Space: The Final Frontier

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In the telecommunications arena, people may be excused for assuming that there is space to spare. After all, there are huge racks of equipment, and surely there's no need to worry about minor things like board area and device size, right? Well, that may be the case for retrofitting existing equipment, but in the majority of new designs, space is one of the most constraining specifications.

"I canna hold her Cap'n, she's gonna blow..."- Scotty

With telecom protocols and data rates growing in complexity, the electronics required to implement competitive products seems to remain just beyond the capacity of a single card. Standard mezzanine cards such as PMC, and a wealth of proprietary offerings, allow the developer to boldly go beyond the frontiers of a 6U board, but the cost may be prohibitive. In the case of the smaller 3U boards, the problem is exacerbated, and a mezzanine card becomes a necessity for all but the simplest of applications.

The interface to the VMEbus backplane is thoroughly specified, and commercially available devices implement all the required protocols. The wide range of features offered by the various devices is matched by the wide choice of footprints. The developer must make a choice between a fat, full-featured interface, or a slimmed-down version with less-extensive protocol support.

"Let me have about me men that are fat - sleek-headed men such as sleep o'nights"- Shakespeare- In Shakespeare's time, a large girth was a desirable characteristic, implying reliability, and contentment. In today's analytical world, developers expect to see more-tangible benefits for the space occupied by large devices. VMEbus interface controllers from Cypress Semiconductor and from Tundra offer a range of features that the telecom board designer will need. In deciding upon the best device for a particular application, the designer may have a list of prioritized requirements such as cost, data transfer performance, protocols to be supported, and local bus requirements, as well as space constraints. Each manufacturer offers a range of devices with different costs and complexities. The Universe from Tundra is developed for boards requiring PCI local bus transfers across the VME backplane. The ubiquitous VIC068A from Cypress is designed for applications powered by Motorola CPUs. Both the Cypress VIC64 and the Tundra SCV64 offer VME64 connectivity. For slave VMEbus applications each company has its own approach, Tundra with their Trooper family, and Cypress with their CY7C96x family. The unfortunate telecom designer will be dismayed to find that each manufacturer's products offer a different mix of features and benefits, requiring a detailed analysis prior to product selection. Making matters worse, of the entire list of products only the VIC068A and the VIC64 are plug-compatible.

On the topic of board area, there are several different package options for each device. Each manufacturer has adopted a different approach to solving the cost-space-performance equation. Tundra has opted for the large centralized device with external drivers. Cypress's philosophy was to integrate the drivers and distribute the control. Each approach has its merits. Integrating the interface drivers has a beneficial effect upon overall board area but increases total parts count; a large centralized controller means fewer part numbers to inventory, but the parts are bigger.

The dangers of entering the Neutral Zone- Some designers may review the catalog products of the dueling vendors and decide to remain neutral with an ASIC development. The most common reason developers give for making that decision is cost: even though both Tundra and Cypress offer low-cost VMEbus controllers, some applications may require features that are only available in the higher-end products. Space, though not usually the primary reason for developing an ASIC, may be part of the picture. The higher-end products are certainly the bulkier members of the family. Tundra's flow-though approach to data management forces a high pin count in their high end products, and Cypress's distributed control philosophy causes pins to be dedicated to companion-chip communications. High pin count means larger packages. So even if the devices are within the financial budget of the developer, they may not fall within the space budget.

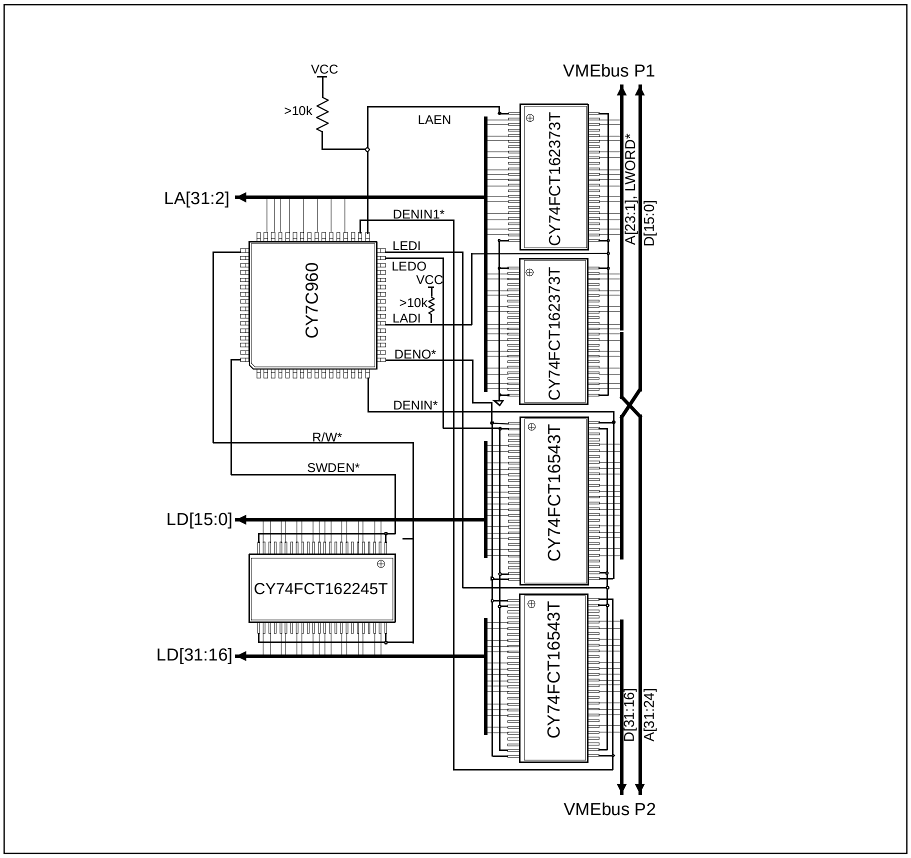

FIGURE 1 - 6U Slave Design

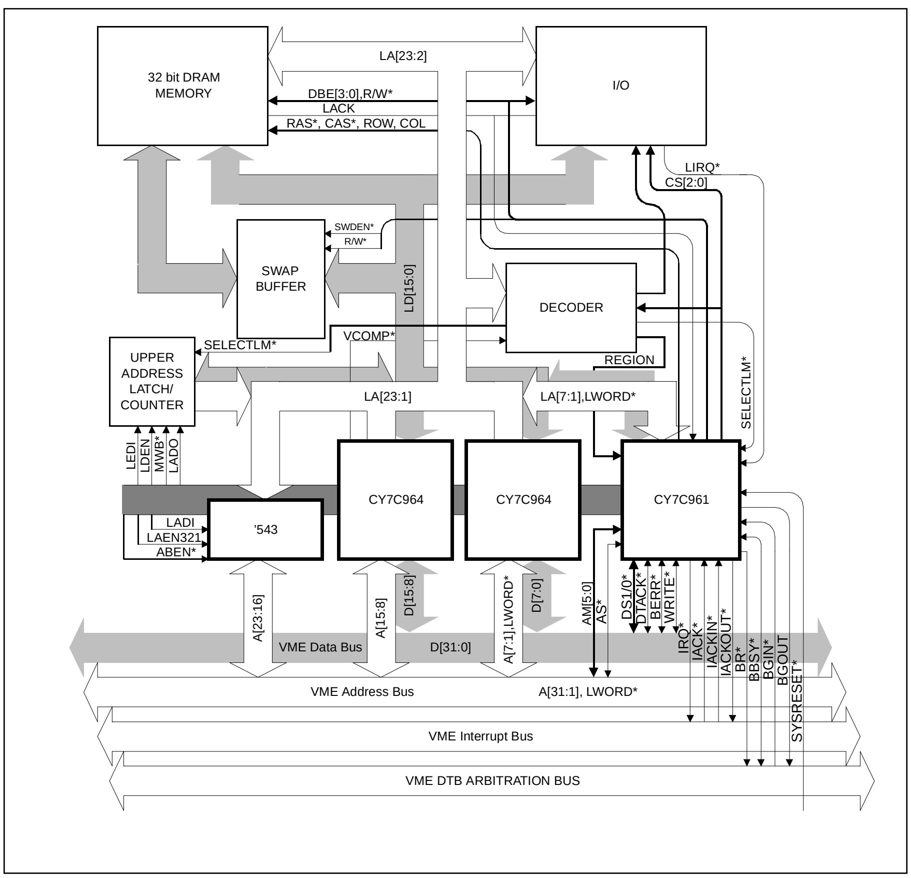

Figure 2 - 3U Master/Slave Design

The biggest disadvantage of developing your own VMEbus controller is the risk of failure: many projects have failed on account of incompatibility and inflexibility, or have suffered from runaway development schedules.

Two to Beam Up- Here are two schematics of practical, low cost, small board area designs that may be useful to review if you're squeezed for space. They each occupy similar footprints, and each set of products is capable of mounting on the 'back' of the board for those really tight constraints.

6U Slave Design-The schematic in Figure 1 implements a complete VMEbus slave interface design. It supports 'Rev C' VMEbus transfers A16/A24/A32/D8/D16/D32/UAT/RMW (incl BLT). (With Cypress CY7C964s in place of the FCT devices, multiplexed transactions such as A64 and MBLT can be supported).

32-bit BLT performance up to 35Mbyte/second has been demonstrated (the data rate is limited by factors outside the control of the interface silicon). This entire interface occupies only 1.08 sq. in. in 6 surface mount devices, with their thin profile allowing mounting on the back of the board without violating VMEbus mechanical constraints.

3U Master/Slave Design- The schematic in Figure 2 shows a complete 3U Master/Slave VMEbus Interface. It supports all transactions appropriate for 3U boards compliant to the VME64 specification, including A40 master and slave operations. The schematic shows both the VMEbus interface and potential local circuitry. The four main VMEbus interface chips in bold occupy 1.09 sq. in., again allowing use on the 'back' of the board.

The conquest of space for a VMEbus interface need not become an exploration of new worlds: the two examples show how the developer can choose off-the-shelf components that occupy a minimum of board area, without sacrificing features or protocols.

For some parts of your board design you may indeed have to 'boldly go where none have gone before'... (but not for the VMEbus controller)!

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