

PC/104 meets Qseven: what's your combination?

By Matt Ferraro

EMBEDDED ELECTRONICS is all about applying commercially available components to a design in a highly custom fashion. OEM products vary so greatly in computational requirements that a “perfect” off the shelf solution rarely exists. Developing the perfect product can be very time consuming and risky; having the ability to quickly configure off the shelf components to get close to perfection quickly and economically is a great virtue.

Stackable modular computers using PC/104 have been in use for many years. Over time, PC/104 has evolved to encompass the latest computer interconnect technology using PCI Express. Evolutionary changes make the stackable modules a top choice for many embedded computing applications. The PC/104 ecosystem is very mature and offers a wide range of modules of all types - processing, I/O, FPGA, power supplies, and enclosures. The form factor is very popular in applications requiring small, rugged, and highly versatile computing elements.

The Qseven concept

A more recent entrant to the world of embedded computing is the computer-on-module (COM). The Qseven concept is an off-the-shelf, multi-vendor COM that integrates all the core components of a common PC and is mounted onto an application specific carrier board. Qseven modules have a standardized form factor of 70x70mm and have specified pin-outs using a low cost, high-speed MXM connector system with a standardized pin-out, regardless of the vendor. Qseven module functions can include, but are not limited to, graphics, sound, mass storage, network, and multiple USB ports. A single ruggedized MXM connector provides the carrier board interface to carry all the I/O signals to and from the Qseven module.

Unlike previous COM standards, Qseven's primary design best supports mobile and ultra-mobile applications. It defines fast serial differential interfaces such as PCI Ex-

press and Serial ATA but omits support for legacy interfaces like EIDE and PCI bus in order to provide support for today as well as future CPU's and chipsets. Qseven COMs are also some of the smallest full function COMs on the market making them very attractive for many embedded applications.

Qseven specifies PCI Express, USB 2.0, ExpressCard, high definition digital audio, Serial ATA, an LPC interface, a secure digital I/O interface, Gigabit Ethernet, DisplayPort, TDMS or SDVO, an LVDS display interface, and a CAN bus, all through a rugged MXM connector.

Carrier board designers can use as little or as many of the I/O interfaces as deemed necessary. The carrier board can therefore provide all the interface connectors required to attach the system to the application specific peripherals.

In many applications, the number of units to be built or the large number of product variations does not warrant the cost of developing a highly integrated custom computing system. The time and expense to develop is cost prohibitive. Off-the-shelf solutions are frequently missing a key feature or have many features that are unnecessary but add to the cost of the module.

The integration of a highly modular and stackable computing platform with a very small COM form factor provides a level of customization that is well suited for many common applications. The Qseven modules are small enough to fit on the 90x96mm PCI-104 Express and PCIe/104 modules, yet leave enough space for the other necessary functions and connectors to be included on 104 modules. The combination of the two

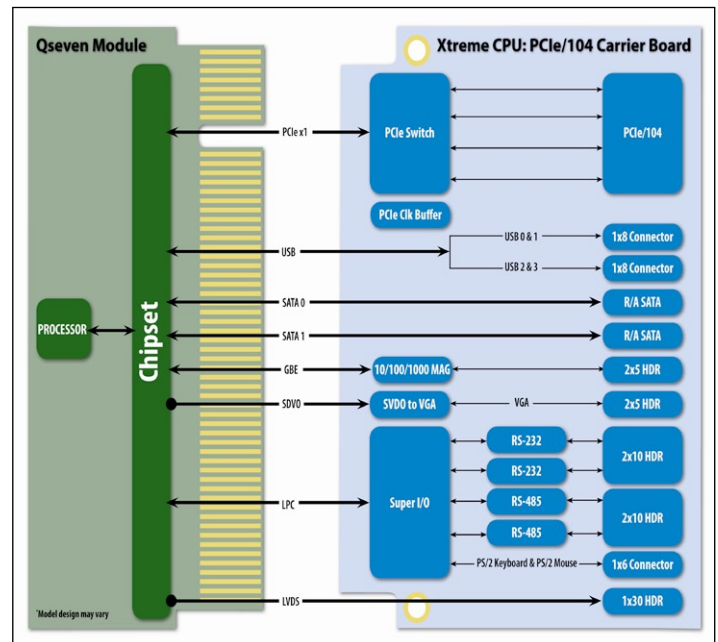


Figure 1: Typical Qseven COM to PCIe/104 interconnect.

delivers a robust I/O platform and a processing module that can stay current with the latest the industry has to offer.

The Qseven specification defines pin-outs for four PCI Express x1 lanes for expansion capability. PCI Express provides a high performance serial interconnect to a wide range of interfaces that are not provided on the COM. Table 1 lists the PC/104 Consortium form factors that match up well with Qseven modules. Each of these PC/104 Consortium boards has direct support for PCI Express. The small size of EBX and Epic form factors make them ideal candidates as host carriers for COMs. Having a mature technology supported by several vendors gives the designers I/O or processing options that can benefit them through the entire design process.

Scalability

Applications are scalable, which means once a product has been created there is the ability to diversify the product range with different performance class Qseven modules and I/O payloads through the PC/104 modules. As Qseven COM host carriers emerge on other form factors, you can reuse a favorite COM and its associated software in a new I/O

configuration. When new COMs and carriers enter the market, you get a multiplying effect on the number of possible combinations. Simply unplug one module and replace it with another, no redesign is necessary.

Processor technology moves very quickly, with enhancements to existing processor families occurring two or three times a year. Compounding the problem are the numerous new processors introduced every year. Having the processing element, memory, and supporting chipsets on a COM lets you try out the newest technology and then move it into your product line at your convenience. Because PCI Express is the common denominator, you have many cross platform processor choices, including Intel Atom, Freescale i.MX, TI OMAP and NVIDIA Tegra, with more to come as the processor suppliers come to appreciate the time-to-market advantages of Qseven. You can offer instant upgrades to existing products and never be trapped in an obsolete design.

Rapid prototyping

Another more subtle advantage is the capability of rapid prototyping or proof of concept development with off-the-shelf PC/104 and Qseven modules. Being able to quickly prototype with various processor and I/O combinations lets you find the most suitable platform for your application. No matter how well you simulate a design, nothing beats being able to create a fully functional prototype.

Flexibility

Additional flexibility is gained by using one of many FPGA modules readily available through the PC/104 Consortium ecosystem. Designers can complete their application by adding FPGA or various I/O solutions from a well-established, robust and well supported PC/104 ecosystem. The programmable flexibility of FPGAs takes the modularity concept to the next level. Several FPGA modules are available from PC/104 Consortium members using Xilinx, Actel, and other FPGAs. System cost can be reduced in lower unit volume applications by using high volume components like Qseven COMs. COM suppliers can increase unit volumes and reduce part numbers generating savings that can be passed onto the integrators. Usually board or module products that snap together have a slightly higher cost associated with them, but with the Qseven COM - PC/104 combination, one can use a very cost competitive, higher unit volume module, offsetting the cost of integration with a high degree of design flexibility.

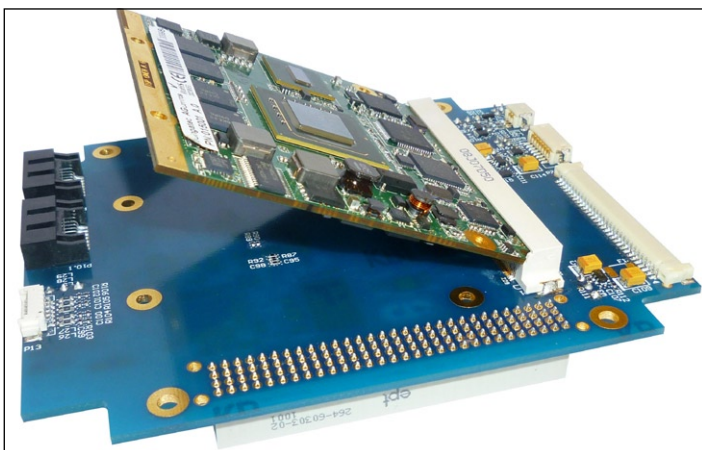


Figure 2: a Qseven module.

Form Factor	Type	Size (mm)	Bus	Advantages
PCI/104-Express	Stackable Module	90x96	PCI + PCI Express	Small size, adds the robust PCI bus and the high-speed PCI Express bus.
PCIe/104	Stackable Module	90x96	PCI Express	Small size, exclusive use of PCI Express bus.
EBX Express	Motherboard	146 x 203	ISA + PCI Express	Same advantages as EBX, plus it adds the high-speed PCI Express bus.
EPIC Express	Motherboard	115 x 165	ISA + PCI Express	Same advantages as EPIC, plus it adds the high-speed PCI Express bus.

Table 1: PC/104 Consortium form factors with PCI Express capability.

Selecting an OS

Operating system and drivers must support your chosen processor platform and I/O payload. If you plan to interchange either one, be sure that the software is capable of handling the changes or compatible software modules are available. Embedded Windows and Linux minimize this challenge, but you should be sure to get the latest drivers and BIOS from the COM supplier to avoid software integration issues. ■



Standard and custom passive components

If your application depends on it



MICROSWITCHES AND POSITIONSWITCHES

- IP67 sealed
- Long life
- High precision
- Temperature resistant



LED ASSEMBLIES

- Custom board mount and panel mount
- Rugged IP66 indicator lights
- RoHS compliant



METAL FOIL RESISTORS

- Close tolerances
- MIL and NASA approved

Microprecision Electronics SA is a manufacturer of precise passive components like microswitches, position switches, LED components and metal foil resistors.

Visit us at : www.microprecision.ch

MICROPRECISION ELECTRONICS SA
P.O. Box 160 ■ Route de l'Industrie 27
CH - 1896 Vouvry ■ Switzerland
P +41 (0)24 481 43 43
F +41 (0)24 481 43 60