PRODUCT FOCUS

BRIDGING

CompactPCI is increasingly living up to its name: Something is happening on the backplane

By Andreas Lenkisch

Backplane manufacturers are not immune to the mounting pressure to minimize the space occupied by components in the subrack, where every single slot width is at stake. At the same time the technical requirements for interference immunity and failure reliability are increasing. Innovative ideas are demanded here.

Optimized bridge creates space

According to standard IEEE-1101, one subrack provides 21 slots in which to fit boards, modules, power supply and drive units etc., i.e. there are exactly 19 inches (482.6 mm) available and not a millimeter more. An additional complete subrack is normally required the moment that a 3U or 6U system needs more space. With demands for better performance in a smaller space constantly being made of industrial computers, every unit of width (HP), wherever it can be saved, is increasingly important.

Schroff, the specialists in microcomputer packaging systems, and a leading brand within the Pentair Enclosures Group Europe, has now developed an innovative CompactPCI backplane design that lets the user gain valuable space while delivering improved quality, performance and interference immunity. The Schroff concept also gives developers of CompactPCI systems a large degree of freedom in their design. The backplane has a completely modular structure to save costly and time-consuming development and manufacture of application-specific backplanes. All the system integrator needs to do now is combine the various Schroff modules into a versatile system, which can be used to provide a rapid and inexpensive solution even in prototype and small-scale production. The basic components comprise modular backplanes that can be abutted and linked together, *power piggybacks* and one or more power backplanes (Figure 1).

Figure 1

Backplanes – modular and interlinkable

When developing the new generation of CompactPCI backplanes, Schroff stuck rigorously to an "interlinkable" design (Figure 2). This means that all backplanes can be linked together without loss of space both horizontally and vertically. Thus one does not lose a slot width or any vertical space, as is so often the case when combining two backplanes. This may sound simple but in practice requires considerable development work to meet the greater demands on the power supply feed. These arise because there is significantly less space available for the connecting elements to carry away the current on the backplane. Considerable problems can result if the current densities are too high at critical points, i.e. at the connecting points between the plated wall of the hole and the internal layers of the backplane. Current densities that are too high at power feed points reduce reliability and thus the lifetime of the backplane.

Increased interference immunity and longer operating life

The electrical development engineers at Schroff have eased these local hot spots considerably by refining the design of the ten inner layers of the backplane. By redesigning the layout it has been possible to reduce current densities and to achieve better heat dissipation. This now enables significantly higher currents to be fed onto the backplane without reducing its operating life.

Backplanes and System EMC

The redesign process did not just involve dimensional changes – the engineers also looked at the subject of EMC. The problem areas of interference susceptibility and noise emission have become increasingly critical with the rise in clock frequencies over recent years – a trend that looks set to continue. Although everything is currently still based on 33 MHz for the Compact-

Figure 2

PCI bus, the jump to 66 MHz technology is already imminent. Processors with clock frequencies around 1 GHz are already in use today – noise sources opening up a new frequency scale.

Schroff has therefore fundamentally redesigned the decoupling principle of the backplane, in order to provide effective attenuation of the noise voltages at these substantially higher frequencies, both today and in the future. The knowledge gained from extensive simulations has been applied to provide significant improvements in state-of-the-art decoupling of supply voltages. These properties have been achieved using ceramic capacitors specially selected for their parasitic characteristics, and by using a precisely defined circuit-board layout. As a result, Schroff backplanes exhibit considerably better attenuation of high frequency noise voltages and currents compared with conventional solutions, with positive effects on the EMC properties of the whole system.

Another positive aspect of the careful choice of components is the increased operating life and system reliability. For instance, neither tantalum nor aluminium electrolytic capacitors are used, since they involve a certain risk. Aluminium electrolytics dry out over time and lose their effectiveness after about five to ten years. Tantalum electrolytics react extremely sensitively to over-voltage peaks and incorrect polarity. Any mistakes made during set-up or maintenance can quickly lead to an explosion, which may cause damage to the backplane or even the whole system. Various companies and even countries now insist on the use of alternative capacitors, such as the ceramic types employed by Schroff. In addition, Schroff only uses robust, high-reliability SMD components.

Optimized bridge creates space

Schroff supplies the new CompactPCI backplanes in 3U or 6U heights, with three- to eight-slot versions. The four- and seven-slot versions are *bridgeable*, i.e. up to seven additional peripheral I/O boards can be connected to the CPU board via a transparent bridge. Many of today's applications need 14 or more slots; with Schroff backplanes and bridges, CompactPCI systems with up to 21 slots can be built in a 19-inch subrack.

Here Schroff has the technical edge. Standard bridge designs are either plugged into the front of the backplane taking up one or two slots, or they are inserted from the rear as so-called *pallet bridges* into the location for connectors P1 and P2. The overall height, which is technically unavoidable with this solution because the bridge is placed on CompactPCI slots, means that no rear I/O is possible. This means it is not an option for computer-telephony applications, which represent a large share of the CompactPCI market.

Being inserted from the rear, the Schroff bridge avoids losing a slot on the front side. In this case, however, the bridge is based on space-saving mezzanine-board connectors, which are located on the rear of the backplane between the CompactPCI slots. This means that the bridge is so flat (8 mm) that rear I/O cards can be inserted easily. This small product available is only (50 x 60 x 8 mm) for connecting two CompactPCI bus segments, and spans just two slots, not up to five as was previously the case (Figure 3).

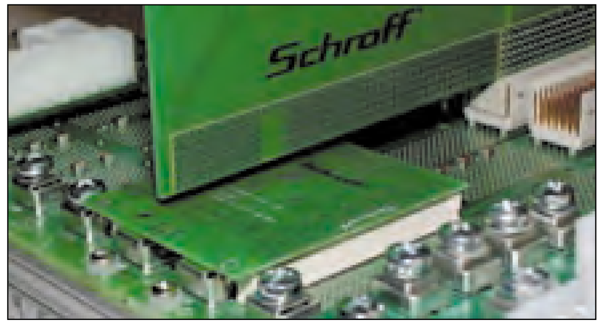

Figure 3

The Schroff solution not only enables the use of rear slots RP3 to RP5, but also positions RP2 in 3U 32-bit systems. The bridge is currently available in the 32-bit version. Backplanes for 64 bit buses have already been designed, and the corresponding bridge will be developed when the market demands it.

Flexible power interface

Now let's return to the other components in the Schroff backplane design. The so-called *piggyback* board is used for connecting the power supply to the backplane. This board contains an ATX connector, various universal supply terminals for M4 eyelets (power bugs) and three disk drive connectors. It is also plugged directly into the rear of the backplane (Figure 1). With its varied range of connection options, it forms a central node for the power supply in the system. Not only can various power sources be connected simply using this board, but also other units such as disk drives or fans can be conveniently powered from here.

Figure 4

The ATX connector can be used to connect the power backplane with P47 connector from Schroff (Figure 4). The power backplanes can be fitted anywhere within the backplane area, and are generally used as adapters between 19-inch power supplies and the backplane. Thus they offer particular benefits in prototype and small-scale production, since users no longer need to develop and manufacture expensive application-specific backplanes with integral power supply interface. The P47 connector provides CompactPCI system developers with a simple, quick and economic means of connecting PICMG 2.11-compliant power supplies, such as Schroff's *maxpower*PRO unit, to CompactPCI backplanes.

Redundant power supplies in view

The power backplane features a particularly high degree of modularity. It supports the connection of up to four power supply units in parallel, with separable fault signals FAL# (Fail) and DEG# (derating of outputs). This means that a higher-level monitoring unit, such as Schroff's Chassis Monitoring Module

(CMM), can perform logical operations on the signals before they are forwarded to the CPU. This is an essential requirement for studying, at the prototype stage, the monitoring of redundant power supplies in high-availability systems. Of course it is electrically possible to connect the fault signals in parallel, but logically this is not compatible with redundant operation of several power supplies.

The System Management Bus as specified in PICMG 2.09 is integrated on the board, so that together with the definable geographical address of each slot, information on the status of each power supply in the system can be monitored at a higher level. Users are thus able to locate weak points well in advance. For instance if a power supply frequently indicates the *Derating* (DEG#) signal, this can point to thermal overload and thus to insufficient cooling. In a redundant system, however, the other power supplies would take over supply in this case. Thus the system would not fail, the problem would go unnoticed by the user and thus no corrective measures would be implemented. Only when another power supply failed, probably with a serial-production model in the field, would the inadequate cooling become apparent. Yet this problem can be picked up by the user right at the development stage using the power backplane.

With the new generation of CompactPCI backplanes, miniaturised bridges, and innovative power feed design, Schroff is offering a technically superior solution employing individual modular components that are designed to fit and work together. For the user this represents an economic and effective answer to the increasing demands within CompactPCI systems.

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