

A Look at ExpressCard® Technology

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The Need for a New High Performance Modular I/O Standard

In the last two years, the computer industry has seen the adoption of a new generation of PC platform taking advantage of the high-performance, scalable PCI Express* standard. With this new I/O standard, which operates up to 2.5 times faster than the PCI bus it replaces, these PC platforms are able to support new high performance applications such as FireWire800, eSATA, and Gigabit Ethernet. In addition to PCI Express, the Universal Serial Bus (USB*) 2.0 standard has become the interface of choice for many common applications such as Flash memory access, cellular modems and WiFi. In anticipation of these new technologies, PCMCIA developed a new standard for hot swappable modular expansion that dramatically improves the I/O performance of both desktop and notebook computers and is based on both the PCI Express and Universal Serial Bus (USB*) 2.0 standards.

The ExpressCard® Standard delivers high- performance, modular expansion to both desktop and notebook computers at a lower cost and in a smaller form factor than the familiar Cardbus PC Card Standard. Users are able to add memory, wired and wireless communications, multimedia and security features, and more by inserting ExpressCard modules into compliant systems. At roughly half the size and lighter than earlier PC Card modules, ExpressCard products leverage the proven advantages of PC Card technology, including reliability, durability and expansion flexibility while offering much improved performance and lower cost.

Relationship to the PC Card Standard

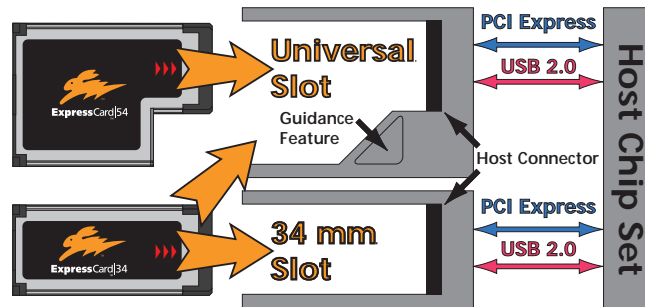
The ExpressCard Standard is the next generation of PC Card technology used in more than 95% of all notebook computers for adding new hardware capabilities. The ExpressCard Standard was created by a broad coalition of PCMCIA member companies, including Dell, Hewlett Packard, IBM, Intel, Lexar Media, Microsoft, 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*). The PCMCIA is a non-profit trade association founded in 1989 to establish technical standards for PC Card technology and to promote interchangeability among computer systems.

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. End users 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, WiFi, WWAN, and more.

The ExpressCard Standard

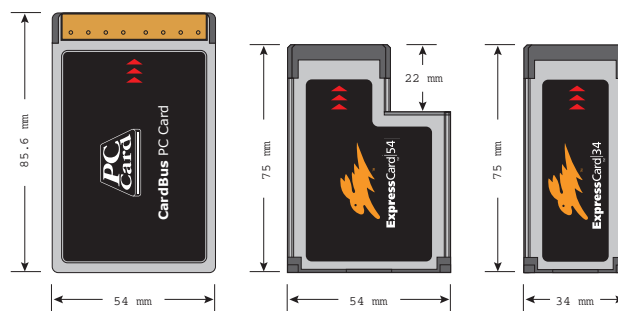
The ExpressCard interface replaces the PCI-derived CardBus interface with one PCI Express port and one USB port. This allows the ExpressCard connector in the host PC to be connected seamlessly to the core of the PC's chipset. With the availability of both PCI Express and USB in the ExpressCard interface, ExpressCard module designers have the flexibility to use PCI Express for their highest performance applications, or to use USB to take advantage of the wide range of USB silicon solutions already available. Whatever the module design, the end user is not burdened with having to be aware of bus interfaces since the ExpressCard slot on the host PC system must support both PCI Express and USB. This new, higher performance design also enables the use of a smaller, less costly connector that is capable of supporting anticipated future speed enhancements.

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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 these two technologies are native to the ExpressCard interface. This allows these very important end user benefits to be supplied without the use of the hardware controller and software stack required by the Cardbus interface. In addition, ExpressCard modules can be designed using hardware and software building blocks that are common to their PCI Express and USB counterparts allowing module manufacturers to further lower product costs.

There are two mechanical formats for ExpressCard modules. The first ExpressCard format is 34mm wide by a minimum of 75mm long designated as an ExpressCard/34 module. While developing the standard, the PCMCIA discovered that there were applications that would be difficult to design into the ExpressCard/34 module size such as smart card readers, compact flash adapters, some TV tuners, and others. To accommodate these applications, a 54mm wide module was added to the standard designated as an ExpressCard/54 module. Like the Type II PC Card, both ExpressCard module formats are 5mm thick and have a minimum length 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 will evolve to allow the use of the smaller form factor for all ExpressCard modules and the 54mm size can potentially be phased out.



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. Some of the larger notebook form factors that support two expansion slots are converting one to an ExpressCard slot and leaving one as a PC Card slot. We expect that this transitional solution will give way to ExpressCard-only configurations as the installed base of PC Card modules give way to integration of their applications into the system, obsolescence, or replacement by higher performance applications in ExpressCard module form.

ExpressCard Compliance Program

In order to ensure interoperability between modules and host systems, PCMCIA has implemented a compliance program for ExpressCard products. The program, open to all PCMCIA members, consists of a two step process intended to test ExpressCard products against PCMCIA's published standard. 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. 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 energetic rabbit signifying mobility, fast performance and ease-of-use. All compliant products are listed in the Resource Directory on www.expresscard.org. End users can be confident that modules that display the ExpressCard logo will operate as advertised in notebook and desktop PCs that also display the logo.



Availability/Adoption/Where to Buy

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 and Toshiba have been shipping a wide range of notebook computers supporting the new standard. These notebook PCs include computers intended for corporate use and those targeted at the consumer. The PCMCIA expects that the transition will continue over the next few years with total transition first occurring in the consumer segment followed by the corporate segment. In the desktop PC segment, there will be an emergence of new small form factor, "sealed box" designs in the marketplace. Since these systems will not allow the end user to open the box to insert add-on cards, ExpressCard technology will be used to offer I/O expansion features that are well established in the notebook marketplace.

Interface	Available Applications
PCI Express* <i>Up to 2.5 Gbps</i>	External HDD Backup (SATA) TV Tuners/Decoders I/O Adapters (e.g. 1394a/b) Wired LAN
USB 2.0 <i>Up to 480 Mbps</i>	Wireless LAN Wireless WAN Flash Memory TV Tuners/Decoders Flash Card Adapters (CF, SD, Memory Stick) Security (Smart Card Readers) Legacy I/O (serial, parallel)

With the transition to ExpressCard technology well on its way in notebook PCs, the module manufacturers are moving rapidly to supply products for these new slots. Today, modules are available for a wide range of applications including eSATA, TV Tuners, FireWire, WiFi, WWAN, Flash Memory Adapters, and more. A

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sampling of ExpressCard products in the marketplace is located in the “Where to Buy” page on www.expresscard.org.

ExpressCard modules listed on the “Where to Buy” page include FireWire (1394) modules from Abocom, Addonics, Belkin, and SIOG in various configurations and module sizes. They are available in both Firewire 400 and Firewire 800 versions along with modules that include USB ports. Memory card adapters are also available from Atech Flash, Buffalo, Delkin, Griffin Technology, and Hagiwara Sys-com in addition to some of the vendors listed above. These include Compact Flash adapters and configurations of adapters that accept many of the popular memory card form factors. TV tuners from AverMedia and HP are also listed along with Wireless Broadband Internet, WiFi, Smart Card, SATA and other modules from Abocom, Addonics, Atech Flash, AverMedia, Belkin, Buffalo, Delkin, Hagiwara Sys-com, Novatel, Ratoc Systems, and SIIG.

Other ExpressCard products on the “Where to Buy” page include a Bluetooth mouse from Newton Peripherals, expansion chassis and docking stations from Belkin and Mobility Electronics, and remote control devices from HP and Interlink Electronics.

Summary

By using both PCI Express and USB, ExpressCard technology brings higher performance and lower cost to desktop and notebook computer systems. With ExpressCard technology, notebook and desktop computer users can be reassured that they will have access to new technologies such as SATA, FireWire 800 and future applications. ExpressCard technology support the hot-plug and power management features important to notebook PCs and supports I/O expandability in small form factor, “sealed box” desktop systems.

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

Supported by all of the top notebook PC vendors and with the availability of modules addressing all popular I/O applications, ExpressCard technology is well on its way to replacing PC Card/Cardbus as the I/O expansion standard for end user expandability.

For more information, visit www.expresscard.org www.expresscard.org and www.pcmcia.org.

Author

Manny Pitta has chaired the PCMCIA Marketing Committee since April 2004. From 1996 to 2006 he held Engineering and Technical Marketing positions at Intel Corporation. Prior to Intel, he held design engineering, technical marketing, and applications engineering positions with AMD, Headland Technology, LSI Logic, Faraday Electronics, and other industry leaders.



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