IDT®
PCI Express®: Selecting the Right Bridge for High-Performance Applications

8000000_AN005_02

September 28, 2009

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Printed in U.S.A.
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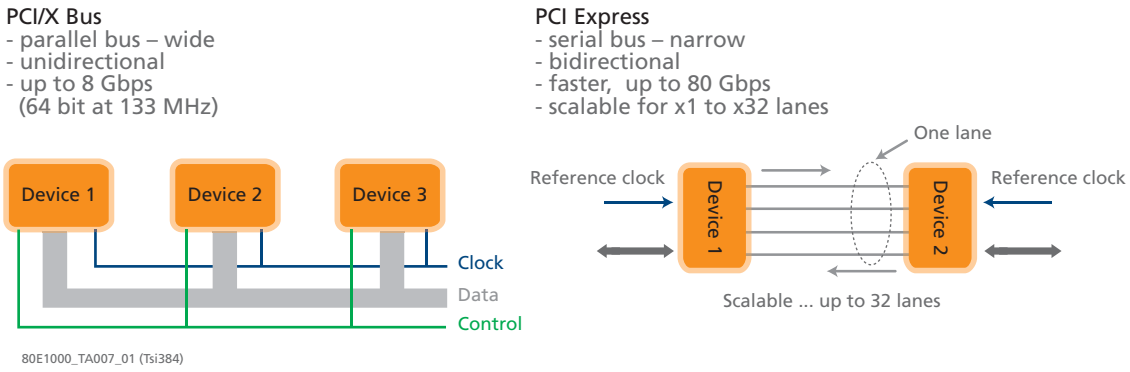
1. PCI Express: Selecting the Right Bridge for High-Performance Applications

PCI Express (PCIe) is the evolution of the PCI standard, which was developed to meet increasing bandwidth and speed requirements, and to upgrade from a parallel bus architecture to a high speed serial point-to-point architecture. PCIe supports faster bus speeds and backwards-compatible PC interconnect support for both chip-to-chip and add-in card applications. PCIe offers many advantages over conventional PCI and PCI/X: It offers higher speed, is scalable from 1 to 32 lanes of 2.5 Gbps for a single 80 Gbps link, compared to maximum 8 Gbps for 64-bit PCI/X at 133 MHz. Additionally as a serial interface, requirements can be met with far fewer physical connections than parallel PCI/X saving on circuit board complexity and space.

PCI Express has been widely adopted across all major markets where PCI/X has been traditionally used. Personal computer manufacturers, server, industrial PC, embedded and telecommunications equipment manufacturers are all moving PCI designs to PCIe. PCIe is becoming more ubiquitous in a broad range of applications. PC motherboards now include PCIe as standard and more PCIe slots are expected to be available in place of PCI. Processors and chipsets now provide PCIe interfaces as standard.

Products developed using components that have PCI/X interfaces either need to use devices redesigned to support PCIe or use a bridge device to connect to PCIe.

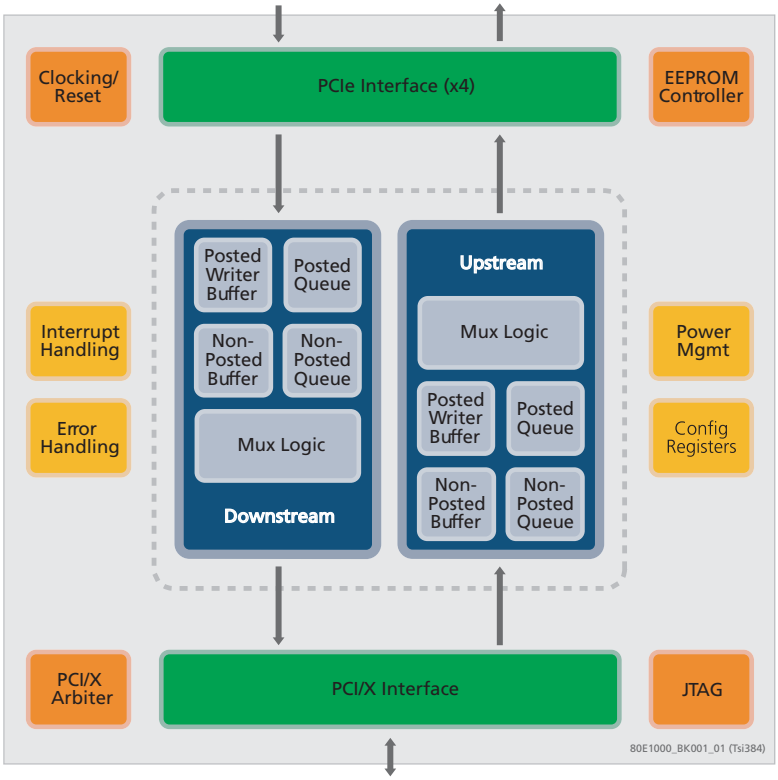
Figure 1: PCI/X Parallel vs. PCI Express Serial



1.1 IDT Tsi384™ PCI Express-to-PCI/X bridge

To meet the need for bridging between PCI/X and PCIe, IDT has introduced the Tsi384 PCIe-to-PCI/X forward bridge. The Tsi384 provides a 4-lane PCIe bridge to 133 MHz PCI/X, ideal for applications that need to push the bandwidth limits of PCI/X.

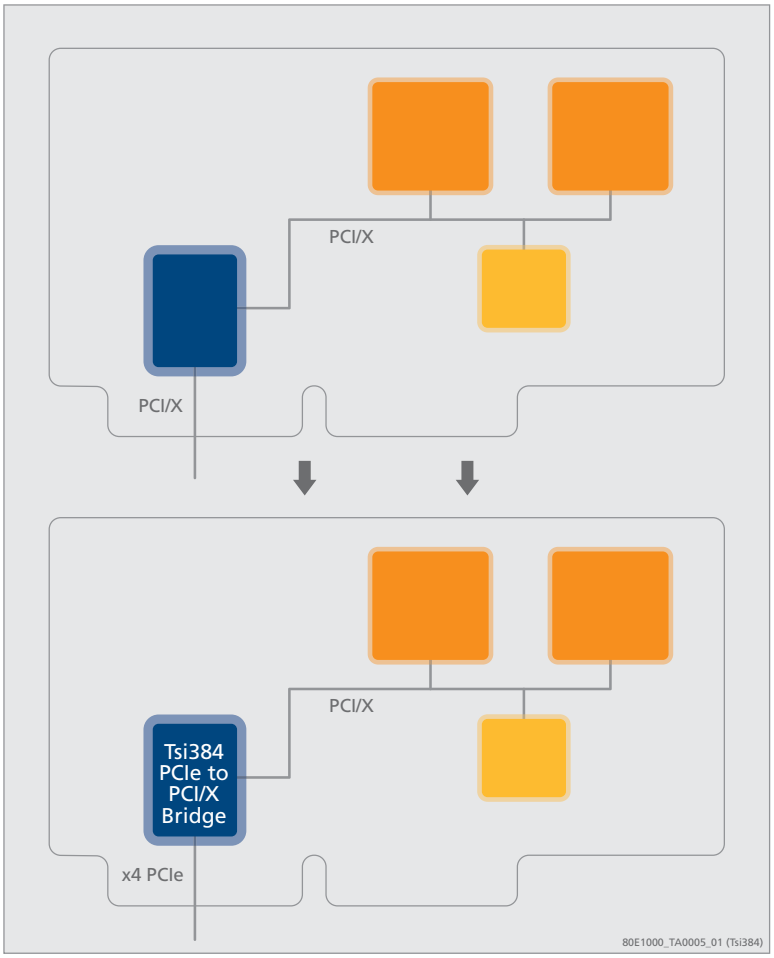
Figure 2: Tsi384 Block Diagram



Using the Tsi384, designers can easily migrate designs using PCI/X to PCIe. For example by replacing the PCI/X bridge or adding the Tsi384 in front of the existing PCI/X I/O adapter logic, developers can quickly bring to market a PCIe based product leaving the remaining logic intact.

As much of the existing design can be used and as there is no need to develop new native PCIe silicon this is a very low risk solution to bring a product to market quickly.

Figure 3: Using the Tsi384 to Create an Adapter with PCIe Capability



The Tsi384's low typical power consumption of 1.3W, and its small footprint BGA package, makes it ideal as a bridging solution, providing board designers savings in space and power supply requirements.

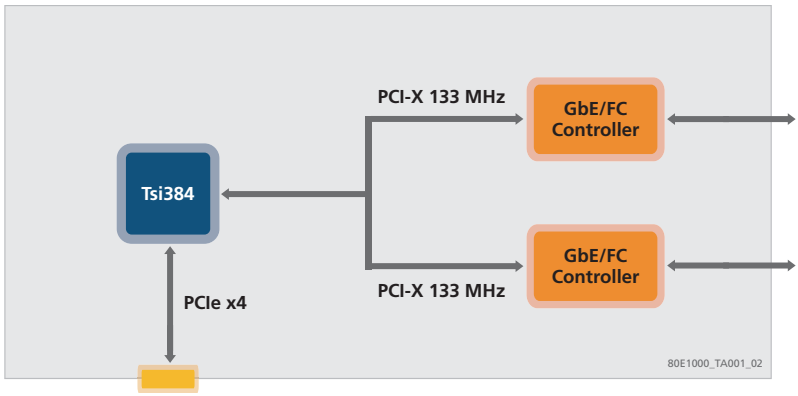
1.2 Maximize Performance and Minimize Latency

One ideal application for the Tsi384 is providing the PCIe interface on a host bus adapter card (HBA). In such applications maximum data throughput and minimal delay in responding to requests to read and write data are critical. Ideally the bridge chosen in such a design must not become a bottleneck in the speed of data transfer in and out of the device and must minimize the time it takes for data transactions to move through the bridge.

The Tsi384 is designed to minimize latency and maximize throughput across the bridge. Deep buffering and superior queuing architecture all contribute to reducing delays in getting data through the bridge from PCI/X to PCIe. Minimal latency and efficient transfer of data through the Tsi384 make it an ideal choice for high performance applications.

Additionally, the Tsi384 can support data payloads up to 512B which make it possible to transfer data with proportionally less overhead – making higher data throughput possible.

Figure 4: Using the Tsi384 to provide PCIe on an HBA Card



Intelligent adapter boards - non-transparent bridging An intelligent adapter board is used to extend the I/O capability of the host board and off-load the processing tasks required for the I/O devices. This is achieved by using an embedded processor on the device that controls and communicates with the other devices on the PCI/X bus. One example is a RAID adapter – in this case the embedded processor handles the processing functions to perform RAID on a SCSI disk controller – off-loading the host from these tasks.

In such designs the embedded processor needs to operate and control devices on the secondary bus without interference from the host processor. A bridge operating in transparent mode would expose devices on the card to the host upon system initialization and it would attempt to initialize and control them.

To prevent this, the bridge needs to hide these devices from the host. This bridging method is implemented using the Tsi384's non-transparent mode.

Figure 5: SCSI Controller Card with I/O Processor

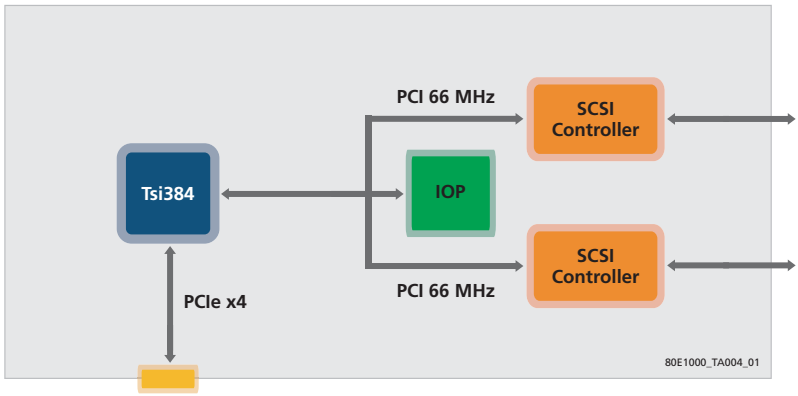
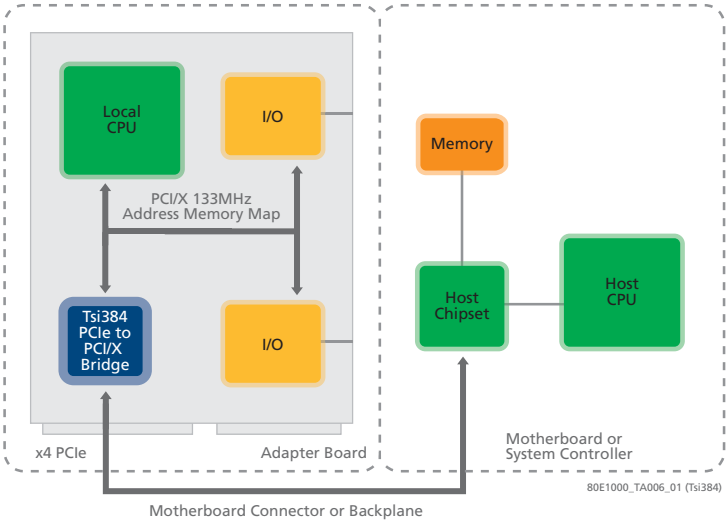


Figure 6: PCIe Intelligent Adapter with Non-Transparent Bridge - Independent Address Map



1.3 Selecting the Right PCIe-to-PCI/X Bridge

IDT is a leading supplier of system interconnect solutions to the world's foremost communications, computing and storage companies. IDT's industry-respected expertise and depth of knowledge in delivering high-quality products brings a welcome solution for PCIe bridging needs, with the new IDT Tsi384 PCIe bridge.

For high performance applications that need to bridge PCI/X devices to PCIe, the Tsi384 is ideal to maximize throughput, payload efficiency and minimize latency. Additionally, the Tsi384's non-transparent bridging mode make it suitable for embedded processing and intelligent I/O adapter card applications.

The Tsi384 is backed by IDT's world-class customer service and technical support which ensures that IDT customers get to market faster with their products.

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