



**ExpressCard® Technology: The  
Future of Notebook Expansion**

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## A New High-Performance Modular I/O Standard

In the past few years, the computer industry has seen the adoption of a new generation of computer platforms that address the high-performance requirements of today's mobile technologies.

The ExpressCard® Standard delivers high-performance, modular I/O expansion capabilities to notebook computers at a lower cost and in a smaller form factor than the familiar CardBus Standard. The ExpressCard Standard, now in its second major revision, is the standard for plug-and-play modular expansion of notebook systems.

ExpressCard technology offers notebook users an easy way to add functionality to their notebooks. An ExpressCard slot offers a high performance, cost-effective optional expansion capability that enables users to upgrade their Apple or PC notebooks with applications that were not originally included by the manufacturer or were not available at the time the PC was purchased.

The advantage of ExpressCard technology is that users can add new functionality without opening up their systems to install the new features. For example, users can add 802.11n Wi-Fi functionality to notebooks that were shipped with 802.11g Wi-Fi using an ExpressCard module. They can also add 'extras' such as TV Tuners, high-speed memory adapters for streaming media (CompactFlash® or SxS) and even smart-card readers (popular in government applications).



Figure 1: ExpressCard® technology provides users with the ability to easily add features that aren't part of their computers when they purchase them.

Users simply add memory, wired and wireless communications, connectivity, multimedia and security features by plugging an ExpressCard module into a compliant system. At roughly half the size and lighter than earlier PC Card/CardBus modules, ExpressCard products take the proven reliability of PC Card technology, including durability and expansion flexibility, while supporting improved performance and lower cost.

The second revision of the ExpressCard Standard (2.0), released in February 2009, takes this technology to the next step by offering data transfer speeds up to 10X faster than the ExpressCard 1.2 standard. This meets the continued demands for increased performance by technologies such as Serial ATA (SATA), streaming media and solid-state storage applications.

## Underlying Technology

The ExpressCard interface replaces the PCI-derived CardBus interface with one PCI Express port and one USB port. This allows the ExpressCard interface in the host computer to be connected directly to the PC's chipset. Since the PCI Express and USB interfaces are serial busses, the ExpressCard connector system is smaller and less costly than the CardBus connector it replaces.

With the availability of both PCI Express and USB in the ExpressCard interface, ExpressCard module designers have the flexibility to use PCI Express or USB, whichever interface suits the application. Either interface allows the module designer to take advantage of the wide range of PCI Express and USB chip sets available for a wide variety of application. Whatever the module design, notebook users do not need to know which bus interface is being used or the technical details of these technologies.

Another benefit of using PCI Express and USB at the heart of the ExpressCard interface is that the hot plug and power management features inherent in both technologies are native to the ExpressCard interface. This eliminates the need for the hardware controller and software stack required by the CardBus interface. In addition, ExpressCard modules can be designed using hardware and software building blocks found in the PCI Express and USB counterparts, further lowering product design and manufacturing costs.

The latest update to the ExpressCard standard incorporates the latest developments in the underlying PCI Express and USB interface technologies, PCI Express 2.0 and SuperSpeed USB 3.0. PCI Express\* supports data transfer rates of up to 5Gbps, which enables computer platforms to support new high performance applications such as IEEE 1394B, also known as FireWire 800, for high-speed communications and eSATA (serial ATA connection for storage).

The new SuperSpeed Universal Serial Bus (USB\*) v3.0 has also been recently updated to support speeds of 5Gbps. USB is the interface of choice for common PC peripherals such as flash memory adapters, external storage devices, printers/scanners, and network connectivity.

Since the ExpressCard interface is designed to take full advantage of the higher performance PCI Express and USB standards and to enable a smaller size module, it is not compatible with the CardBus PC Card interface.

## ExpressCard Formats

There are two mechanical formats for ExpressCard modules. The first ExpressCard format is 34mm wide by a minimum of 75mm long. This is called the ExpressCard/34 module. Some applications are difficult to design into the ExpressCard/34 module size, such as smart-card readers, compact flash adapters, some TV tuners. To accommodate these applications, a 54mm wide module is offered, called ExpressCard/54.

Like the Type II PC Card, both ExpressCard module formats are 5mm thick. They have a minimum of length of 75mm, which is 10.6mm shorter than a standard PC Card. Over time, we expect that the applications and underlying technologies driving the need for the larger module to the smaller form factor.



Figure 2: ExpressCard modules come in two sizes: 34 mm (left) and 54 mm.



Figure 3: The ExpressCard slot comes in two sizes. The slot (left) is for ExpressCard/34 modules. A slightly wider slot, called the Universal slot, (right) supports both ExpressCard/34 and ExpressCard/54 modules.

Computers that implement an ExpressCard slot are not required to support the larger 54mm module and some computer manufacturers, notably Apple, have chosen to only support the ExpressCard/34 module. Many notebook PC manufacturers have chosen to support both module formats by implementing a universal ExpressCard slot. These universal slots will accept either an ExpressCard/34 or ExpressCard/54 module.

## Compliance Program

To ensure interoperability between modules and host computers, PCMCIA has implemented a compliance program for ExpressCard products. Open to all PCMCIA members, this program tests ExpressCard products

against PCMCIA's published standard. (The two-step process will change to a three-step process as part of the adoption of the ExpressCard Standard 2.0 in 2009.)

In the first step, manufacturers are asked to verify their products against a comprehensive requirements checklist and submit the list to PCMCIA for review. In the second step, system and module products are tested against a wide range of compliant products to ensure electrical and functional compatibility.

In the newly added third step adopted in 2009, ExpressCard products will be tested for compliance to specified signal quality requirements. These tests further ensure the reliability of the electrical interface between the host system card slots and modules.



Figure 4: The ExpressCard logo can be found on products that pass the compliance process

With the successful completion of these steps and the execution of a license with the PCMCIA, compliant products have the right to display the ExpressCard® logo, an orange rabbit signifying mobility, fast performance and ease-of-use. All compliant products are listed in the Resource Directory on [www.expresscard.org](http://www.expresscard.org). Notebook users can be confident that modules that display the ExpressCard logo will operate as advertised in notebook systems that also display the logo. Going forward, products compliant with the ExpressCard 2.0 standard will be backward compatible with the current ExpressCard standard. This assures users that today's products will continue to operate with those in the future.

## Adoption of ExpressCard Technology

Late 2004 and early 2005 saw the introduction of the first notebook computers with ExpressCard slots. Since then, the PC industry's top 20 notebook suppliers including Acer, Apple, Asus, Dell, HP, Fujitsu, Lenovo, Sony and Toshiba have been shipping a wide range of notebook computers supporting the new standard.

These notebook systems are sold to both the corporate and consumer markets, with faster adoption of ExpressCard technology by the consumer segment. ExpressCard slots could be found on well over half of the card slots in consumer notebook PCs being shipped in 2008. PCMCIA expects this transition to continue with ExpressCard slots completely replacing CardBus slots in notebook PCs in just a few years.

ExpressCard technology is also being adopted into new areas. Many netbooks, streamlined notebook computers that are increasing in popularity, are incorporating an ExpressCard slot to give users the means to add new features. ExpressCard products may also be adapted for desktop computers. New, small form-factor desktop computers, which apply mobile computing features to the desktop market, are an ideal application for ExpressCard technology. These 'sealed box' systems do not allow the users to open the box to add functionality. The addition of ExpressCard slots offer users the ability to add features available in the notebook marketplace and expand the usability of their systems.

## Wide Variety of Applications

A wide variety of ExpressCard modules are available both in retail stores and online. The latest modules address a wide range of applications, including:

- **Storage/Memory:** eSATA, 1394B (such as Apple's FireWire 800), wireless broadband, high speed CompactFlash® adapters, Gigabit Ethernet adapters and high capacity storage devices (such as Sony/SanDisk's SxS modules that support large data transfers). These modules are available from vendors such as, SIIG, Sony, SanDisk, and Ratoc Systems. One of the more popular new

applications is high-speed, high capacity solid-state storage which will eventually support a 300Mbps transfer rates and e-SATA, which will support up to 6Mbps.

- **Multimedia:** Popular PC Card/CardBus applications are available now available as ExpressCard modules including wireless broadband, memory card adapters, video frame grabbers (video editing), TV Tuners, WiFi, serial ports, and USB bus expansion. In addition to the vendors listed above, modules supporting these applications are available from Buffalo Technologies, AVerMedia, HP, and Novatel, .
- **Security:** Smart-card readers, SIM readers, and digital rights management can provide an additional means of security for notebook applications and users. Products are available from SCM Microsystems and WIBU-Systems.

**Other:** Other popular applications include a graphics docking station from Village Tronic and remote control devices from HP. Consumers can, however, find products in the market today that support all of the popular applications for expansion modules including flash memory adapters, eSATA, TV Tuners, FireWire, Wi-Fi, 3G and more.

Other compliant ExpressCard products can be found on the ‘Where to Buy’ page at [www.expresscard.org](http://www.expresscard.org).

## Industry Support

The leader of PC Card®, CardBus® and ExpressCard technology standard development is PCMCIA, a non-profit trade association founded in 1989 to establish technical standards and to promote interchangeability among computer systems. The ExpressCard Standard was created by a broad coalition of PCMCIA member companies, including Dell, Hewlett Packard, IBM, Intel, Lexar Media, Microsoft, Molex, Foxconn and Texas Instruments. The PCMCIA developed the new standard in coordination with the USB Implementers Forum (USB-IF\*) and the Peripheral Component Interconnect-Special Interest Group (PCI-SIG\*) to leverage their expertise for both hardware and software requirements and the compliance program.

## Support for the Future

Today, ExpressCard /or PC Card technology can be found in more than 95% of all notebook computers. By using both PCI Express and USB, ExpressCard technology brings higher performance and lower cost to both notebook systems. With ExpressCard technology, notebook users can be assured that they will have access to new technologies such as eSATA, solid-state storage, streaming media and future high-performance applications that are only being dreamed of today. ExpressCard technology supports the hot-plug and power management features important to notebook systems.



Figure 5: ExpressCard modules are smaller and lighter than previous PC Card and CardBus options.

With PCMCIA’s compliance program and endorsed by industry leaders, the ExpressCard Standard offers a friendly, easy to use, reliable technology. Vendors benefit from a lower implementation cost due to its system and mechanical design, which is less complex to implement than CardBus.

For more information, visit [www.expresscard.org](http://www.expresscard.org) or [www.pcmcia.org](http://www.pcmcia.org).

## Author

Manny Pitta has held design engineering, technical marketing, and applications engineering positions with Intel, AMD, Headland Technology, LSI Logic, Faraday Electronics, and other industry leaders since 1975. Since 2006, Manny has been providing technical marketing services to the high tech industry. Some of his current activities include providing marketing support in the U.S. for Asian and European companies and standards technology promotion and compliance event activities for PCMCIA and VESA. He has chaired the PCMCIA Marketing Committee since April 2004. For more information see [www.mpitta.com](http://www.mpitta.com) and [www.siliconvalleyoffice.biz](http://www.siliconvalleyoffice.biz) or contact Manny at [manny@mpitta.com](mailto:manny@mpitta.com).