y88AA#xxx
	HP 65W Smart AC Adapter	H6Y89AA#xxx
<b>Storage - External Storage</b>	HP USB External DVDRW Drive	F2B56AA
<b>Security</b>	HP UltraSlim Keyed Cable Lock	H4D73AA
	HP USB Smart Card Reader	F6V67AA
	HP Docking Station Cable Lock	AU656AA#XXX
<b>Display</b>	HP ProDisplay P232	K7X31AA
	HP ProDisplay P222va	K7X30AA
	HP ProDisplay P222c	L4J08AA



## Summary of Changes

<b>Date of change:</b>	<b>Version History:</b>		<b>Description of change:</b>
January 21, 2016	Version 1 to 2	Added	Environmental info
January 29, 2016	Version 2 to 3	Updated	MIL STD testing Battery life and stand by time Discrete graphics for HP ProBook 650 G2 Display descriptions with CG and nits
February 12, 2016	Version 3 to 4	Changed	Overview statement to Three USB 3.0 ports for fast data transfer from devices: 1 standard, 1 charging, and one USB-C™ charging port
February 18, 2016	Version 4 to 5	Added	Security specs to the back for Finger Print Reader and Smart Card Reader
February 18, 2016	Version 5 to 6	Updated	Intel® 802.11a/b/g/n/ac specs to 4.0
		Added	Specs for panels
March 3, 2016	Version 6 to 7	Added	Battery recharge times, new broadband module: Broadcom 802.11a/b/g/n (2x2) and Bluetooth® 4.0 Combo
		Removed	Intel® 802.11a/b/g/n (2x2) and Bluetooth® 4.2 Combo
March 31, 2016	Version 7 to 8	Changed	TPM upgrade footnote
May 5, 2016	Version 8 to 9	Changed	TPM 1.2 to 2.0
June 8, 2016	Version 9 to 10	Added	Storage and drives section
June 30, 2016	Version 10 to 11	Added	Numeric pad callout to 650 G2
August 8, 2016	Version 11 to 12	Changed	Processors and chipset section
September 9, 2016	Version 12 to 13	Changed	Cache spec on HDD
March 16, 2016	Version 13 to 14	Updated	Memory section updated (Added Memory)
March 24, 2017	Version 14 to 15	Updated	Displays section updated
April 14, 2017	Version 15 to 16	Updated	Storage and Drives section updated
September 22, 2017	Version 16 to 17	Updated	Touchpoint Manager removed
January 28, 2018	Version 17 to 18	Update	Longevity and Upgrading section removed from HP ProBook 640 G2 Notebook PC

