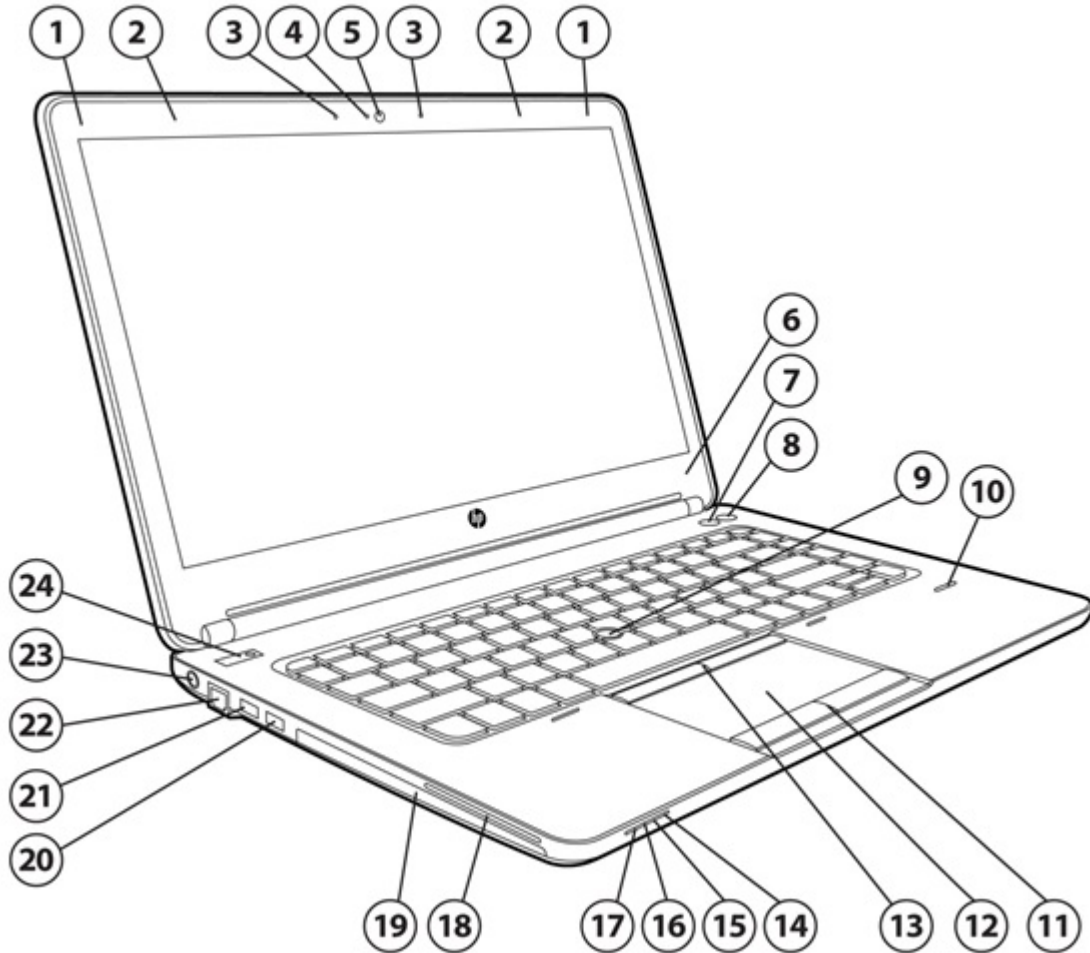


### Overview

#### HP ProBook 640 G1 Notebook PC



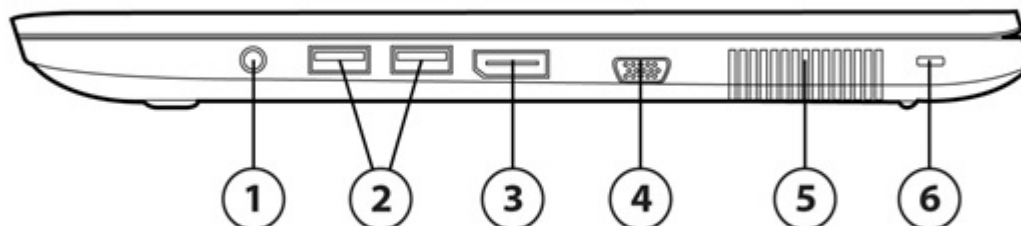
#### Front/Left

- |   |   |
|---|---|
| 1. WLAN antennas (2)*                       | 13. Pointing stick buttons (select models only) |
| 2. WWAN antennas (2)*                       | 14. Hard drive light                            |
| 3. Internal dual-microphone array (2)**     | 15. AC adapter/Battery light                    |
| 4. Webcam light (select models only)        | 16. Power light                                 |
| 5. Webcam (select models only)              | 17. Wireless light                              |
| 6. Internal display switch                  | 18. Smart Card Reader                           |
| 7. Wireless button                          | 19. Optical Drive (select models only)          |
| 8. Volume mute button                       | 20. USB 3.0 port (1)                            |
| 9. Pointing stick (select models only)      | 21. USB 3.0 Charging port                       |
| 10. Fingerprint reader (select models only) | 22. RJ-45 (network) jack/lights                 |
| 11. Touchpad buttons                        | 23. Power connector                             |
| 12. Touchpad zone                           | 24. Power button                                |

### Overview

\* The antennas are not visible from the outside of the computer. For optimal transmission, keep the areas immediately around the antennas free from obstructions.

\*\* Models without optional webcam have single integrated microphone on left side of display panel.

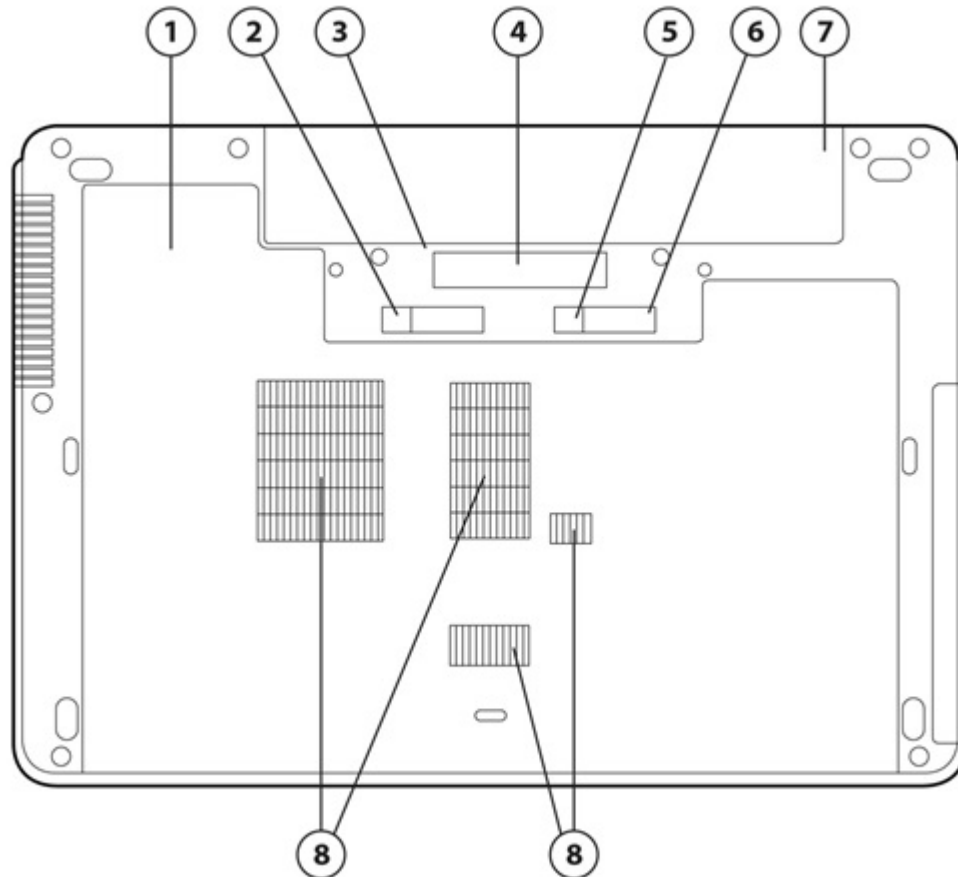


1. Audio-out (headphone) jack/Audio-in (microphone) jack
2. USB 3.0 ports (2)
3. DisplayPort 1.2

#### Right

4. External VGA monitor port
5. Vents (2)
6. Security cable slot

## Overview

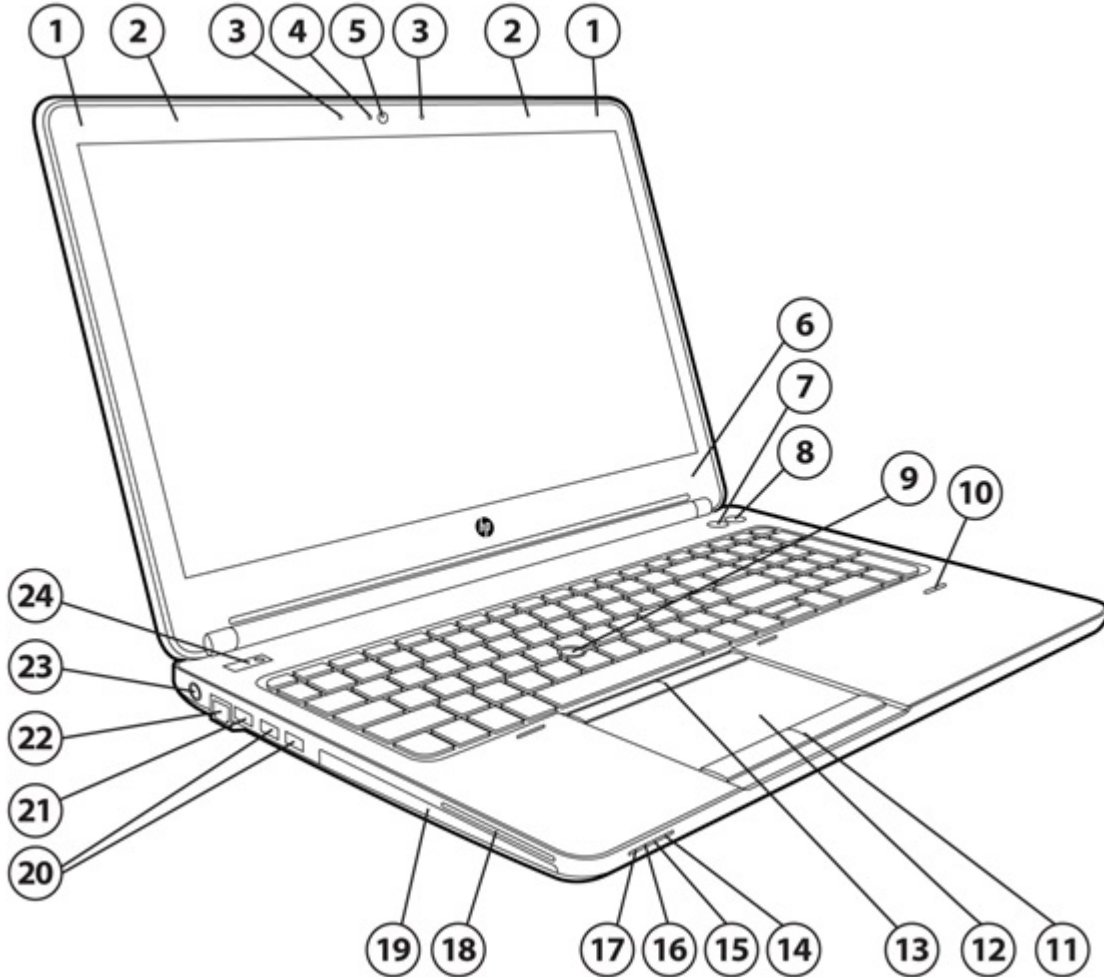


### Bottom

- |  |                               |
|--|-------------------------------|
| 1. Service cover                       | 5. Service cover release lock |
| 2. Battery release latch               | 6. Service door release latch |
| 3. SIM card slot- (inside battery bay) | 7. Battery bay                |
| 4. Docking connector                   | 8. Vents                      |

## HP ProBook 650 G1 Notebook PC

## Overview



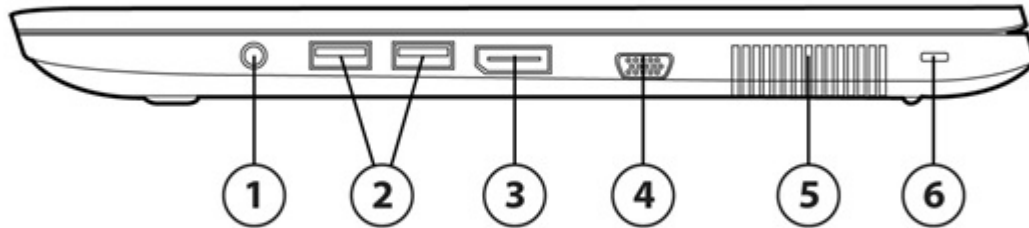
### Front/Left

- |   |   |
|---|---|
| 1. WLAN antennas (2)*                       | 13. Pointing stick buttons (select models only) |
| 2. WWAN antennas (2)*                       | 14. Hard drive light                            |
| 3. Internal dual-microphone array (2)**     | 15. AC adapter/Battery light                    |
| 4. Webcam light (select models only)        | 16. Power light                                 |
| 5. Webcam (select models only)              | 17. Wireless light                              |
| 6. Internal display switch                  | 18. Smart Card Reader                           |
| 7. Wireless button                          | 19. Optical Drive (select models only)          |
| 8. Volume mute button                       | 20. USB 3.0 ports (2)                           |
| 9. Pointing stick (select models only)      | 21. USB 3.0 charging                            |
| 10. Fingerprint reader (select models only) | 22. RJ-45 (network) jack                        |
| 11. Touchpad buttons                        | 23. Power connector                             |
| 12. Touchpad zone                           | 24. Power button                                |

\* The antennas are not visible from the outside of the computer. For optimal transmission, keep the areas immediately around the antennas free from obstructions.

\*\* Models without optional webcam have single integrated microphone on left side of display panel.

## Overview

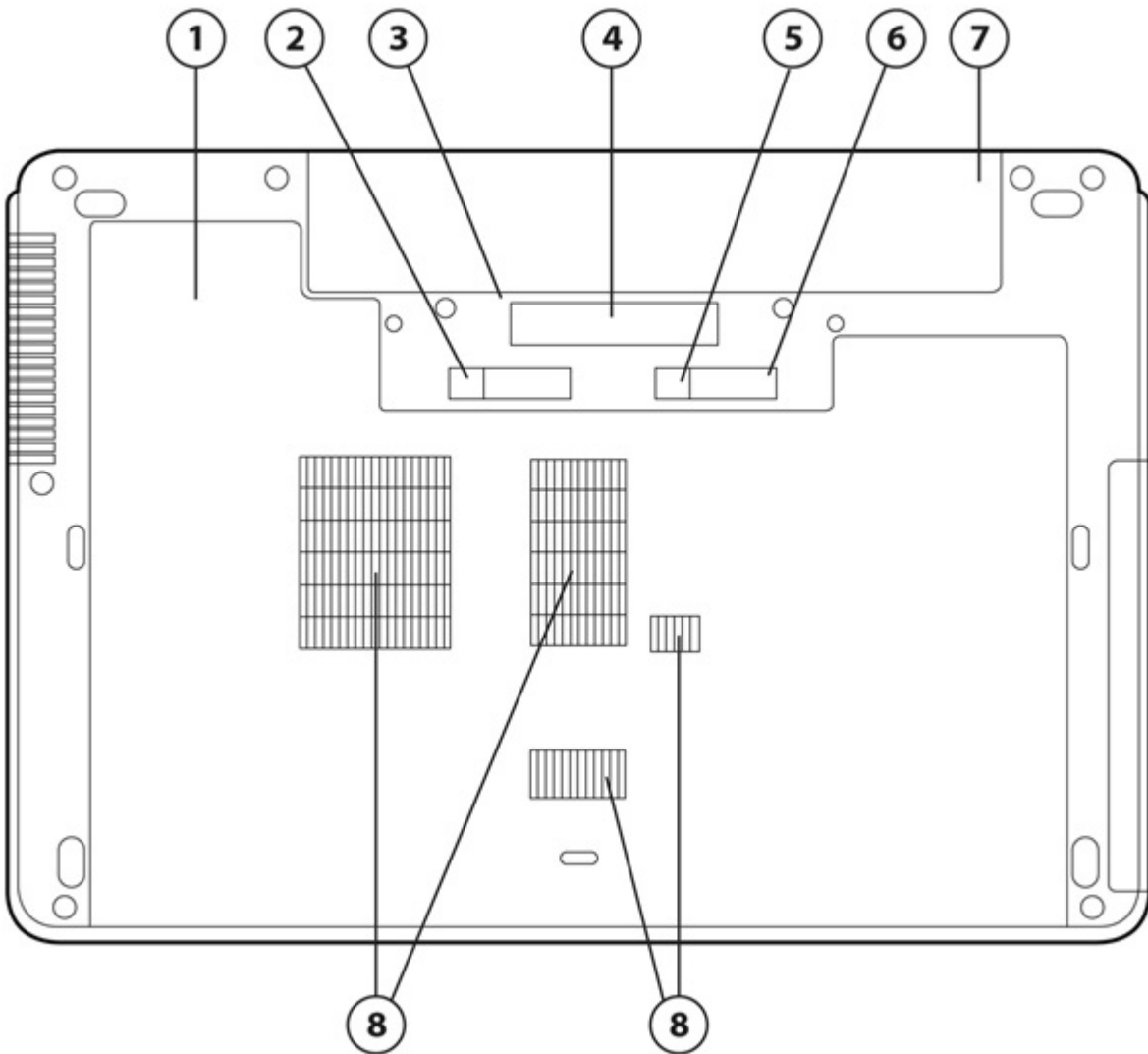


1. Audio-out (headphone) jack/Audio-in (microphone) jack
2. USB 3.0 ports (2)
3. DisplayPort 1.2

### Right

4. External VGA monitor port
5. Vents (2)
6. Security cable slot

## Overview



### Bottom

- |                                       |                               |
|---------------------------------------|-------------------------------|
| 1. Service cover                      | 5. Service cover release lock |
| 2. Battery release latch              | 6. Service door release latch |
| 3. SIM card slot (inside battery bay) | 7. Battery bay                |
| 4. Docking connector                  | 8. Vents                      |

## Overview

### At A Glance

- Windows 8 versions, Windows 7 versions, SUSE Linux, or FreeDOS 2.0
- New thinner and lighter design ;V PC-ABS (Polycarbonate;VAcrylnitrile/Butadiene/Styrene) durable material is nearly 20% thinner than previous generation; 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
- Full-sized spill-resistant keyboard; full separate numeric keypad (HP ProBook 650 only)
- Choice of 4th generation Intel® Core. i7, i5 and i3 processors
- Integrated Intel® HD Graphics 4600 or AMD Radeon™ HD 8750M discrete graphics with 1 GB dedicated GDDR5 video memory
- New User Experience Software: HP ePrint, HP Wireless Hotspot (Win 8 only), HP PageLift, HP Trust Circles, HP Mobile Connect (EMEA only)
- Enhanced security features including HP Client Security, new HP Trust Circles and optional HP Fingerprint Reader
- LED-backlit display
  - HP ProBook 640: 14.0-inch diagonal HD, HD+, FHD
  - HP ProBook 650: 15.6-inch diagonal HD or FHD
- Optional HD webcam with dual-microphone array for video conferencing
- DisplayPort 1.2 now native with integrated graphics
- Four USB 3.0 (640) or Five USB 3.0 (650) ports for fast data transfer from devices (1 charging)
- HD Audio with DTS Studio Sound optimized for high fidelity audio
- Wireless and speaker mute button to conveniently manage the connectivity and speaker.
- Flexible wireless connectivity options:
  - HP Connection Manager allows full control over wireless connections, including 3G and 4G mobile broadband, Wi-Fi, Ethernet and Bluetooth® (Win 7 only)
  - HP Mobile Connect (EMEA Only) (Win 8 Only)
  - Integrated 4G HP Mobile Broadband Modules
  - Integrated 802.11 b/g/n or a/b/g/n wireless LAN module
  - Integrated 802.11 ac, a/b/g/n or b/g/n with Bluetooth 4.0 combo card (Linux supports Bluetooth 2.1 only) (Bluetooth sold separately or as an optional feature)
  - HP Wireless Hotspot (Win 8 Only)
  - Intel WiDi Software
- Choice of 7200 rpm user-removable hard drive (up to 500 GB) with HP 3D DriveGuard, 5400 rpm user-removable hard drive (up to 1 TB), 500 GB 7200 rpm Self Encrypting Drive, 500 GB 5400 rpm FIPS Self Encrypting Drive, 256 GB SED Solid State Drive, or 128/180 GB Solid State Drive
- M.2 32GB flash cache for Intel Smart Response Technology

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

### Features

#### PRODUCT NAMES

HP ProBook 640 G1 Notebook PC  
HP ProBook 650 G1 Notebook PC

#### OPERATING SYSTEM

**Preinstalled**

- Windows 8 64\*
- Windows 8 Pro 64\*
- Windows 7 Professional 32 (available through downgrade rights from Windows 8 Pro 32)\*\*
- Windows 7 Professional 64 (available through downgrade rights from Windows 8 Pro 64)\*\*
- Windows 7 Professional 32
- Windows 7 Professional 64\*\*\*
- Windows 7 Home Premium 32\*\*\*
- Windows 7 Home Premium 64\*\*\*
- FreeDOS 2.0

\* Not all features are available in all editions of Windows 8. Systems may require upgraded and/or separately purchased hardware, drivers and/or software to take full advantage of Windows 8 functionality. See <http://www.microsoft.com> for details.

\*\* This system is preinstalled with Windows® 7 Pro software and also comes with a license and media for Windows 8 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.

\*\*\* Not all features are available in all editions of Windows 7. This system may require upgraded and/or separately purchased hardware to take full advantage of Windows 7 functionality. See <http://www.microsoft.com/windows/windows-7/> for details.

#### PROCESSOR

- 4th Generation Intel® Core™ i7-4600M with Intel HD Graphics 4600 (2.9 GHz, 4 MB cache, 2 cores)\*  
Up to 3.6 GHz with Intel Turbo Boost Technology
- 4th Generation Intel® Core™ i5-4330M with Intel HD Graphics 4600 (2.8 GHz, 3 MB cache, 2 cores)\*  
Up to 3.5 GHz with Intel Turbo Boost Technology
- 4th Generation Intel® Core™ i5-4200M with Intel HD Graphics 4600 (2.5 GHz, 3 MB cache, 2 cores)\*  
Up to 3.1 GHz with Intel Turbo Boost Technology
- 4th Generation Intel® Core™ i3-4000M with Intel HD Graphics 4600 (2.4 GHz, 3 MB cache, 2 cores)\*

\* Multi-Core is designed to improve performance of certain software products. Not all customers or software applications will necessarily benefit from use of this technology. 64-bit computing on Intel® architecture requires a computer system with a processor, chipset, BIOS, operating system, device drivers, and applications enabled for Intel® 64 architecture. Processors will not operate (including 32-bit operation) without an Intel® 64 architecture-enabled BIOS. Performance will vary depending on your hardware and software configurations. Intel's numbering is not a measurement of higher performance.

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



## Features

### INTEL TURBO BOOST TECHNOLOGY\*

Intel Turbo Boost is a feature that speeds up the CPU for a short time. It is similar to overclocking the processor, except within a framework provided by Intel. This feature provides additional performance and allows the computer to perform certain tasks more quickly. It also draws additional power and generates additional heat. Therefore, if Turbo Boost is used while powered from battery, it causes additional stress on the battery.

Using Turbo Boost while powered from battery might impact battery cycle life. Cycle life describes how long the battery will last before it needs to be replaced. A cycle refers to one complete charge/discharge cycle of the battery. Because Turbo Boost causes extra stress on the battery, it often shortens the lifetime of the battery.

HP decided not to enable Turbo Boost when powered from battery. This decision was based on the desire to give customers the greatest battery cycle life possible. Turbo Boost is enabled when powered from AC adapter.

Based on customer requests, HP will provide an option to enable Turbo Boost while powered from battery. For the 2013 platform, it will be an F10 option. Turbo Boost will be available for devices powered from battery by the end of the year. The additional performance might cause a slight reduction in battery cycle life, but will not void the battery warranty.

\*Implementing Turbo Boost in F10 option is only allowed for batteries over 40WHr.

### CHIPSET

Mobile Intel® HM87 or QM87

### GRAPHICS

Integrated:

Intel® HD\* Graphics 4600

Discrete:

AMD Radeon™ HD 8750M\*\*, with 1 GB dedicated DDR5 video memory\*\*\*

\* HD content required to view HD images.

\*\*\* 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).

## Features

### DISPLAY

#### HP ProBook 640

##### Internal

14.0" diagonal LED-backlit HD anti-glare SVA eDP 1.2 flat (1366x768)

14.0" diagonal LED-backlit HD+ anti-glare SVA eDP 1.2 flat (1366x768)

##### External

Up to 32-bit per pixel color depth

##### VGA

Port supports resolutions up to 1920 x 1200 external resolution @75 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

##### DVI-D (single link)

Video signal available through DVI port in optional HP Docking Station (sold separately)

supports resolutions up to 1600 x 1200 at both full and reduced blanking, and 1920 x 1200 at reduced blanking

**NOTE:** HD content required to view HD images.

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

#### HP ProBook 650

##### Internal

15.6" diagonal LED-backlit HD anti-glare SVA eDP 1.2 flat (1366x768)

15.6" diagonal LED-backlit FHD anti-glare SVA eDP 1.2 slim (1920x1080)

##### External

Up to 32-bit per pixel color depth

##### VGA

Port supports resolutions up to 1920 x 1200 external resolution @75 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

##### DVI-D (single link)

Video signal available through DVI port in optional HP Docking Station (sold separately)

supports resolutions up to 1600 x 1200 at both full and reduced blanking, and 1920 x 1200 at reduced blanking

**NOTE:** HD content required to view HD images.

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

## Features

### STORAGE AND DRIVES

#### Primary Storage Bay

##### Hard Drives\*

320/500 GB 7200 rpm SMART SATA II HDD  
500 GB 7200 rpm SED (Self Encrypting Drive)

##### Solid State Drive\*

128/180 GB 2.5" Solid State Drive  
256 GB SED Solid State Drive

#### HP 3D DriveGuard (Windows only)

The hard drive is mounted directly to the notebook frame, reducing the transmission of shock to the hard drive

\*For hard drives and solid state drives, GB = 1 billion bytes. Actual formatted capacity is less. Up to 16 GB (for Windows 7) and 36 GB (for Windows 8) of system disk is reserved for the system recovery software.\*

\* FIPS-certified, hardware-based AES-256 encryption image

**NOTE:** For hard drives, GB = 1 billion bytes. Actual formatted capacity is less. Up to 16 GB (for Windows 7) and 36 GB (for Windows 8) of system disk is reserved for the system recovery software.

### OPTICAL DRIVES

#### Fixed 9.5 mm Serial ATA Upgrade Bay

DVD+/-RW SuperMulti DL Drive  
DVD-ROM Drive

#### Weight saver

### FLASH CACHE

32 GB M.2 (NGFF)

Optional 32 GB mSATA flash cache module support for Intel Smart Response Technology. (Available only with standard non-SED hard drive.)

## Features

### MEMORY

#### Standard

DDR 3L PC3L-12800 (1600 MHz)  
Two SODIMM slots supporting dual-channel memory  
4 GB and 8 GB SODIMMs

#### Maximum

Upgradeable to 16384 MB with optional 8192 MB SODIMMs in slots 1 and 2

#### Dual-channel

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

\* Maximum memory capacities assume Windows 64-bit operating systems or Linux. With Windows 32-bit operating systems, memory above 3 GB may not all be available due to system resource requirements.

**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

#### Wireless

Support for a broad range of secure, integrated wireless LAN and wireless WAN options featuring support for the latest industry standards. Broadband Wireless (WWAN) requires a Windows operating system and is available in select countries as a standard, factory configurable feature only. Integrated Bluetooth is also available (factory configurable only) and can be combined with any of the supported wireless LAN and wireless WAN options.

#### Broadband Wireless (WWAN)

HP hs3110 HSPA+ Mobile Broadband\*  
HP lt4111 LTE/EV-DO/HSPA+ Mobile Broadband Module\*,\*\* (US)  
HP lt4112 LTE/HSPA+ Mobile Broadband Module\*,\*\* (EMEA, APJ)

#### Wireless LAN (WLAN)\*

Atheros 802.11b/g/n (1x1)\*\*\*  
Broadcom 802.11a/b/g/n (2x2) and Bluetooth 4.0 Combo\*\*\*, \*\*\*\*\*  
Intel® Centrino Advanced N-6235 802.11a/b/g/n and Bluetooth 4.0 Combo\*\*\*, \*\*\*\*\*

**NOTE:** Supports Bluetooth® v2.1 on Linux operating systems

\* WWAN is an optional feature sold separately or as an add on feature. WWAN connection requires wireless data service contract, network support, and is not available in all areas. Contact service provider to determine the coverage area and availability. Connection speeds will vary due to location, environment, network conditions, and other factors.

\*\* 4G LTE not available on all products, in all regions and only available on products featuring Intel processors.

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

\*\*\*\* The specifications for the 802.11ac WLAN are draft specifications and are not final. If the final specifications differ from the draft specifications, it may affect the ability of the notebook to communicate with other 802.11ac WLAN devices.

\*\*\*\*\* Bluetooth sold separately or as an optional feature.

#### Communications

Intel I218LM Gigabit Network Connection\*  
56K V.92 modem\*\* (available as a factory configurable option)

\* 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.

\*\* Designed for downloads from 56K modem compliant sources. Maximum achievable download transmission rates currently do

## Features

not reach 56 KB/s, and will vary with line conditions. Modem availability is subject to country regulatory approval.

## AUDIO/MULTIMEDIA

### Audio

HD Audio with DTS Sound+

(2) Integrated stereo speakers

Integrated digital microphone (dual-microphone array when equipped with optional webcam)- correct use up

Function keys for microphone mute, volume up, volume down

Stereo headphone/line out

Stereo microphone in

### Webcam

Optional\* 720p HD\*\* webcam

- 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

\* Sold separately as an optional feature.

\*\* HD content required to view HD images.

## KEYBOARDS/POINTING DEVICES/BUTTONS & FUNCTION KEYS

### 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. US and International key layouts are available. Includes a separate numeric keypad (HP ProBook 650 only).

### Pointing Devices

Touchpad with gestures support, on/off button with LED indicator, two-way scroll, two pick buttons, optional point stick

### Buttons and Function Keys

Separate launch buttons provide easy access to wireless on/off and speaker mute. Function keys provide control of features including: standby mode, display brightness, external display, microphone mute, volume down, and volume up.

## SOFTWARE AND SECURITY

### Preinstalled Software with Windows Operating System

#### BIOS

HP DriveLock | HP Automatic Drive Lock

HP BIOS Protection\*

HP Disk Sanitizer\*\*

HP SpareKey\*\*\*

Update via Network

Master Record Security

## Features

Power On Authentication  
Pre-Boot Security  
Secure Erase\*\*\*\*  
Hybrid Boot  
Measured Boot  
Secure Boot  
Absolute Persistence Module\*\*\*\*\*

\* HP Tools partition with an HP BIOS required for automatic recovery.

\*\* For the use cases outlined in the DOD 5220.22-M Supplement. Does not support Solid State Drives (SSDs). Initial setup required.

Web history deleted only in Internet Explorer and Firefox browsers and must be user enabled.

\*\*\* Requires initial user set up.

\*\*\*\* For the methods outlined in the National Institute of Standards and Technology Special Publication 800-88.

\*\*\*\*\* The Absolute Persistence 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.

### MultiMedia

CyberLink PowerDVD

### Communication

HP Connection Manager (Windows 7 only)  
HP GPS and Location\*  
HP Mobile Connect\*\* (Windows 8 only)  
HP Wireless Hotspot\*\*\* (Windows 8 only)  
Intel WiDi Software\*\*\*\*  
HP Roaming Alert  
Intel My WiFi and Wireless Drivers

### HP Value Add Software

Getting Started with Windows 8  
HP 3D DriveGuard  
HP ePrint Driver\*\*\*\*\* (HP Exclusive)  
HP Hotkey Support  
HP PageLift (HP Exclusive)  
HP Quick Start  
HP Recovery Manager (Windows 8 only)  
HP Support Assistant W8  
HP Recovery Disc Creator (Windows 7 only)  
UEFI System Diagnostics W8

### 3rd Party

Adobe Flash Player (Commercial)  
Bing Search  
Skype\*\*\*\*\*  
Buy Office

## Features

NOTE: HP Recovery Manager enables fast recovery of the factory preinstalled image if the system becomes corrupted or if important system files are accidentally deleted. Up to 16 GB (for Windows 7) and 36 GB (for Windows 8) of system disk is reserved for the system recovery software.

\*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.

\*\*Internet access required.

\*\*\* The wireless hotspot application requires an active internet connection and separately purchased data plan. While HP wireless hotspot is active, on-device applications will continue to work and will use the same data plan as the wireless hotspot. Wireless hotspot data usage may incur additional charges. Check with your service provider for plan details. Requires Windows.

\*\*\*\* 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.

\*\*\*\*\*Requires an Internet connection to HP web-enabled printer and HP ePrint account registration (for a list of eligible printers, supported documents and image types and other HP ePrint details, see [www.hp.com/go/eprintcenter](http://www.hp.com/go/eprintcenter)). 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.

\*\*\*\*\* Skype is not offered in China.

## Security

### Standard

HP Remote Management of HP Client Security\*

Security Manager

Secure Erase

File Sanitizer\*\*

HP Trust Circles\*\*\* (Planned to be available Fall 2013)

TPM 1.2 Embedded Security Chip

Integrated Smart Card Reader

HP Spare Key

HP Connection Manager

Device Access Manager

Credential Manager

Drive encryption\*\*\*\*

Security lock slot

Security screw for bottom access door

Microsoft Security Essentials\*\*\*\*\* (Win 7)

Computrace Support\*\*\*\*\*

Absolute Data Protect

MS Defender (WIN8)

### Optional

HP Fingerprint Sensor (plug)

\* Not all features are remotely manageable.

\*\* For the use cases outlined in the DOD 5220.22-M Supplement. Does not support Solid State Drives (SSDs). Initial setup required. Web history deleted only in Internet Explorer and Firefox browsers and must be user enabled.

\*\*\* HP Trust Circles Standard, when included, allows up to 5 Trust Circles with up to 5 contacts in each Trust Circle. Optional Trust Circles Professional required for unrestricted number of Trust Circles and members contacts. Trust Circles Reader is

## Features

available to allow a contact to participate in an invited Trust Circle. Requires Windows

\*\*\*\*\* Requires Windows. Data is protected prior to Drive Encryption login. Turning the PC off or into hibernate logs out of Drive Encryption and prevents data access. Drive encryption planned to be available in October 2013.

\*\*\*\*\* Opt in and internet connection required for updates.

\*\*\*\*\* The Absolute Persistence agent is shipped turned off, and is activated with customer purchase of a subscription. Service may be limited. Check with Absolute for availability outside the U.S. The optional subscription service of Absolute Recovery Guarantee is a limited warranty. Certain conditions apply. For full details visit:

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

For more information on HP security solutions refer to: <http://www.hp.com/go/security>.

## POWER

### Power Supply

Models with discrete graphics:

External 90W HP Smart AC Adapter

Models with integrated graphics:

External 65W HP Smart AC Adapter

External 90W HP Smart AC Adapter

Power cord included is 1.8 m (+/- 0.1 m) or 1.0 m (+/- 0.1 m).

Total length including external AC adapter is TBD feet (TBD meter).

HP Fast Charge\*

### Primary Battery

HP 9-cell Lithium-Ion Battery (100 WHr)

HP 6-cell Lithium-Ion Battery (55 WHr)

HP 6-cell Long Life Lithium-Ion Battery (55 WHr)

HP 3-cell Lithium-Ion Battery (33 WHr)

### Battery Life\*

#### Configurations with integrated graphics

#### Configurations with discrete graphics

#### HP ProBook 640

6-cell (55 WHr) battery Up to 13 hours 35 minutes

Up to 13 hours 13 minutes

6-cell Long Life (55 WHr) battery Up to 11 hours 18 minutes

Up to 11 hours 5 minutes

#### HP ProBook 650

6-cell (55 WHr) battery Up to 13 hours 28 minutes

Up to 13 hours 11 minutes

6-cell Long Life (55 WHr) battery Up to 11 hours 7 minutes

Up to 10 hours 56 minutes

### System Standby Time\*\*

Up to TBD days

\* Windows 7 battery life will vary depending on numerous 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.

\*\* Standby life will vary depending on various factors including battery, Memory, CPU, EC and LAN chip. The maximum capacity of



## Features

the battery will naturally decrease with time and usage.

**NOTE:** Fast Charge recharges your battery up to 90% within 90 minutes when the system is off (3- and 6-cell only).

### Power Conservation

AMD PowerPlay technology (discrete models)  
Hibernation  
Standby  
ACPI compliance

## WEIGHTS & DIMENSIONS

### HP ProBook 640 Notebook PC

#### Weight

Starting at 4.40 lb (2.0 kg) with weight saver (weight will vary by configuration)  
Starting at 4.69 lb (2.13 kg) with optical drive (weight will vary by configuration)

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

13.39 x 9.33 x 0.99 (front)/1.14 (rear) in  
34.0 x 23.7 x 2.53 (front)/2.90 (rear) cm

### HP ProBook 650 Notebook PC

#### Weight

Starting at 5.1 lb (2.32 kg) with weight saver (weight will vary by configuration)  
Starting at 5.39 lb (2.50 kg) with optical drive (weight will vary by configuration)

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

37.80 x 25.70 x 2.53 (front) -2.90 cm (rear)

## PORTS/SLOTS

### Ports

USB 3.0 – Three (640)  
USB 3.0 – Four (650)  
USB 3.0 charging port– One  
DisplayPort 1.2 – One  
VGA – One  
Stereo microphone input – One  
Headphone/line out – One  
RJ-45 (Ethernet) – One  
RJ-11 (Modem)- One (available as a factory configurable option)  
Docking connector – One  
RS-232 serial port– One\*  
Power connector – One  
\* ProBook 650 only

### Expansion Slots

Media Card Reader  
- supports SD, SDHC, SDXC

## Features

### SERVICE AND SUPPORT

HP Services offers limited 3-year and 1-year warranty options depending on country; 1-year limited warranty on primary battery. On-site service and warranty upgrades are also available. Optional\* HP Care Pack Services\*\* are extended service contracts which go beyond your standard warranties. For more details visit: <http://www.hp.com/go/lookuptool>.

\*Sold separately or as an optional feature.

\*\* 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>

**NOTE:** Service levels and response times for HP Care Packs may vary depending on your geographic location. Service starts on date of hardware purchase. Restrictions and limitations apply. For details, visit: [www.hp.com/go/cpc](http://www.hp.com/go/cpc)

## Technical Specifications

### SYSTEM UNIT

<b>Stand-Alone Power Requirements</b> (AC Power)	Nominal Operating Voltage	TBD
	Average Operating Power	TBD W
	Max Operating Power	Discrete < 90W UMA < 65W or 90W
Temperature	Operating	32° to 95° F (0° to 35° C) (not writing optical) 41° to 95° F (5° to 35° C) (writing optical)
	Non-operating	-4° to 140° F (-20° to 60° C)
Relative Humidity	Operating	10% to 90%, non-condensing
	Non-operating	5% to 95%, 101.6° F (38.7° C) maximum wet bulb temperature
Shock	Operating	40 G, 2 ms, half-sine
	Non-operating	200 G, 2 ms, half-sine
Random Vibration	Operating	0.75 grms
	Non-operating	1.50 grms
<b>Altitude</b> (unpressurized)	Operating	-50 to 10,000 ft (-15.24 to 3,048 m)
	Non-operating	-50 to 40,000 ft (-15.24 to 12,192 m)
Planned Industry Standard Certifications	UL	Yes
	CSA	Yes
	FCC Compliance	Yes
	ENERGY STAR®	Select models*
	EPEAT	Registered TBD in United States**
	ICES	Yes
	Australia / NZ A-Tick Compliance	Yes
	CCC	Yes
	Japan VCCI Compliance	Yes
	KC	Yes
	BSMI	Yes
	CE Marking Compliance	Yes
	BNCI or BELUS	Yes
	CIT	Yes
	GOST	Yes
Saudi Arabian Compliance (ICCP)	Yes	
SABS	Yes	
UKRSERTCOMPUTER	Yes	

\* Configurations of the HP ProBook 640 and HP ProBook 650 that are ENERGY STAR qualified are identified as HP ProBook 640 ENERGY STAR and HP ProBook 650 ENERGY STAR on HP websites and on [www.energystar.gov](http://www.energystar.gov).

\*\* EPEAT registration varies by country. See [www.epeat.net](http://www.epeat.net) for registration status by country. EPEAT status listed above applies to U.S.

For accessibility information on HP products, please visit: <http://www.hp.com/accessibility>.



## Technical Specifications

### DISPLAYS

<b>14" diagonal LED-backlit HD anti-glare SVA flat (1366 x 768)</b>	<b>Outline Dimensions</b> (W x H x D)	12.6 x 8.09 x 0.14 in (32.09 x 20.56 x 0.36 cm)
	<b>Active Area</b>	12.18 x 6.85 in (30.94 x 17.395 cm)
	<b>Weight</b>	0.71 lb (320g) (max)
	<b>Diagonal Size</b>	14.0 in (35.6cm)
	<b>Surface Treatment</b>	Anti-glare
	<b>Contrast Ratio</b>	300:1 (min)
	<b>Refresh Rate</b>	60 Hz
	<b>Brightness</b>	200 nit (typical)
	<b>Pixel Resolution</b>	<b>Format</b> 1366 x 768 (HD) <b>Configuration</b> RGB Stripe
	<b>Interface</b>	eDP 1.2 (1 lane)
	<b>LCD Mode</b>	TN
	<b>PPI</b>	125 ppi
	<b>Viewing Angle</b>	SVA 40/40/15/30 (Left/Right/Down/Up)
	<b>14" diagonal LED-backlit HD+ anti-glare SVA flat (1600 x 900)</b>	<b>Outline Dimensions</b> (W x H x D)
<b>Active Area</b>		12.19 x 6.86 in (30.96 x 17.415 cm)
<b>Weight</b>		0.72 lb (325 g) (max)
<b>Diagonal Size</b>		14.0 in (35.6cm)
<b>Surface Treatment</b>		Anti-glare
<b>Contrast Ratio</b>		300:1 (min)
<b>Refresh Rate</b>		60 Hz
<b>Brightness</b>		250 nit (typical)
<b>Pixel Resolution</b>		<b>Format</b> 1600 x 900 (HD+) <b>Configuration</b> RGB Stripe
<b>Interface</b>		eDP 1.2 (1 lane)
<b>LCD Mode</b>		TN
<b>PPI</b>		131 ppi
<b>Viewing Angle</b>		SVA 40/40/15/30 (Left/Right/Down/Up)

## Technical Specifications

<b>14" diagonal LED-backlit FHD anti-glare UWVA slim (1920 x 1080)</b>	<b>Outline Dimensions</b> (W x H x D)	12.6 x 8.09 x 0.12 in (32.09 x 20.56 x 0.3 cm)	
	<b>Active Area</b>	12.18 x 6.85 in (30.93 x 17.4 cm)	
	<b>Weight</b>	0.75 lb (340 g) (max)	
	<b>Diagonal Size</b>	14.0 in (35.6cm)	
	<b>Surface Treatment</b>	Anti-glare	
	<b>Contrast Ratio</b>	600:1 (min)	
	<b>Refresh Rate</b>	60 Hz	
	<b>Brightness</b>	300 nit (typical)	
	<b>Pixel Resolution</b>	<b>Format</b>	1920 x 1080 (FHD)
		<b>Configuration</b>	RGB Stripe
	<b>Interface</b>	eDP 1.3+PSR (2 lane)	
	<b>LCD Mode</b>	IPS/FFS/VA	
	<b>PPI</b>	157 ppi	
	<b>Viewing Angle</b>	UWVA 85/85/85/85 (Left/Right/Down/Up)	
<b>15.6" diagonal LEDbacklit HD anti-glare SVA flat (1366 x 768)</b>	<b>Outline Dimensions</b> (W x H x D)	14.17 x 8.83 x 0.15 in (36.0 x 22.43 x 0.38 cm)	
	<b>Active Area</b>	13.55 x 7.62 in (34.42 x 19.35 cm)	
	<b>Weight</b>	< 1.1 lb (500 g) (max)	
	<b>Diagonal Size</b>	15.6 in (39.62 cm)	
	<b>Surface Treatment</b>	Anti-glare	
	<b>Contrast Ratio</b>	300:1 (min)	
	<b>Refresh Rate</b>	60 Hz	
	<b>Brightness</b>	200 nit (typical)	
	<b>Pixel Resolution</b>	<b>Format</b>	1366 x 768 (HD)
		<b>Configuration</b>	RGB Stripe
	<b>Interface</b>	eDP 1.2 (1 lane)	
	<b>LCD Mode</b>	TN	
	<b>PPI</b>	101 ppi	
	<b>Viewing Angle</b>	SVA 40/40/15/30 (Left/Right/Down/Up)	

## Technical Specifications

<b>15.6" diagonal LEDbacklit FHD anti-glare SVA slim (1920 x 1080)</b>	<b>Outline Dimensions</b> (W x H x D)	TBD		
	<b>Active Area</b>	TBD		
	<b>Weight</b>	TBD		
	<b>Diagonal Size</b>	TBD		
	<b>Surface Treatment</b>	TBD		
	<b>Contrast Ratio</b>	TBD		
	<b>Refresh Rate</b>	TBD		
	<b>Brightness</b>	TBD		
	<b>Pixel Resolution</b>	<b>Format</b>	1920 x 1080 (FHD)	
		<b>Configuration</b>	RGB Stripe	
	<b>Interface</b>	eDP 1.2 (2 lane)		
	<b>LCD Mode</b>	TN		
	<b>PPI</b>	TBD		
<b>Viewing Angle</b>	UWVA 85/85/85/85 (Left/Right/Down/Up)			

## STORAGE AND DRIVES

### Internal Storage

<b>320 GB* 5400 rpm SATA Hard Drive</b>	<b>Drive Weight</b>	0.25 lbs (115 g)		
	<b>Capacity</b>	320 GB		
	<b>Height</b>	0.37 in (9.5 mm)		
	<b>Width</b>	2.75 in (70 mm)		
	<b>Interface</b>	ATA-8, SATA 2.6, 3.0 Gb/s, NCQ		
	<b>Transfer Rate</b>	<b>Synchronous (maximum)</b>	300 MB/s (Drive Capability)	
	<b>Seek Time</b> (typical reads, including settling)	<b>Single Track</b>	1.5 ms	
		<b>Average</b>	11 ms	
		<b>Maximum</b>	22 ms	
	<b>Rotational Speed</b>	7200 rpm		
	<b>Logical Blocks</b>	625,142,448		
	<b>Operating Temperature</b>	32° to 140° F (0° to 60° C) [case temp]		
	<b>Features</b>	ATA Security		

## Technical Specifications

### 500 GB\* 5400 rpm SATA Hard Drive

<b>Drive Weight</b>	0.22 lb (101 g)	
<b>Capacity</b>	500 GB	
<b>Height</b>	0.37 in (9.5 mm)	
<b>Width</b>	2.75 in (70 mm)	
<b>Interface</b>	ATA-8, SATA 2.6, 3.0 Gb/s, NCQ	
<b>Transfer Rate</b>	<b>Synchronous</b> (maximum) 300 MB/s (Drive Capability)	
<b>Seek Time</b> (typical reads, including settling)	<b>Single Track</b>	3 ms
	<b>Average</b>	13 ms
	<b>Maximum</b>	24 ms
<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	

### 1 TB\* 5400 rpm SATA Hard Drive

<b>Drive Weight</b>	0.254 lb (115 g)	
<b>Capacity</b>	1 TB	
<b>Height</b>	0.37 in (9.5 mm)	
<b>Width</b>	2.75 in (70 mm)	
<b>Interface</b>	ATA-8, SATA 2.6, 3.0 Gb/s, NCQ	
<b>Transfer Rate</b>	<b>Synchronous</b> (maximum) 300 MB/s (Drive Capability)	
<b>Seek Time</b> (typical reads, including settling)	<b>Single Track</b>	3 ms
	<b>Average</b>	13 ms
	<b>Maximum</b>	24 ms
<b>Rotational Speed</b>	5400 rpm	
<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>	ATA Security	

## Technical Specifications

### 320 GB\* 7200 rpm SATA Hard Drive

<b>Drive Weight</b>	0.25 lbs (115 g)
<b>Capacity</b>	320 GB
<b>Height</b>	0.37 in (9.5 mm)
<b>Width</b>	2.75 in (70 mm)
<b>Interface</b>	ATA-8, SATA 2.6, 3.0 Gb/s, NCQ
<b>Transfer Rate</b>	<b>Synchronous</b> (maximum) 300 MB/s (Drive Capability)
<b>Seek Time</b> (typical reads, including settling)	<b>Single Track</b> 1.5 ms
	<b>Average</b> 11 ms
	<b>Maximum</b> 22 ms
<b>Cache</b>	16 MB
<b>Rotational Speed</b>	7200 rpm
<b>Logical Blocks</b>	625,142,448
<b>Operating Temperature</b>	32° to 140° F (0° to 60° C) [case temp]
<b>Features</b>	ATA Security

### 500 GB\* 7200 rpm SATA Hard Drive

<b>Drive Weight</b>	0.25 lbs (115g)
<b>Capacity</b>	500 GB
<b>Height</b>	0.37 in (9.5 mm)
<b>Width</b>	2.75 in (70 mm)
<b>Interface</b>	ATA-8, SATA 2.6, 3.0 Gb/s, NCQ
<b>Transfer Rate</b>	<b>Synchronous</b> (maximum) 300 MB/s (Drive Capability)
<b>Seek Time</b> (typical reads, including settling)	<b>Single Track</b> 1.5 ms
	<b>Average</b> 11 ms
	<b>Maximum</b> 22 ms
<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



## Technical Specifications

<b>750 GB* 7200 rpm SATA Hard Drive</b>	<b>Drive Weight</b>	0.25 lbs (115g)	
	<b>Capacity</b>	750 GB	
	<b>Height</b>	0.37 in (9.5 mm)	
	<b>Width</b>	2.50 in (63.5 mm)	
	<b>Interface</b>	ATA-8, SATA 2.6, 3.0 Gb/s	
	<b>Transfer Rate</b>	<b>Synchronous</b> (maximum) 300 MB/s (Drive Capability)	
	<b>Seek Time</b> (typical reads, including settling)	<b>Single Track</b>	1.5 ms
		<b>Average</b>	11 ms
		<b>Maximum</b>	22 ms
	<b>Rotational Speed</b>	7200 rpm	
	<b>Logical Blocks</b>	1,465,149,168	
	<b>Operating Temperature</b>	32° to 140° F (0° to 60° C) [case temp]	
	<b>Features</b>	ATA Security	

<b>500 GB* 7200 rpm SMART SATA II Self Encrypting Drive</b>	<b>Drive Weight</b>	0.25 lbs (115g)	
	<b>Capacity</b>	500 GB	
	<b>Height</b>	0.37 in (9.5 mm)	
	<b>Width</b>	2.50 in (63.5 mm)	
	<b>Interface</b>	ATA-8, SATA 2.6, 3.0 Gb/s	
	<b>Transfer Rate</b>	<b>Synchronous</b> (maximum) 300 MB/s (Drive Capability)	
	<b>Seek Time</b> (typical reads, including settling)	<b>Single Track</b>	1 ms
		<b>Average</b>	12 ms
		<b>Maximum</b>	20 ms
	<b>Cache</b>	16 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		

## Technical Specifications

### 500 GB\* 5400 rpm SATA FIPS\*\* Hard Drive

<b>Drive Weight</b>	0.25 lbs (95g)	
<b>Capacity</b>	500 GB	
<b>Height</b>	0.28 in (7 mm)	
<b>Width</b>	2.75 in (70 mm)	
<b>Interface</b>	ATA-8, SATA 2.6, 3.0 Gb/s, NCQ	
<b>Transfer Rate</b>	<b>Synchronous</b> (maximum)	300 MB/s (Drive Capability)
<b>Seek Time</b> (typical reads, including settling)	<b>Single Track</b>	1.5 ms
	<b>Average</b>	11 ms
	<b>Maximum</b>	22 ms
<b>Cache</b>	16 MB	
<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	

### SATA 6 Gb/s 128 GB\*, 2.5- inch Solid State Drive

<b>Drive Weight</b>	73 Grams	
<b>Capacity</b>	128 GB	
<b>Height</b>	0.276 in (7 mm)	
<b>Width</b>	2.76 in (70 mm)	
<b>Interface</b>	SATA 3 (6 Gb/s)	
<b>Performance</b>	<b>Maximum Sequential Read</b>	<b>Maximum Sequential Write</b>
	415 MB/s	175 MB/s
<b>Logical Blocks</b>	250,069,680	
<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [case temp]	
<b>Features</b>	ATA Security; ATA-8; SATA 3.0; DIPM; TRIM	

### SATA 6 Gb/s 180 GB\*, 2.5- inch SATA Solid State Drive

<b>Drive Weight</b>	78 Grams	
<b>Capacity</b>	180 GB	
<b>Height</b>	0.276 in (7 mm)	
<b>Width</b>	2.76 in (70 mm)	
<b>Interface</b>	SATA Gen 3 (6 Gb/s)	
<b>Performance</b>	<b>Maximum Sequential Read</b>	<b>Maximum Sequential Write</b>
	Up to 550 MB/s	Up to 520 MB/s
<b>Logical Blocks</b>	351,651,888	
<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [case temp]	
<b>Features</b>	ATA Security; ATA-8, SATA 3.0; DIPM; TRIM	

## Technical Specifications

<b>SATA 6 Gb/s 256 GB*, 2.5-inch SATA SED Solid State Drive</b>	Drive Weight	73 Grams		
	Capacity	256 GB		
	Height	0.276 in (7 mm)		
	Width	2.76 in (70 mm)		
	Interface	SATA 3 (6 Gb/s)		
	Performance	Maximum Sequential Read	Up to 460 MB/s	Maximum Sequential Write Up to 260 MB/s
		Maximum Sequential Write		
	Logical Blocks	500,118,192		
	Operating Temperature	32° to 158°F (0° to 70°C) [case temp]		
	Features	ATA Security; ATA-8 compliant; SATA 3.0; DIPM; TRIM		

\* For hard drives and solid state drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 16 GB (for Windows 7) and 36 GB (for Windows 8) of system disk is reserved for the system recovery software.

\*\* \* FIPS-certified, hardware-based AES-256 encryption image.

## OPTICAL DRIVES

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

## Technical Specifications

<b>DVD-ROM Drive</b>	<b>Access Times</b>	Random	< 140 ms CD (typical) < 160 ms DVD (typical)
	<b>Max Data Transfer Rate</b>	24X CD-ROM 8X-DVD	
	<b>Transfer Mode</b>	UDMA Mode 5	
	<b>Interface</b>	Gen 1 SATA	
	<b>Supported Media (read)</b>	CD-DA, CD-TEXT, CD-ROM, CD-ROM XA, MIXED MODE CD, CD-I, CD-I Bridge (Photo-CD, Video CD), Multisession CD (Photo-CD, CD-EXTRA, Portfolio, CD-R, CD-RW), CD-R, CD-RW, DVD-ROM (DVD-5, DVD-9, DVD-10, DVD-18), DVD-R, DVD-RW, DVD+R, DVD+RW, DVD-RAM	
	<b>Supported Media (write)</b>	None	
	<b>Max Media Capacity (read)</b>	8.5GB	
	<b>Transport</b>	Tray Loading	

## SECURITY

<b>HP Fingerprint Reader (optional)</b>	<b>Mobile Voltage Operation</b>	3.0V-3.6V
	<b>Operating Temperature</b>	14° - 167°F (-10° - 75°C)
	<b>Current Consumption Image</b>	36 mA peak
	<b>Low Latency Wait for Finger</b>	950 uA
	<b>Capture Rate</b>	3000. lines/sec
	<b>ESD Resistance</b>	IEC 61000-4-2 4B (±15KV)
	<b>Detection Matrix</b>	200*1 (plus another secondary line) 508 dpi 12*3 mm sensor area

## NETWORKING/COMMUNICATIONS

## Technical Specifications

<b>Intel I218LM Gigabit Network Connection</b>	<b>Connector</b>	RJ-45
	<b>System Interface</b>	Integrated on PCA
	<b>Controller</b>	Intel I218LM GbE platform LAN connect networking controller
	<b>Memory</b>	24 KB FIFO packet buffer memory
	<b>Data rates supported</b>	10/100/1000 Mbps
	<b>IEEE Compliance</b>	802.1P
		802.1Q
		802.2
		802.3
		802.3ab
		802.3az 802.3u
	<b>Bus architecture</b>	PCI Express and SMBus
	<b>Data transfer mode</b>	PCIe-based interface for active state operation (S0 state) and SMBus for host and management traffic (Sx low power state)
	<b>Power requirement</b>	Requires 3.3V and 0.9V or just 3.3V with integrated regulators Power consumption 0.733 Watts
	<b>Boot ROM support</b>	Yes
<b>Network transfer mode</b>	Full-duplex	
	Half-duplex (not supported for the 1000BASE-T transceiver)	
<b>Network transfer rate</b>	10BASE-T (half-duplex) 10 Mbps	
	10BASE-T (full-duplex) 20 Mbps	
	100BASE-TX (half-duplex) 100 Mbps	
	100BASE-TX (full-duplex) 200 Mbps	
	1000BASE-T (full-duplex) 2000 Mbps	
<b>Environmental</b>	Operating Temperature: 0° to 85° C	
	Operating Humidity: 60% RH	
<b>Management</b>	WOL, auto MDI crossover, PXE, Multi-port teaming, RSS, Advanced cable diagnostic.	
<b>Alerting</b>	ASF 2.0 support; iAMT 9.0 support	
<b>HP 3110 HSPA+ Mobile Broadband Module*</b>	<b>Technology/Operating Bands</b>	CDMA/1xRTT/EvDO: 800MHz (Cell), 1900MHz (PCS)
		GSM/GPRS/EDGE: 850MHz (Cell), 900MHz (EGSM), 1800MHz (DCS), 1900MHz (PCS)
		UMTS/WCDMA with receive diversity: 2100MHz (UTRA FDD Band I), 1900MHz (UTRA FDD Band II), 900MHz (UTRA FDD Band VIII), 850 MHz (UTRA FDD Band V)
		LTE: 700 MHz (Verizon, Band XIII)
<b>Mobile Operator</b>	Verizon (US only)	
<b>Wireless Protocol Standards</b>	GSM/GPRS/EDGE: Class B, Multi-slot class 10 operation, coding schemes CS1 - CS4 and MSC1 - MSC9.	
	CDMA: 1xEVDO Release 0 and Release A, IS-95A, IS-95B, IS-856, IS-2000	
	UMTS/WCDMA: Release 99 and Release 7	
	LTE: Power Class III as per 3GPP TS 36.101	

## Technical Specifications

<b>Wireless Parametric Standards</b>	Complies with 3GPP specifications Release 8 for LTE
<b>Maximum Data Rates</b>	EvDO (Revision A) - 3.1 Mbps (Download), 1.8 Mbps (Upload) WCDMA (DC-HSPA+) - 42Mbps (Download) LTE (Category 3) - 100 Mbps (Download ), 50Mbps (Upload)
<b>GPS</b>	Standalone, Assisted, XTRA
<b>GPS Bands</b>	1575.42 MHz (± 1.023 MHz)
<b>Maximum Output Power</b>	GSM/GPRS/EDGE: 32dBm (+/-1) WCDMA: 24dBm (+0.7/-2.3) LTE: +23 dBm (+2.7 dBm/-1.7 dBm) 1xRTT/EvDO: +24 dBm (+0.5 dBm/-1.5 dBm)
<b>Maximum Power Consumption</b>	2700mA (peak)
<b>Power Consumption, Sleep Mode</b>	10 mA
<b>Power Management</b>	USB selective suspend Integrated notebook wireless button
<b>Antenna Type</b>	Dual high efficiency 6 band antennae with spatial diversity, mounted in the display enclosure
<b>Form Factor</b>	PCI-Express MiniCard, USB 2.0 interface
<b>Weight</b>	< 10 g
<b>Dimensions</b> (Length x Width x Thickness)	2.01 x 1.18 x 0.18 in (51 x 30 x 4.5 mm)
<b>Voltage, Operating</b>	3.3v +/- 9%
<b>Temperature, Operating</b>	-4° to 149° F (-20° to 65° C)
<b>Temperature, Non-operating, 96 hours</b> (from MIL-STD 202 Method 108)	-40° to 185° F (-40° to 85° C)
<b>Humidity, Non-operating</b>	85% relative humidity for 48 hours @ 185° F (85° C) (non-condensing)
<b>LED Activity</b>	LED Off - Radio Off; Solid LED On - Radio On

\* Mobile Broadband is an optional feature sold separately or as an add on 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.

**HP It4111 LTE/EV-DO/HSPA+ 4G WWAN\***

<b>Technology/Operating Bands</b>	LTE FDD all bands with diversity: 1900 MHz (Band II) <sup>1</sup> , 1700/2100MHz (Band IV (AWS), 850 MHz (Band V), 700MHz (Band XIII), 700MHz (Band XVII), 1900MHz G Block (Band XXV) WCDMA/HSDPA/HSUPA/HSPA+: all bands with diversity: 2100 MHz (Band I), 1900 MHz (Band II) , AWS 1700/2100MHz (Band IV), 850 MHz (Band V), 800 MHz (Band VIII) GSM/GPRS/EDGE: 1900 MHz, 1800 MHz , 850 MHz , 900 MHz CDMA: Cellular 800MHz (BC0), PCS 1900MHz (BC1)
-----------------------------------	--

## Technical Specifications

<b>Wireless Protocol Standards</b>	3GPP Release 8 LTE Specification WCDMA R99, 3GPP Release 5, 6 and 7 UMTS Specification EVDO Release 0 and Release A
<b>Wireless Parametric Standards</b>	Complies with 3GPP specifications Release 8 for LTE
<b>Maximum Data Rates</b>	LTE (Category 3): 100 Mbps (Download), 50Mbps (Upload) DC-HSPA+: 42 Mbps (Download), 5.76 Mbps (Upload) HSPA+: 21.6 Mbps (Download), 5.76 Mbps (Upload) EDGE: 236.8 kbps (Download), 236.8 kbps (Upload) GPRS: 85.6 kbps(Download), 85.6 kbps (Upload)
<b>GPS</b>	Standalone GPS, A-GPS, GPS XTRA
<b>GPS Bands</b>	1575.42 MHz (± 1.023 MHz), GLONASS 1596-1607MHz
<b>Maximum Output Power</b>	LTE: +23 dBm (+/- 1 dBm) WCDMA: +23 dBm (+/- 1 dBm) GSM850/900, GMSK: +32dBm (+/- 1dBm) GSM850/900, 8PSK: +27dBm (+/- 1dBm) DCS1800 / PCS 1900, GMSK: +29dBm (+/- 1dBm) DCS1800 / PCS 1900, 8PSK: +26dBm (+/- 1dBm) CDMA: +24dBm (+/- 1dBm)
<b>Maximum Power Consumption</b>	LTE: 1,200 mA (peak); <900 mA (average) WCDMA: 1,100 mA (peak); <800 mA (average) EGPRS: 2,500 mA (peak); <700 mA (average)
<b>Power Consumption, Sleep Mode</b>	2 mA
<b>Power Management</b>	USB selective suspend, Integrated notebook wireless button
<b>Antenna Type</b>	Dual high efficiency multi-band antennae with spatial diversity
<b>Form Factor</b>	M.2, 3042-S3 Key B
<b>Weight</b>	6 g
<b>Dimensions</b> (Length x Width x Thickness)	42 mm × 30 mm × 2.3 mm
<b>Voltage, Operating</b>	3.135 V to 4.4 V (3.3 V +1.1V/-0.165V)
<b>Temperature, operating</b> (from TIA/EIA/IS-98-D)	-13° to 140° F (-25° to 60° C)
<b>Temperature, non-operating, 96 hours</b> (from MIL-STD 202 Method 108)	-40° to 185° F (-40° to 85° C)
<b>Humidity, Non-operating</b>	95% relative humidity for 48 hours @ 185° F (85° C) (non-condensing)
<b>LED Activity</b>	LED Off - Radio Off; Solid LED On - Radio On

<sup>1</sup> 1900 MHz (Band II) and 850 MHz (Band V) not supported at launch but support planned in a future firmware update.

\* 4G LTE not available on all products, in all regions and only available on products featuring Intel processors. WWAN use 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.

## Technical Specifications

<b>HP It4112 LTE/HSPA+ Gobi 4G Module*</b>	<b>Technology/Operating Bands</b>	LTE FDD all bands with diversity: 2100 MHz (Band I), 1900 MHz (Band II), 1800 MHz (Band III), 850 MHz (Band V), 2600 MHz (Band VII), 900 MHz (Band VIII), 800 MHz (Band XX, DD800) WCDMA/HSDPA/HSUPA/HSPA+ all bands with diversity: 2100 MHz (Band I), 1900 MHz (Band II), 800 MHz (Band V), 900 MHz (Band VIII) GSM/GPRS/EDGE: 1900 MHz (Band II), 1800 MHz (Band III), 850 MHz (Band V), 900 MHz (Band VIII)
	<b>Wireless Protocol Standards</b>	3GPP Release 8 LTE Specification WCDMA R99, 3GPP Release 5, 6 and 7 UMTS Specification
	<b>Wireless Parametric Standards</b>	Complies with 3GPP specifications Release 8 for LTE
	<b>Maximum Data Rates</b>	LTE (Category 3): 100 Mbps (Download), 50Mbps (Upload) DC-HSPA+: 42 Mbps (Download), 5.76 Mbps (Upload) HSPA+: 21.6 Mbps (Download), 5.76 Mbps (Upload) EDGE: 236.8 kbps (Download), 236.8 kbps (Upload) GPRS: 85.6 kbps(Download), 85.6 kbps (Upload)
	<b>GPS</b>	Standalone
	<b>GPS Bands</b>	1575.42 MHz (± 1.023 MHz), GLONASS 1596-1607MHz
	<b>Maximum Output Power</b>	LTE: +23 dBm (+/- 2 dBm) WCDMA: +23.5 dBm (+/- 1 dBm) GPRS Band II, III: +29.5 dBm (+/- 1 dBm) GPRS Band V, VIII: +32.5 dBm (+/- 1 dBm) EGPRS Band II, III: +26.5 dBm (+/-1.5 dBm) EGPRS Band V, VIII: +27.5 dBm (+/-1.5 dBm)
	<b>Maximum Power Consumption</b>	LTE: 1,200 mA (peak); <900 mA (average) WCDMA: 1,100 mA (peak); <800 mA (average) EGPRS: 2,800 mA (peak); <700 mA (average)
	<b>Power Consumption, Sleep Mode</b>	3 mA
	<b>Power Management</b>	USB selective suspend, Integrated notebook wireless button
	<b>Antenna Type</b>	Dual high efficiency multi-band antennae with spatial diversity
	<b>Form Factor</b>	M.2, USB 2.0 interface
	<b>Weight</b>	6 g
	<b>Dimensions</b> (Length x Width x Thickness)	42 mm × 30 mm × 2.3 mm
	<b>Voltage, Operating</b>	3.135 V to 4.4 V (3.3 V +1.1V/-0.165V)
	<b>Temperature, operating</b> (from TIA/EIA/IS-98-D)	14° to 131° F (-10° to 55° C)
	<b>Temperature, non-operating, 96 hours</b> (from MIL-STD 202 Method 108)	-40° to 185° F (-40° to 85° C)
	<b>Humidity, Non-operating</b>	95% relative humidity for 48 hours @ 185° F (85° C) (non-condensing)
	<b>LED Activity</b>	LED Off - Radio Off; Solid LED On - Radio On



## Technical Specifications

\* 4G LTE not available on all products, in all regions and only available on products featuring Intel processors. WWAN use 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.

\

### Atheros 802.11 b/g/n (1x1)\*

<b>Wireless LAN Standards</b>	IEEE 802.11b IEEE 802.11g IEEE 802.11n
<b>Interoperability</b>	Wi-Fi certified
<b>Frequency Band</b>	2.4 GHz
<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: many possible data rates, ranging from 6 Mbps to 300 Mbps, depending on the combination of Bandwidth, Modulation Coding Scheme, and Guard Interval used, as defined in IEEE 802.11n specification
<b>Modulation</b>	Direct Sequence Spread Spectrum DBPSK, DQPSK, CCK, OFDM, BPSK, QPSK, 16-QAM, 64-QAM
<b>Security<sup>1</sup></b>	Supports 64- and 128-bit WEP, WPA, WPA2, hardware-accelerated AES, 802.1x authentication types EAP-TLS, EAP-TTLS, PEAP-GTC, PEAP-MSCHAPv2, LEAP, EAP-FAST.
<b>Sub-channels</b>	Multinational support with frequency bands and channels compliant to local regulations.
<b>Media Access Protocol</b>	CSMA/CA (Collision Avoidance) with ACK
<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>	13.5 dBm, nominal
<b>Power Consumption</b>	Transmit: 2.0 W (max) Receive: 1.6 W (max) Associated to Access Point, Idle: 250 mW nominal Wireless Button Off: 100 mW nominal Radio disabled: 75 mW nominal
<b>Power Management</b>	ACPI compliant power management 802.11 compliant power saving mode
<b>Receiver Sensitivity<sup>3</sup></b>	72.2 Mbps: -70 dbm, 54 Mbps: -74 dBm, 11 Mbps: -88 dBm , 1 Mbps: -95 dBm
<b>Antenna Connections</b>	High efficiency antenna with spatial diversity, mounted in the display enclosure
<b>Form Factor</b>	PCI-Express Half-MiniCard 1.2
<b>Weight</b>	0.013 lb (6 g)
<b>Dimensions</b>	0.19 x 1.06 x 1.18 in (4.75 x 26.8 x 30 mm)
<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)

## Technical Specifications

<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 Off - Radio OFF; Solid LED On - 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 (CCK modulation) and a packet error rate of 10% for 802.11a/g (OFDM modulation).

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

### Atheros 802.11b/g/n (1x1) and Bluetooth 4.0 Combo\*

<b>Wireless LAN Standards</b>	IEEE 802.11b IEEE 802.11g IEEE 802.11n
<b>Interoperability</b>	Wi-Fi certified
<b>Frequency Band</b>	2.402 - 2.482 GHz
<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: card will support rates for NSS=1 for RX and TX for 20 MHz channels. Short and long guard interval shall be supported.
<b>Modulation</b>	Direct Sequence Spread Spectrum BPSK, QPSK, CCK, 16-QAM, 64-QAM
<b>Security<sup>1</sup></b>	Support for WPA and WPA2 Support for CCX version up to and including CCXv5 Support for the following EAP types: EAP-TLS, EAP-PEAPv0, EAP-PEAPv1, EAP-PEAPv2, EAP-FAST, EAP-SIM Support for using both machine and user credentials in a single profile. The same profile must be able to be used both before user login and after user login Support the use of Windows Domain credentials IP provider shall have support for an auto-logon to Windows using a PLC and LEAP via the IP provider UI ( <a href="http://support.microsoft.com/default.aspx/kb/315231">http://support.microsoft.com/default.aspx/kb/315231</a> ). Must have Windows Single Sign On support so that customers can use the WLAN as their primary domain network. With regard to SSO, network association and authentication must occur and be successful before Windows domain authentication is attempted Support for use of the UI client in a user account with limited local security privileges Client service / profile manager must support the WiFi Alliance's WiFi Protected Setup specification. Any credentials saved in a profile must be done securely such that they cannot be re-used by any other user or machine.
<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>	13.5dBm , minimum

## Technical Specifications

<b>Power Consumption</b>	Transmit: 2.0 W (max) Receive: 1.6 W (max) Associated to Access Point, Idle: 250 mW nominal Wireless Button Off: 100 mW nominal Radio disabled: 75 mW nominal	
<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: -95 dBm (1 Mbps), -93 dBm (2 Mbps), -91 dBm (5.5 Mbps), -88 dBm (11 Mbps)  802.11g: -90 dBm (6 Mbps), -89 dBm (9 Mbps), -87 dBm (12 Mbps), -85 dBm (18 Mbps), -82 dBm (24 Mbps), -79 dBm (36 Mbps), -76 dBm (48 Mbps), -74 dBm (54 Mbps)  802.11n: -70dBm (72.2 Mbps)	
<b>Antenna type</b>	High efficiency antenna with spatial diversity, mounted in the display enclosure	
<b>Form Factor</b>	PCI-Express Half-MiniCard	
<b>Dimensions</b>	0.19 x 1.06 x 1.18 in (4.75 x 26.8 x 30 mm)	
<b>Operating Voltage</b>	3.3v +/- 10%	
<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 Off - Radio OFF; Solid LED On - Radio ON	
	<ol style="list-style-type: none"> <li>1. Check latest software/driver release for updates on supported security features.</li> <li>2. Maximum output power may vary by country according to local regulations.</li> <li>3. Receiver sensitivity is measured at a packet error rate of 8% for 802.11b (CKK modulation) and a packet error rate of 10% for 802.11a/g (OFDM modulation).</li> </ol>	
<b>Bluetooth Specification</b>	V4.0 High Speed, V2.1+EDR, backwards compatible with V1.1, 1.2 and 2.0	
<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>	-6 dBm to 4 dBm (Bluetooth Class II)	
<b>Receiver Sensitivity</b>	Better than -80 dBm at 0.1 % raw bit error rate	
<b>Power Consumption</b>	Peak (Tx) 330 mW Peak (Rx) 230 mW Sleep <17 mW	
<b>Antenna</b>	Internally integrated within module	
<b>Range</b>	Up 33 ft (10 m)	

## Technical Specifications

<b>Electrical Interface</b>	USB 2.0 compliant Microsoft Windows Plug and Play compliant
<b>Bluetooth Software Supported</b>	Broadcom Bluetooth for Windows Microsoft Windows Bluetooth Software
<b>Link Topology</b>	Point to Point, Multipoint Pico Nets up to 7 slaves
<b>Security</b>	Full support of Bluetooth Security Provisions
<b>Power Management</b>	Microsoft Windows ACPI, and USB Bus Support Self configurable to optimize power conservation in all operating modes, including Standby, Hold, Park, and Sniff
<b>Certifications</b>	All necessary regulatory approvals for supported countries, including: FCC (47 CFR) Part 15C, Section 15.247 & 15.249 ETS 300 328, ETS 300 826 Low Voltage Directive IEC950 UL, CSA, and CE Mark
<b>Bluetooth Profiles Supported</b>	Generic Access Profile (GAP) Service Discovery Application Profile (SDAP) Serial Port Profile (SPP) Dial_Up Networking Profile (DUN) Generic Object Exchange Profile (GOEP) Object Push Profile (OPP) File Transfer Profile (FTP) Synchronization Profile (SYNC) Hard Copy Cable Replacement (HCRP) Personal Area Networking Profile (PAN) Human Interface Device Profile (HID) Generic Audio/Video Distribution Profile (GAVDP) Advanced Audio/Video Distribution Profile (A2DP) FAX Profile (FAX) Basic Imaging Profile (BIP) Headset Profile (HSP) Hands Free Profile (HFP) Basic Printing Profile (BPP) VDP (Video Distribution Profile) AVRCP (Audio Video Remote Control Profile)

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

<b>Broadcom 802.11 a/b/g/n (2x2) with Bluetooth® v4.0 combo*, **</b>	<b>Wireless LAN Standards</b>	IEEE 802.11a IEEE 802.11b 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> 802.11a/n

### Technical Specifications

	<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><li>● 2.402 - 2.482 GHz</li></ul>
<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: card will support rates for NSS=1 and NSS=2 for RX and TX for 20 and 40 MHz channels. Short and long guard interval shall be supported.
<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 V5</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>● 2.4G: +13.5dBm minimum</li><li>● 5G: +12dBm minimum</li><li>● Maximum output power must be able to achieve modular regulatory certification with notebooks that have antennas &gt;20cm from the user and peak gain of +3dBi at 2.4GHz and +4dBi at 5GHz</li></ul>
<b>Power Consumption</b>	Transmit: 2.0 W (max) Receive: 1.6 W (max) Idle mode (PSP): 250 mW (WLAN Associated) Idle mode: 100 mW (WLAN unassociated) Radio disabled: 75 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: -95 dBm (1 Mbps), -93 dBm (2 Mbps), -91 dBm (5.5 Mbps), -88 dBm (11 Mbps)  802.11a/g: -90 dBm (6 Mbps), -89 dBm (9 Mbps), -87 dBm (12 Mbps), -85 dBm (18 Mbps), -82 dBm (24 Mbps), -79 dBm (36 Mbps), -76 dBm (48 Mbps), -74 dBm (54 Mbps)  802.11n: -69 dBm (72.2 Mbps), -66 dBm (300 Mbps)

## Technical Specifications

<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 Half-MiniCard	
<b>Dimensions</b>	0.19 x 1.06 x 1.18 in (4.75 x 26.8 x 30 mm)	
<b>Weight</b>	3.3g	
<b>Operating Voltage</b>	3.3v +/- 9%	
<b>Temperature</b>	Operating	14° to 158° F (-10° to 70° C)
	Non-operating	-40° to 176° F (-40° to 80° C)
<b>Humidity</b>	Operating	10% to 90% (non-condensing)
	Non-operating	5% to 95% (non-condensing)
<b>Altitude</b>	Operating	0 to 10,000 ft (3,048 m)
	Non-operating	0 to 50,000 ft (15,240 m)
<b>LED Activity</b>	LED Off - Radio OFF; Solid LED On - Radio ON	
	<ol style="list-style-type: none"> <li>1. Check latest software/driver release for updates on supported security features.</li> <li>2. Maximum output power may vary by country according to local regulations.</li> <li>3. Receiver sensitivity is measured at a packet error rate of 8% for 802.11b (CKK modulation) and a packet error rate of 10% for 802.11a/g (OFDM modulation).</li> </ol>	
<b>Bluetooth Specification</b>	V4.0 High Speed, V2.1+EDR, backwards compatible with V1.1, 1.2 and 2.0	
<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>	-6 dBm to 4 dBm (Bluetooth Class II)	
<b>Receiver Sensitivity</b>	Better than -80 dBm at 0.1 % raw bit error rate	
<b>Power Consumption</b>	Peak (Tx) 330 mW Peak (Rx) 230 mW Sleep <17 mW	
<b>Antenna</b>	Internally integrated within module	
<b>Range</b>	Up to 33 ft (10 m)	
<b>Electrical Interface</b>	USB 2.0 compliant Microsoft Windows Plug and Play compliant	
<b>Bluetooth Software Supported</b>	Broadcom Bluetooth for Windows Microsoft Windows Bluetooth Software	
<b>Link Topology</b>	Point to Point, Multipoint Pico Nets up to 7 slaves	
<b>Security</b>	Full support of Bluetooth Security Provisions	

## Technical Specifications

<b>Power Management</b>	Microsoft Windows ACPI, and USB Bus Support Self configurable to optimize power conservation in all operating modes, including Standby, Hold, Park, and Sniff
<b>Certifications</b>	All necessary regulatory approvals for supported countries, including: FCC (47 CFR) Part 15C, Section 15.247 & 15.249 ETS 300 328, ETS 300 826 Low Voltage Directive IEC950 UL, CSA, and CE Mark
<b>Bluetooth Profiles Supported</b>	Generic Access Profile (GAP) Service Discovery Application Profile (SDAP) Serial Port Profile (SPP) Dial_Up Networking Profile (DUN) Generic Object Exchange Profile (GOEP) Object Push Profile (OPP) File Transfer Profile (FTP) Synchronization Profile (SYNC) Hard Copy Cable Replacement (HCRP) Personal Area Networking Profile (PAN) Human Interface Device Profile (HID) Generic Audio/Video Distribution Profile (GAVDP) Advanced Audio/Video Distribution Profile (A2DP) FAX Profile (FAX) Basic Imaging Profile (BIP) Headset Profile (HSP) Hands Free Profile (HFP) Basic Printing Profile (BPP) VDP (Video Distribution Profile) AVRCP (Audio Video Remote Control Profile)

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

\*\* Bluetooth sold separately or as an optional feature.

<b>Intel Dual Band Wireless-N 7260 802.11 a/b/g/n (2x2) WiFi + Bluetooth 4.0 Combo Adaptor*, **</b>	<b>Wireless LAN Standards</b>	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n
	<b>Interoperability</b>	Wi-Fi certified Cisco Compatible Extensions Program compliant with Microsoft Windows 7, Windows Vista and XP (details at: <a href="http://www.hp.com/go/notebooks/WLAN">http://www.hp.com/go/notebooks/WLAN</a> )
<b>Frequency Band</b>	802.11b/g/n	2.402 - 2.482 GHz
	802.11a/n	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	
<b>Antenna Structure</b>	2 transmit; 2 receive (2x2)	

### Technical Specifications

<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: card will support rates for NSS=1 and NSS=2 for RX and TX for 20 and 40 MHz channels. Short and long guard interval shall be supported.
<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 V5</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>• 2.4G: +13.5dBm minimum</li><li>• 5G: +12dBm minimum</li></ul>
<b>Power Consumption</b>	Transmit: 2.0 Watts Receive: 1.6 Watts Idle mode <sup>3</sup> : 250 mW (WLAN Associated) Idle mode: 100 mW (WLAN unassociated) Radio off: 75 mW
<b>Power Management</b>	ACPI and PCI Express compliant power management 802.11 compliant power saving mode
<b>Receiver Sensitivity<sup>4</sup></b>	802.11g: -90 dBm (6 Mbps), -89 dBm (9 Mbps), -87 dBm (12 Mbps), -85 dBm (18 Mbps), -82 dBm (24 Mbps), -79 dBm (36 Mbps), -76 dBm (48 Mbps), -74 dBm (54 Mbps)  802.11b: -95 dBm (1 Mbps), -93 dBm (2 Mbps), -91 dBm (5.5 Mbps), -88 dBm (11 Mbps)  802.11g: -90 dBm (6 Mbps), -89 dBm (9 Mbps), -87 dBm (12 Mbps), -85 dBm (18 Mbps), -82 dBm (24 Mbps), -79 dBm (36 Mbps), -76 dBm (48 Mbps), -74 dBm (54 Mbps)  802.11n: -69 dBm (150 Mbps), -66 dBm (300 Mbps)
<b>Antenna Connections</b>	2 U.FL type connectors (output impedance of 50 ± 2 ohms)
<b>Form Factor</b>	PCI-Express Half-MiniCard
<b>Dimensions</b>	0.12 x 1.06 x 1.18 in (3.1 x 26.8 x 30.0 mm)
<b>Weight</b>	TBD
<b>Operating Voltage</b>	3.3v +/- 9%



## Technical Specifications

<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 Off - Radio OFF; Solid LED On - 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. In Power Save Polling mode and on battery power.</li> <li>4. Receiver sensitivity is measured at a packet error rate of 8% for 802.11b (CCK modulation) and a packet error rate of 10% for 802.11a/g (OFDM modulation).</li> <li>5. WLAN supplier's client utility is required for Cisco Compatible Extensions support with Microsoft Windows XP. WLAN may also be compatible with certain third-party software supplicants. WLAN supplier IHV extensions required for Cisco Compatible Extensions support for Microsoft Windows Vista.</li> </ol>	
	<b>HP Integrated Module with Bluetooth 4.0+EDR Wireless Technology</b>	
<b>Bluetooth Specification</b>	4.0+EDR Compliant	
<b>Dimensions</b>	1.18 x 0.26 x 0.13 in (30 x 6.5 x 3.25 mm)	
<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>	-1.5 dBm to 4 dBm (Bluetooth Class II)	
<b>Receiver Sensitivity</b>	Better than -20 dBm at 0.1 % raw bit error rate	
<b>Power Consumption</b>	Peak (Tx) 264 mW Peak (Rx) 231 mW Sleep <1 mW	
<b>Antenna</b>	Internally integrated within module	
<b>Range</b>	Up to 33 ft (10 m)	
<b>Electrical Interface</b>	USB 2.0 compliant Microsoft Windows Plug and Play compliant	
<b>Bluetooth Software Supported</b>	Broadcom Bluetooth for Windows Microsoft Windows Bluetooth Software	
<b>Link Topology</b>	Point to Point, Multipoint Pico Nets up to 7 slaves	
<b>Security</b>	Full support of Bluetooth Security Provisions	
<b>Power Management</b>	Microsoft Windows ACPI, and USB Bus Support Self configurable to optimize power conservation in all operating modes, including Standby, Hold, Park, and Sniff	

## Technical Specifications

<b>Certifications</b>	All necessary regulatory approvals for supported countries, including: FCC (47 CFR) Part 15C, Section 15.247 & 15.249 ETS 300 328, ETS 300 826 Low Voltage Directive IEC950 UL, CSA, and CE Mark								
<b>Bluetooth Profiles Supported</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) 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)								
	1. indicates the profile is supported by Microsoft Windows XP SP2 2. indicates the profile is part of Windows Vista								
	* Wireless access point and internet service required. Availability of public wireless access points limited.								
	** Bluetooth sold separately or as an optional feature.								
<b>Intel Dual Band Wireless-AC 7260 802.11 ac (2x2) WiFi + BT 4.0 combo Adapter<sup>*, **</sup></b>	<table border="0"> <tr> <td style="vertical-align: top;"><b>Wireless LAN Standards</b></td> <td>IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n IEEE 802.11ac</td> </tr> <tr> <td style="vertical-align: top;"><b>Interoperability</b></td> <td>Wi-Fi certified</td> </tr> <tr> <td style="vertical-align: top;"><b>Frequency Band</b></td> <td>802.11b/g/n           <ul style="list-style-type: none"> <li>● 2.402 - 2.482 GHz</li> </ul>           802.11a/n           <ul style="list-style-type: none"> <li>● 4.9 - 4.95 GHz (Japan)</li> <li>● 5.15 - 5.25 GHz</li> <li>● 5.25 - 5.35 GHz\</li> <li>● 5.47 - 5.725 GHz</li> <li>● 5.825 - 5.850 GHz</li> <li>● 2.402 - 2.482 GHz</li> </ul> </td> </tr> <tr> <td style="vertical-align: top;"><b>Data Rates</b></td> <td> <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> </td> </tr> </table>	<b>Wireless LAN Standards</b>	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n IEEE 802.11ac	<b>Interoperability</b>	Wi-Fi certified	<b>Frequency Band</b>	802.11b/g/n <ul style="list-style-type: none"> <li>● 2.402 - 2.482 GHz</li> </ul> 802.11a/n <ul style="list-style-type: none"> <li>● 4.9 - 4.95 GHz (Japan)</li> <li>● 5.15 - 5.25 GHz</li> <li>● 5.25 - 5.35 GHz\</li> <li>● 5.47 - 5.725 GHz</li> <li>● 5.825 - 5.850 GHz</li> <li>● 2.402 - 2.482 GHz</li> </ul>	<b>Data Rates</b>	<ul style="list-style-type: none"> <li>● 802.11b: 1, 2, 5.5, 11 Mbps</li> <li>● 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li> <li>● 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li> <li>● 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)</li> <li>● 802.11ac : MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, and 80MHz)</li> </ul>
<b>Wireless LAN Standards</b>	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n IEEE 802.11ac								
<b>Interoperability</b>	Wi-Fi certified								
<b>Frequency Band</b>	802.11b/g/n <ul style="list-style-type: none"> <li>● 2.402 - 2.482 GHz</li> </ul> 802.11a/n <ul style="list-style-type: none"> <li>● 4.9 - 4.95 GHz (Japan)</li> <li>● 5.15 - 5.25 GHz</li> <li>● 5.25 - 5.35 GHz\</li> <li>● 5.47 - 5.725 GHz</li> <li>● 5.825 - 5.850 GHz</li> <li>● 2.402 - 2.482 GHz</li> </ul>								
<b>Data Rates</b>	<ul style="list-style-type: none"> <li>● 802.11b: 1, 2, 5.5, 11 Mbps</li> <li>● 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li> <li>● 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li> <li>● 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)</li> <li>● 802.11ac : MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, and 80MHz)</li> </ul>								

## Technical Specifications

<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> <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>• 2.4G: +13.5dBm minimum</li> <li>• 5G: +12dBm minimum</li> <li>• Maximum output power must be able to achieve modular regulatory certification with notebooks that have antennas &gt;20cm from the user and peak gain of +3dBi at 2.4GHz and +4dBi at 5GHz</li> </ul>
<b>Power Consumption</b>	Transmit: 2.0 W (max) Receive: 1.6 W (max) Idle mode (PSP): 250 mW (WLAN Associated) Idle mode: 100 mW (WLAN unassociated) Radio disabled: 75 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:-95 dBm (1 Mbps), -93 dBm (2 Mbps), -91 dBm (5.5 Mbps), -88 dBm (11 Mbps)  802.11a/g:-90 dBm (6 Mbps), -89 dBm (9 Mbps), -87 dBm (12 Mbps), -85 dBm (18 Mbps), -82 dBm (24 Mbps), -79 dBm (36 Mbps), -76 dBm (48 Mbps), -74 dBm (54 Mbps)  802.11n:-69 dBm (72.2 Mbps), -66 dBm (300 Mbps)
<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 Half-MiniCard
<b>Dimensions</b>	0.19 x 1.06 x 1.18 in (4.75 x 26.8 x 30 mm)
<b>Weight</b>	3.1g
<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)
<b>LED Activity</b>	LED Off - Radio OFF; Solid LED On - Radio ON	
	<ol style="list-style-type: none"> <li>1. Check latest software/driver release for updates on supported security features.</li> <li>2. Maximum output power may vary by country according to local regulations.</li> <li>3. Receiver sensitivity is measured at a packet error rate of 8% for 802.11b (CKK modulation) and a packet error rate of 10% for 802.11a/g (OFDM modulation).</li> </ol>	
<b>Bluetooth Specification</b>	V4.0 High Speed, V2.1+EDR, backwards compatible with V1.1, 1.2 and 2.0	
<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>	-6 dBm to 4 dBm (Bluetooth Class II)	
<b>Receiver Sensitivity</b>	Better than -80 dBm at 0.1 % raw bit error rate	
<b>Power Consumption</b>	Peak (Tx) 330 mW Peak (Rx) 230 mW Sleep <17 mW	
<b>Antenna</b>	Internally integrated within module	
<b>Range</b>	Up to 33 ft (10 m)	
<b>Electrical Interface</b>	USB 2.0 compliant Microsoft Windows Plug and Play compliant	
<b>Bluetooth Software Supported</b>	Broadcom Bluetooth for Windows Microsoft Windows Bluetooth Software	
<b>Link Topology</b>	Point to Point, Multipoint Pico Nets up to 7 slaves	
<b>Security</b>	Full support of Bluetooth Security Provisions	
<b>Power Management</b>	Microsoft Windows ACPI, and USB Bus Support Self-configurable to optimize power conservation in all operating modes, including Standby, Hold, Park, and Sniff	
<b>Certifications</b>	All necessary regulatory approvals for supported countries, including: FCC (47 CFR) Part 15C, Section 15.247 & 15.249 ETS 300 328, ETS 300 826 Low Voltage Directive IEC950 UL, CSA, and CE Mark	
<b>Bluetooth Profiles Supported</b>	Generic Access Profile (GAP) Service Discovery Application Profile (SDAP) Serial Port Profile (SPP) Dial_Up Networking Profile (DUN) Generic Object Exchange Profile (GOEP) Object Push Profile (OPP) File Transfer Profile (FTP) Synchronization Profile (SYNC)	

### Technical Specifications

Hard Copy Cable Replacement (HCRP)  
Personal Area Networking Profile (PAN)  
Human Interface Device Profile (HID)  
Generic Audio/Video Distribution Profile (GAVDP)  
Advanced Audio/Video Distribution Profile (A2DP)  
FAX Profile (FAX)  
Basic Imaging Profile (BIP)  
Headset Profile (HSP)  
Hands Free Profile (HFP)  
Basic Printing Profile (BPP)  
VDP (Video Distribution Profile)  
AVRCP (Audio Video Remote Control Profile)

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

\*\* Bluetooth sold separately or as an optional feature.

**Intel Centrino® Advanced- N 6205 802.11a/b/g/n (2x2)\***

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

**Interoperability**

Wi-Fi certified  
Cisco Compatible Extensions Program compliant with Microsoft Windows 7, Windows Vista and XP (details at: <http://www.hp.com/go/notebooks/WLAN>)

**Frequency Band**

2.4 GHz and 5GHz

**Antenna Structure**

2 transmit; 2 receive (2x2)

**Data Rates**

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: 66 possible data rates, ranging from 6 Mbps to 300 Mbps, depending on the combination of Bandwidth, Modulation Coding Scheme, and Guard Interval used, as defined in IEEE 802.11n specification

**Modulation**

Direct Sequence Spread Spectrum  
DBPSK, DQPSK, CCK, OFDM, BPSK, QPSK, 16-QAM, 64-QAM

**Security<sup>1</sup>**

Authentication: WPA and WPA2, 802.1x (EAP\_TLS, TTLS, PEAP, LEAP, EAP-FAST)

Authentication Protocols: PAP, CHAP, TLS, GTC, MS-CHAP, MS-CHAPv2

Encryption: 64 and 128-bit WEP, AES-CCMP, CKIP, TKIP

Support for Cisco Security Features (proven compatibility with Cisco Aironet infrastructure products through the Cisco Compatible Extensions Program Version 4) with Microsoft Windows Vista and XP only.

**Sub-channels**

Multinational support with frequency bands and channels compliant to local regulations.

**Media Access Protocol**

CSMA/CA (Collision Avoidance) with ACK

## Technical Specifications

<b>Network Architecture Models</b>	Ad-hoc (Peer to Peer) Infrastructure (Access Point Required)	
<b>Roaming</b>	IEEE 802.11 compliant roaming between 2.4GHz band Access Points	
<b>Output Power</b> (for CCK and OFDM) <sup>2</sup>	17 dBm max	
<b>Power Consumption</b>	Transmit: 2.3 Watts (max, with two spatial streams) Receive: 1 Watt (max with two spatial streams) Idle mode <sup>3</sup> : 35 mW (average) Radio off: 20 mW (max)	
<b>Power Management</b>	ACPI compliant power management 802.11 compliant power saving mode	
<b>Receiver Sensitivity</b> <sup>4</sup>	54 Mbps: -76 dBm, 6 Mbps: -92 dBm	
<b>Antenna Connections</b>	2 U.FL type connectors, 50 ohm nominal impedance	
<b>Form Factor</b>	PCI-Express Half-MiniCard	
<b>Weight</b>	0.0075 lb (3.4 g)	
<b>Dimensions</b>	0.12 x 1.06 x 1.18 in (3.1 x 26.8 x 30.0 mm)	
<b>Operating Voltage</b>	3.3V +/- 9%	
<b>Temperature</b>	Operating	32° to 176° F (0° to 80° C)
	Non-operating	-40° to 176° F (-40° to 80° C)
<b>Humidity</b>	Operating	10% to 90% (non-condensing)
	Non-operating	5% to 90% (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 Off - Radio OFF; Solid LED On - 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. In Power Save Polling mode and on battery power.</li> <li>4. Receiver sensitivity is measured at a packet error rate of 8% for 802.11b (CCK modulation) and a packet error rate of 10% for 802.11a/g (OFDM modulation).</li> <li>5. WLAN supplier's client utility is required for Cisco Compatible Extensions support with Microsoft Windows XP. WLAN may also be compatible with certain third-party software supplicants. WLAN supplier IHV extensions required for Cisco Compatible Extensions support for Microsoft Windows Vista.</li> </ol>	
	* Wireless access point and internet service required. Availability of public wireless access points limited.	
<b>Intel Centrino® Advanced-N 6235 802.11a/b/g/n and Bluetooth 4.0 Combo</b> <sup>*, **</sup>	<b>Wireless LAN Standards</b>	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n
	<b>Interoperability</b>	Wi-Fi certified Cisco Compatible Extensions Program compliant with Microsoft Windows 7, Windows Vista and XP (details at: <a href="http://www.hp.com/go/notebooks/WLAN">http://www.hp.com/go/notebooks/WLAN</a> )
	<b>Frequency Band</b>	2.4 GHz and 5 GHz

## Technical Specifications

<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: 66 possible data rates, ranging from 6 Mbps to 300 Mbps, depending on the combination of Bandwidth, Modulation Coding Scheme, and Guard Interval used, as defined in IEEE 802.11n specification
<b>Modulation</b>	Direct Sequence Spread Spectrum DBPSK, DQPSK, CCK, OFDM, BPSK, QPSK, 16-QAM, 64-QAM
<b>Security<sup>1</sup></b>	Supports 64- and 128-bit WEP, WPA, WPA2, hardware-accelerated AES, 802.1x authentication types EAP-TLS, EAP-TTLS, PEAP-GTC, PEAP-MSCHAPv2, LEAP, EAP-FAST.  Support for Cisco Security Features (proven compatibility with Cisco Aironet infrastructure products through the Cisco Compatible Extensions Program Version 5) with Microsoft Windows 7, Windows Vista and XP only.
<b>Sub-channels</b>	Multinational support with frequency bands and channels compliant to local regulations.
<b>Media Access Protocol</b>	CSMA/CA (Collision Avoidance) with ACK
<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>	13.5 dBm , nominal
<b>Power Consumption</b>	Idle associated: 250 mW Idle unassociated: 100 mW Radio disabled: 75mW Transmit: 2.0 W (max) Receive: 1.6 W (max)
<b>Power Management</b>	ACPI compliant power management 802.11 compliant power saving mode
<b>Receiver Sensitivity<sup>3</sup></b>	54 Mbps: -71 dBm, 11 Mbps: -85 dBm , 1 Mbps: -95 dBm
<b>Antenna Connections</b>	High efficiency dual band antenna with spatial diversity, mounted in the display enclosure
<b>Form Factor</b>	PCI-Express Half-MiniCard 1.2
<b>Weight</b>	0.013 lb (6 g)
<b>Dimensions</b>	0.19 x 1.06 x 1.18 in (4.75 x 26.8 x 30 mm)
<b>Operating Voltage</b>	3.3v +/- 10%
<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>Configuration Utility<sup>4</sup></b>	Microsoft Windows XP Choice of Configuration Utility: <ul style="list-style-type: none"> <li>● Microsoft Windows XP Wireless Network Connection Manager</li> </ul>

### Technical Specifications

- Broadcom Wireless Configuration Utility (required for Cisco Compatible Extensions support)

#### Microsoft Windows Vista

- Microsoft Windows Vista Wireless Network Connection Manager
- Broadcom IHV extensions for Windows Vista available to support Cisco Compatible Extensions.

#### Microsoft Windows 7

- Microsoft Windows 7 Wireless Network Connection Manager
- Broadcom IHV extensions for Windows 7 available to support Cisco Compatible Extensions.

#### LED Activity

LED Off - Radio OFF; Solid LED On - 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 (CCK modulation) and a packet error rate of 10% for 802.11a/g (OFDM modulation).
4. WLAN supplier's client utility is required for Cisco Compatible Extensions support with Microsoft Windows XP. WLAN may also be compatible with certain third-party software supplicants. WLAN supplier IHV extensions required for Cisco Compatible Extensions support for Microsoft Windows Vista.

#### Bluetooth 4.0 Wireless Technology

**Bluetooth Specification** 2.1+EDR, 3.0+HS, 4.0 Compliant

**Dimensions** 1.18 x 0.26 x 0.13 in (30 x 6.5 x 3.25 mm)

**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** Max 4 dBm (Bluetooth Class II)

**Receiver Sensitivity** Better than -80 dBm at 0.1 % raw bit error rate

**Power Consumption** Average 230mW  
Sleep <1 mW

**Antenna** Internally integrated within module

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

**Electrical Interface** USB 2.0 compliant  
Microsoft Windows Plug and Play compliant

**Bluetooth Software Supported** Broadcom Bluetooth for Windows  
Microsoft Windows Bluetooth Software

**Link Topology** Point to Point, Multipoint Pico Nets up to 7 slaves

**Security** Full support of Bluetooth Security Provisions



## Technical Specifications

<b>Power Management</b>	Microsoft Windows ACPI, and USB Bus Support Self configurable to optimize power conservation in all operating modes, including Standby, Hold, Park, and Sniff
<b>Certifications</b>	All necessary regulatory approvals for supported countries, including: FCC (47 CFR) Part 15C, Section 15.247 & 15.249 ETS 300 328, ETS 300 826 Low Voltage Directive IEC950 UL, CSA, and CE Mark
<b>Temperature</b>	Operating -4° to 158° F (-20° to 70° C) Non-operating -40° to 176° F (-40° to 80° C)
<b>Humidity</b>	Operating 10% to 90% Non-operating 5% to 95%
<b>Altitude</b>	Operating 15,000 ft (4,572 m) Non-operating 40,000 ft (12,192 m)
<b>Bluetooth Profiles Supported</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) Hard Copy Cable Replacement (HCRP) <sup>1,2</sup> Personal Area Networking Profile (PAN) <sup>1,2</sup> Human Interface Device Profile (HID) <sup>1,2,3</sup> FAX Profile (FAX) Basic Imaging Profile (BIP) <sup>2</sup> Headset Profile (HSP) Hands Free Profile (HFP) Advanced Audio Distribution Profile (A2DP)

1. indicates the profile is supported by Microsoft Windows XP SP2

2. indicates the profile is part of Windows Vista

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

\*\* Bluetooth sold separately or as an optional feature.

## AUDIO/MULTIMEDIA - DTS SOUND+

## Technical Specifications

<b>Hardware</b>	<b>Implementation</b>	IDT 92HD91
	<b>Function Key Volume Controls</b>	Volume up, volume down, and mute
	<b>Full Duplex</b>	Yes
	<b>Microphone In</b>	Stereo
	<b>Headphone/Line Out</b>	Stereo
	<b>Integrated Microphone</b>	Yes, dual digital microphone array when equipped with optional webcam
	<b>Audio Output Quality</b>	<b>Frequency Response</b>
	<b>Signal to Noise Ratio</b>	>85 dB
	<b>Total Harmonic Distortion</b>	0.01%
	<b>Noise Floor</b>	-110 dB
	<b>Play/Record Sampling Rate(s)</b>	8 kHz - 48kHz
	<b>DAC</b>	16, 20 or 24-bit
	<b>ADC</b>	16 or 20-bit
<b>Integrated Stereo Speakers</b>	<b>Power Rating</b>	2 Watts
	<b>Impedance</b>	4 Ohms

## POWER

<b>HP 90W Smart AC Adapter (discrete or UMA configurations)</b>	<b>Dimensions</b>	5.00 x 1.97 x 1.1 in (12.7 x 5.0 x 2.9 cm)		
	<b>Weight</b>	0.82 lb (370 g)		
	<b>Input</b>	<b>Input</b>	100 to 240 VAC	
		<b>Input Efficiency</b>	87% min at 115 VAC	
		<b>Input frequency range</b>	47 to 63 Hz	
		<b>Input AC current</b>	1.5 A at 90 VAC, 0.75 A at 180 VAC PFC Version 2.4 A at 90 VAC, 1.2 A at 180 VAC NON PFC Version	
	<b>Output</b>	<b>Output power</b>	90W	
		<b>DC output</b>	19.0V	
		<b>Hold-up time</b>	5 msec at 115 VAC input	
		<b>Output current limit</b>	<11A, Over voltage protection- 29V max automatic shutdown	
		<b>Connector</b>	3 pin/grounded, mates with interchangeable cords	
	<b>Environmental Design</b>	<b>Operating temperature</b>	32° to 104° F (0° to 40° C)	
		<b>Non-operating (storage) temperature</b>	-4° to 149° F (-20° to 65° C)	
		<b>Altitude</b>	0 to 10,000 ft (0 to 3,048 m)	

## Technical Specifications

		<b>Humidity</b>	20% to 80%
		<b>Storage Humidity</b>	10% to 90%
	<b>EMI and Safety Certifications</b>	CE Mark - full compliance with LVD and EMC directives; Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, SELV; Agency approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CISPR22 Class B, CCC, NOM-1 NYCE; MTBF- over 200,000 hours at 25°C ambient condition.	
<b>HP 65W Smart AC Adapter (UMA configurations)</b>	<b>Dimensions</b>	4.17 x 1.85 x 1.1 in (10.6 x 4.7 x 2.8 cm)	
	<b>Weight</b>	0.62 lb (280 g)	
	<b>Input</b>	100 to 240 VAC	
		<b>Input Efficiency</b>	87% min at 115 VAC
		<b>Input frequency range</b>	47 to 63 Hz
		<b>Input AC current</b>	1.7 A at 90 VAC, 0.85 A at 180 VAC
	<b>Output</b>	<b>Output power</b>	65W
		<b>DC output</b>	18.5V
		<b>Hold-up time</b>	5 msec at 115 VAC input
		<b>Output current limit</b>	<11A, Over voltage protection- 29V max automatic shutdown
	<b>Connector</b>	3 pin/grounded, mates with interchangeable cords	
	<b>Environmental Design</b>	<b>Operating temperature</b>	32° to 104° F (0° to 40° C)
		<b>Non-operating (storage) temperature</b>	-4° to 149° F (-20° to 65° C)
		<b>Altitude</b>	0 to 10,000 ft (0 to 3,048 m)
		<b>Humidity</b>	20% to 80%
		<b>Storage Humidity</b>	10% to 90%
	<b>EMI and Safety Certifications</b>	CE Mark - full compliance with LVD and EMC directives; Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, SELV; Agency approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CISPR22 Class B, CCC, NOM-1 NYCE; MTBF - over 200,000 hours at 25°C ambient condition.	

## Technical Specifications

**HP 9-cell (100 WHr)  
Lithium-Ion Primary  
battery**

<b>Dimensions (H x W x L)</b>	0.8 x 2.4 x 8.1in (2 x 6.6 x 20.5cm)
<b>Weight (max)</b>	1.1lb, (.488kg)
<b>Cells/Type</b>	Lithium-Ion
<b>Energy</b>	<b>Voltage</b> 11.25V <b>Amp-hour capacity</b> 8.85Ah <b>Watt-hour capacity</b> 100Wh
<b>Temperature</b>	<b>Operating (Charging)</b> 32° to 113° F (0° to 45° C) <b>Operating (Discharging)</b> 14° to 122° F (-10° to 50° C) <b>Non-operating</b> -4° to 122° F (-20° to 50° C)
<b>Battery Re-Charge Time</b>	<b>System in OFF or Standby Mode</b> 3.5 to 5 hours <b>System ON</b> 4 to 7 hours
<b>Fuel Gauge LED</b>	No
<b>Warranty</b>	1 year
<b>Compatible with optional Travel Battery</b>	Yes

**HP 6-cell (55 WHr)  
Lithium-Ion Primary  
battery**

<b>Dimensions (H x W x L)</b>	0.8 x 1.8 x 8.0in (2.0 x 4.7 x 20.5cm)
<b>Weight (max)</b>	.70lb, (.313kg)
<b>Cells/Type</b>	Lithium-Ion
<b>Energy</b>	<b>Voltage</b> 10.8V <b>Amp-hour capacity</b> 5.1Ah <b>Watt-hour capacity</b> 55Wh
<b>Temperature</b>	<b>Operating (Charging)</b> 32° to 113° F (0° to 45° C) <b>Operating (Discharging)</b> 14° to 122° F (-10° to 50° C) <b>Non-operating</b> -4° to 122° F (-20° to 50° C)
<b>Battery Re-Charge Time</b>	<b>System in OFF or Standby Mode</b> 2.5 hours <b>System ON</b> 3 to 5 hours
<b>Fuel Gauge LED</b>	No
<b>Warranty</b>	1 year
<b>Compatible with optional Travel Battery</b>	Yes

## Technical Specifications

<b>HP 6-cell (55 WHr) Long Life Primary Battery</b>	<b>Dimensions (H x W x L)</b>	0.8 x 1.8 x 8.0in (2.0 x 4.7 x 20.5cm)	
	<b>Weight (max)</b>	.72lb, (.323kg)	
	<b>Cells/Type</b>	Lithium-Ion	
	<b>Energy</b>	<b>Voltage</b>	10.8V
		<b>Amp-hour capacity</b>	5.1Ah
		<b>Watt-hour capacity</b>	55Wh
	<b>Temperature</b>	<b>Operating (Charging)</b>	32° to 113° F (0° to 45° C)
		<b>Operating (Discharging)</b>	14° to 122° F (-10° to 50° C)
		<b>Non-operating</b>	-4° to 122° F (-20° to 50° C)
	<b>Battery Re-Charge Time</b>	<b>System in OFF or Standby Mode</b>	2.5 hours
		<b>System ON</b>	3 to 5 hours
	<b>Fuel Gauge LED</b>	No	
	<b>Warranty</b>	3 years*	
	<b>Compatible with optional Travel Battery</b>	Yes	

\* 3-year platform warranty is required for a 3-year Long Life Battery warranty.

<b>HP 3-cell (31 WHr) Lithium-Ion Primary battery</b>	<b>Dimensions (H x W x L)</b>	0.8 x 1.8 x 8.0in (2.0 x 4.7 x 20.5cm)	
	<b>Weight (max)</b>	0.47lb, (.210kg)	
	<b>Cells/Type</b>	Lithium-Ion	
	<b>Energy</b>	<b>Voltage</b>	11.1V
		<b>Amp-hour capacity</b>	2.8Ah
		<b>Watt-hour capacity</b>	31Wh
	<b>Temperature</b>	<b>Operating (Charging)</b>	32° to 113° F (0° to 45° C)
		<b>Operating (Discharging)</b>	14° to 122° F (-10° to 50° C)
		<b>Non-operating</b>	-4° to 122° F (-20° to 50° C)
	<b>Battery Re-Charge Time</b>	<b>System in OFF or Standby Mode</b>	2.5 hours
		<b>System ON</b>	3 to 5 hours
	<b>Fuel Gauge LED</b>	No	
	<b>Warranty</b>	1 year	
	<b>Compatible with optional Travel Battery</b>	Yes	

## ENVIRONMENTAL

### Technical Specifications

#### Environmental Data

##### 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.

#### HP ProBook 640 G1 Notebook PC

##### 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	12.48 W	13.27 W	13.15 W
Sleep	0.86 W	1.02 W	0.85 W
Off	0.35 W	0.47 W	0.34 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.

##### Heat Dissipation\*

	115VAC, 60Hz	230VAC, 50Hz	100VAC, 60Hz
Normal Operation	43 BTU/hr	45 BTU/hr	45 BTU/hr
Sleep	3 BTU/hr	3 BTU/hr	3 BTU/hr
Off	1 BTU/hr	2 BTU/hr	1 BTU/hr

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

## Technical Specifications

### Declared Noise Emissions (in accordance with ISO 7779 and ISO 9296)

	Sound Power (LWAd, bels)	Sound Pressure (LpAm, decibels)
Typically Configured - Idle	3.4	27
Fixed Disk - Random writes	3.4	27

### 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

Battery size: 6-cell high capacity Lithium-Ion battery (optional 8 cell available)

Battery type:

### 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 5% post-consumer recycled plastic (by wt.)
- This product is 97.3% recycle-able when properly disposed of at end of life.

### Packaging Materials

- External:
  - PAPER/Corrugated 482.6 g
- Internal:
  - PLASTIC/EPE (Expanded Polyethylene) 28 g
  - PLASTIC/Polyethylene low density 30.4 g
- The PAPER/Corrugated packaging material is made from 70 % recycled content.
- The PLASTIC/EPE (Expanded Polyethylene) packaging materials contains at least 50% recycled content.
- The PLASTIC/Polyethylene low density packaging materials contains at least 50% recycled content.

## Technical Specifications

### HP ProBook 650 G1 Notebook PC

#### 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	13.57 W	13.7 W	12.9 W
Sleep	0.88 W	1.02 W	0.87 W
Off	0.36 W	0.47 W	0.35 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.

#### Heat Dissipation\*

	115VAC, 60Hz	230VAC, 50Hz	100VAC, 60Hz
Normal Operation	46 BTU/hr	47 BTU/hr	44 BTU/hr
Sleep	3 BTU/hr	3 BTU/hr	3 BTU/hr
Off	1 BTU/hr	2 BTU/hr	1 BTU/hr

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

#### Declared Noise Emissions

(in accordance with ISO 7779 and ISO 9296)

	Sound Power (LWAd, bels)	Sound Pressure (LpAm, decibels)
Typically Configured - Idle	3.6	29
Fixed Disk - Random writes	3.7	30

#### 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

Battery size: 6-cell high capacity Lithium-Ion battery (optional 8 cell available)

Battery type:

#### 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



## Technical Specifications

ISO1043.

- This product contains 5% post-consumer recycled plastic (by wt.)
- This product is 97.3% recycle-able when properly disposed of at end of life.

### Packaging Materials

- External:
  - PAPER/Corrugated 482.6 g
- Internal:
  - PLASTIC/EPE (Expanded Polyethylene) 28 g
  - PLASTIC/Polyethylene low density 30.4 g
- The PAPER/Corrugated packaging material is made from 70 % recycled content.
- The PLASTIC/EPE (Expanded Polyethylene) packaging materials contains at least 50% recycled content.
- The PLASTIC/Polyethylene low density packaging materials contains at least 50% recycled content.

## ALL MODELS

### 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
- 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.

## Technical Specifications

- 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.

### 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)

Type	Description	Part #
<b>Cases</b>	HP Professional Series Carrying Case (up to 15.6")	H4J90AA
	HP Professional Slim Top Load Case (up to 17.3")	H4J91AA
	HP Essential Top Load Case (up to 15.6")	H2W17AA#xxx
	HP Business Nylon Case	H5M92AA
	HP Business Backpack (up to 17.3")	H5M90AA
	HP Business 4 Wheel Roller Case	H5M93AA
<b>Docking</b>	HP Adjustable Dual Monitor Stand	AW664AA#xxx
	HP Adjustable Display Stand	AW663AA#xxx
	HP Display and Notebook Stand	AW662AA#xxx
	HP 90W Docking Station	A7E32AA#xxx
	HP 120W Advd Docking Station	A7E36AA#xxx
<b>Input/Output</b>	HP Comfort Grip Wireless Mouse	H2L63AA
	HP 3-Button USB Laser Mouse	H4B81AA
	HP USB Optical Travel mouse	RH304AA
<b>Adapters</b>	HP 65W Slim Adapter	AX727AA#XXX
	90W Smart AC Adapter	ED495AA#xxx
	90W Slim Adapter	BT796AA#xxx
	HP 65W Smart AC Adapter	H6Y89AA
	HP 90W Smart AC Adapter	H6Y90AA
	HP 65W Slim AC Adapter	H6Y82AA
	HP 90W Slim AC Adapter	H6Y83AA
<b>Batteries</b>	HP CA06XL Notebook Battery 6-cell 55 WHr	TBD
	HP CA09 Notebook Battery 9-cell 100 WHr	TBD
<b>Security</b>	HP Docking Station Cable Lock	AU656AA#XXX
	HP Notebook Combo Lock	AY475AA#XXX
	HP UltraSlim Keyed Cable Lock	H4D73AA
<b>Storage - External Storage</b>	HP Mobile USB DVDRW	A2U57AA
<b>Health and Education</b>	HP 20-Notebook Managed Charging Cart	QL489AA#xxx
	HP 30-Notebook Managed Charging Cart	QL490AA

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

Copyright © 2014 Hewlett-Packard Development Company, L.P.

All rights reserved. Intel, Core, and Celeron are registered trademarks or trademarks of Intel Corporation in the U.S. and/or other countries. Bluetooth is a trademark owned by its proprietor and used by Hewlett-Packard Company under license. Microsoft and Windows are U.S. registered trademarks of Microsoft Corporation. Adobe is a trademark of Adobe Systems Incorporated. ENERGY STAR is a registered mark owned by the U.S. government.

The information contained herein is subject to change without notice and is provided "as is" without warranty of any kind. The warranties for HP products are set forth in the express limited warranty statements accompanying such products. Nothing herein should be construed as constituting an additional warranty. HP shall not be liable for technical or editorial errors or omissions contained herein.