

PC-MIP: Evolution of a Mezzanine Standard

Space and flexibility are the primary objectives of industrial mezzanines. And since systems designers are not afforded the luxury of creating electronics from scratch for every program, standards evolve to address convenience, time and cost. The success of a standard is based on how well it delivers practical solutions. Embedded industrial applications are increasingly relying on off-the-shelf components that offer the flexibility to create a "customized" system. The latest mezzanine available to system designers, PC-MIP, leverages the experience of three market leaders to create the "next generation" of density, modularity and cost-efficiency.

SPACE AND FLEXIBILITY.

The international collaboration behind PC-MIP is the first of its kind. SBS GreenSpring Modular I/O (Menlo Park, CA, USA), the most successful mezzanine vendor in North America, and MEN Mikro Elektronik (Numburg, Germany), a European leader in front panel I/O, have been joined by Motorola Computer Group (Tempe AZ, USA) a leading CPU board manufacturer to sponsor a Standards Task Group under the ANSI/VITA Standards Organization. The name of the mezzanine reflects its roots: "PC" is derived from the mezzanine's PCI bus; "M" is derived from MEN's success with M-module I/O; and "IP" reflects SBS GreenSpring's standing as inventor of the IndustryPack module specification.

With the PCI bus as the logical interface, PC-MIP modules can capitalize on very high bandwidth I/O applications, up to 132 MB/second. The bus also opens up PC-MIP to a large and growing family of inexpensive integral PCI chips with I/O or CPU functions. SBS GreenSpring, MEN and Motorola form a front line that is sensitive to and experienced with the challenges facing systems designers now and into the future. This combination of technology and teamwork appear to have marked PC-MIP for success.

REQUIREMENTS AND ADVANTAGES

As IndustryPacks are to VME in commercial applications, so will PC-MIP be for PC-based architectures in industrial markets. The migration path from desktop PCs to Windows NT today and Windows CE 2.0 tomorrow will be facilitated by a standard that accommodates all software and I/O modules. That next generation standard is PC-MIP, created on a foundation of fundamental advantages to industrial markets:

- 100 percent electrical PCI-compatibility
- Suitability for desktop PCs and for 6U Eurocard slot boards (such as VMEbus and CompactPCI systems)

tems)

- Optional front I/O
- Ease of use
- Full software compatibility
- Fully automatic system configuration capability
- Sufficient bandwidth for next generation systems
- Low cost implementation
- Very high I/O line density (300 lines per 6U host, six modules per 6U VME/cPCI/PCI carrier)
- High reliability with 100 percent surface mount construction (for low cost manufacturing)
- Rugged standard with injector/ejectors and positive hold-downs
- Access to large and growing family of inexpensive single-chip interfaces
- Backed by an international partnership and ANSI standards organization

FORM FACTOR DRIVEN BY DENSITY

Compatible, low cost modules are critical to the success of a mezzanine standard. PC-MIP modules were conceived to support low cost implementation, as well as high density. With a focus on density, the team behind PC-MIP changed the dimension slightly from the IndustryPack (IP) module in order to add more modules to a 3U and 6U carrier board. The 47mm x 90mm dimension is ideal, as modules of that size fit on both Eurocards and on desktop PC boards. There is more available space to mount components than on an IP, because the connectors are 100 percent surface mounted. The space is more efficient than on an IP because standard thickness ICs can be added to either side of the module.

The PC-MIP design also reflects close attention to space planning and signal routing to the host carrier boards, so the modules are much easier to support mechanically. The space-intensive PMC, for example

PC-MIP

demands a 31mm "keep-out" for the front panel connectors, while PC-MIP requires only 9mm. Yet, this 9mm is sufficient space to accommodate standard video, SCSI, Ethernet and serial connectors. The mezzanine can also use the same fab to support both front panel and back panel I/O versions.

PC-MIP offers two-form factor options (Figures 1): Type I modules use a traditional I/O connector mated to the host carrier. Type II modules use an integral I/O connector for host carrier board front panel I/O. Avionics and military customers are examples of markets that usually prefer back-panel I/O. Research-oriented and low-volume customers generally prefer the convenience of front-panel I/O. PC-MIP offers both choices. The compatibility between the Type I and Type II modules adds substantial flexibility of implementation for the designer.

PC-MIPs are inherently compatible. Building on the successful concept behind IP modules, "all modules work in all slots," the designers paid close attention to the number of mechanical options and electrical variations, as well as strict adherence to the PCI 2.1 Specification. Not all PCI based mezzanines can make this claim. For example, CMC, IEEE-P1386 lists 32 combinations of size, height and voltage, as well as 15 other standards documents. PC-MIPs, on the other hand, are as easy to design as they are to use, for those customers who prefer to design their own specialized modules.

While PC-MIP offers different sizes and heights, it

requires only a single PCI-bus signalling voltage: 3.3 volts. Because the heights and widths are inter-compatible, this single voltage eliminates the need for mechanical protection against incompatible voltages (as required by some mezzanines). It also reduces the potential frustration of having to match specification profiles during the product selection process.

DISTINGUISHING FEATURES PROVIDE NEW ADVANTAGES

The PC-MIP design incorporates a number of new features that are not available on any other mezzanine. For example, the large number of ground pins on the perimeter of the module assures outstanding, high frequency performance. The ground pins also facilitate the compliance with strict CE and FCC emissions requirements. Two 64-pin SMT connectors serve the PCI bus, complete with 22 ground pins and 25 power pins. A third identical 64 pin connector provides 50 lines of I/O and 14 additional grounds. In addition, all PC-MIP modules include captive injector/ejector hardware to facilitate easy, reliable installation and removal. This attribute is also unique among mezzanine standards.

If density is a measure of success, PC-MIP shows sure signs of being a winner, as the following density examples show:

- 4 independent FP connectors on a single VME or

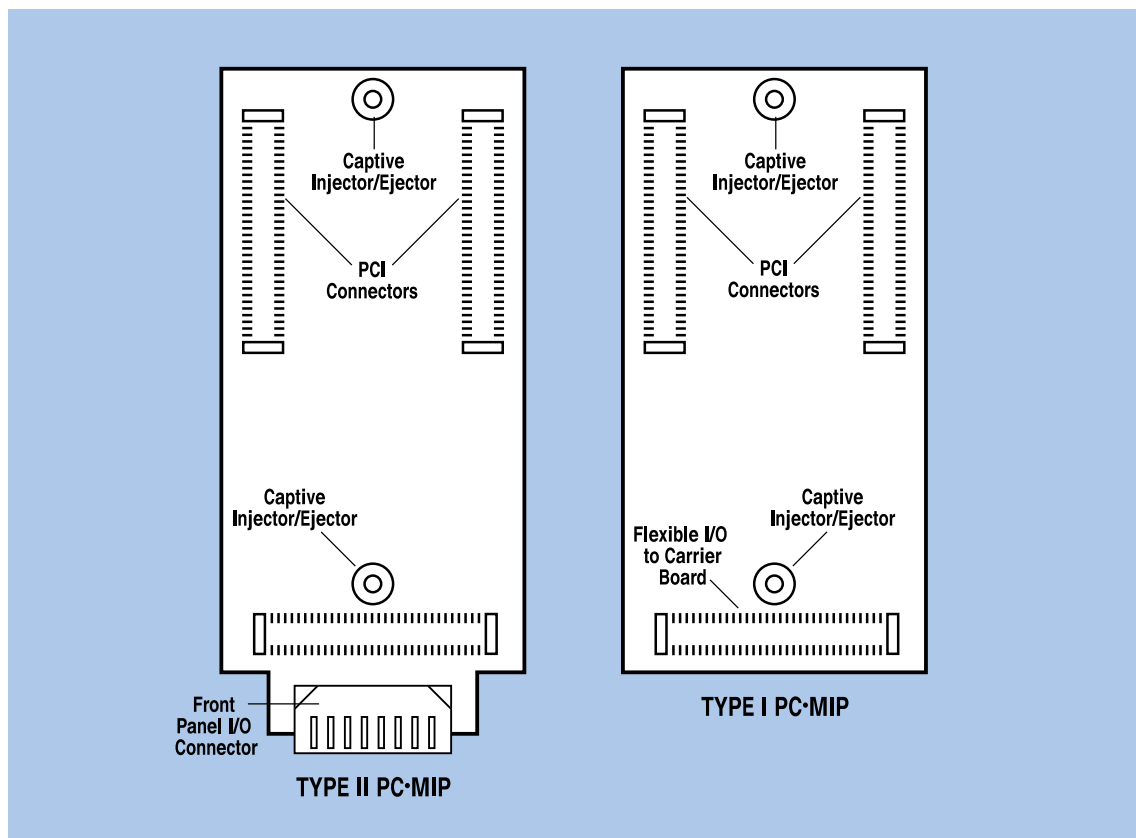


Figure 1. PC-MIP

- CompactPCI card
- 300 lines of I/O on a 6U VME card
- 300 lines of I/O on a 6U CompactPCI card
- 300 lines of I/O on a full size desktop PCI card
- 150 lines of I/O on a half size short desktop PCI card
- 150 lines of I/O on a 3U VME card
- 150 lines of I/O on a 3U CompactPCI card
- 150 lines of I/O on a PLC form factor (Allen-Bradley Open Controller)

FUTURE PRODUCTS AND FURTHER INFORMATION

A technology agreement between SBS GreenSpring and MEN Mikro Elektronik will serve to enhance and accelerate product development. The transition from "creating the standard" to "launching the standard" will be complete with the release of the first set of PC-MIP modules by the fourth quarter of 1998. The process of developing products to launch the standard has been defined by SBS GreenSpring in three general phases: the first phase is identifying the highest volume, most common functions that will appeal to the broadest range of users and CPU board vendors. The second step is to add functions that are a particularly good technology fit with PC-MIP -- such as 64 MB burst DRAM and 128 MB Flash modules, and DSP modules that all benefit from the high bandwidth and efficient single-chip implementation of PC-MIP. Lastly, a wide range of digital functions is addressed, such as digital, analog and avionics.

These parameters will be reflected in upcoming announcements from SBS GreenSpring of new PC-MIP modules and carrier boards. The first set of PC-MIP mezzanine modules will include:

- SVGA/LCD controller

- SCSI II/Ultra SCSI
- DRAM with DMA controller
- USB, Firewire and high speed serial
- High speed general purpose I/O
- ATM, ISDN, T1/E1
- Motorola 96K DSP and MPC860 based modules
- Flash with DMA controller

A current version of the PC-MIP draft standard may be obtained from VITA (Scottsdale, AZ Ph 602-951-8866), or the Task Group Chair, Kim Rubin of SBS Computer Group (kim@greenspring.com). Manufacturers planning to design a PC-MIP carrier board or module may contact the Task Group. PC-MIP uses the Peripheral Component Interconnect (PCI) specification, and further information on this specification is available from the PCI Special Interest Group (www.pcisig.com). ■

Kim Rubin is chief technical officer for the SBS Technologies Computer Group. Prior to this position, Mr. Rubin served as executive vice president and chief technical officer at SBS GreenSpring Modular I/O in Menlo Park, CA (an SBS Technologies business unit). Mr. Rubin is generally regarded as the inventor of IndustryPack mezzanine I/O modules, which are now recognized by the ANSI standard, "ANSI/VITA 4-1995, IP Modules" and supported by over 120 company's worldwide. (See GRoupIPC-website at <http://www.groupipc.com>) Prior to joining SBS GreenSpring, Mr. Rubin was U.S. director of engineering for Force Computers. He is a graduate of UC Berkely (EECS, 1975) and occasionally lectures at Stanford University. Mr. Rubin can be reached at kim@greenspring.com.