

# Quatro6x

**4 GFLOPS floating-point  
6400 MIPS fixed-point  
Quad TMS320C6x01 DSP**



## Overview

The Quatro6x's high performance, coprocessor network-on-a-card architecture provides excellent processor connectivity between its four TMS320C6x01 processors, allowing the highest overall system performance. This DSP powerhouse is ideal for a wide range of computationally demanding applications including adaptive control, high bandwidth noise cancellation, complex simulations and advanced signal processing.

## Processor Core

Each processor features numerous on-chip peripherals including two 32-bit counter/timers, four DMA channels, 1 Mbit of on-chip RAM, an HPI parallel port interface and a prioritized interrupt controller. Memory on the Quatro6x includes a 512 KByte asynchronous SRAM region (ASRAM) for bus mastering transfers and 16 MBytes of 1 wait-state synchronous DRAM (SDRAM) per processor. Memory may also be expanded to include 512 Kbytes of 1 wait-state synchronous burst RAM (SBRAM) per processor.

## Expansion

All four processors are connected to one another via fast, simple, 32-bit, bidirectional FIFOLinks which are compatible with the processor DMA controllers and provide an ideal mechanism for high-performance inter-processor data flow.

Three of the Quatro6x processors may communicate with external hardware via dedicated, 16-bit, onboard, buffered, FIFOPort interfaces. This allows the Quatro6x to readily interface with any FIFOPort compatible card to increase processing power and access remote I/O.

## Host PC Interface

The Quatro6x is a standard 32-bit, full-size PCI card. ASRAM, which may be used for data storage, is the memory portal for PCI bus mastering transfers to and from the host PC. Data may be bus-mastered bidirectionally under the control of the primary 'C6x processor to the host PC's driver memory pool at burst rates to 132 MBytes/sec. During bus master transfers, the Quatro6x is free to perform data collection and analysis functions. The ASRAM is also addressable from the host PC. Thus, applications may freely bus master or direct-address this memory, for ultimate control and performance. Multiple cards may be installed with full driver support under Windows 9x/NT/2000.

## Development Tools

First time buyers of the Quatro6x will need to purchase the Quatro6x DevPack. The DevPack includes the Quatro6x card, Code Composer Studio Integrated Development Environment, CodeHammer JTAG Emulator and Zuma Toolset for the Quatro6x.

Innovative Integration's Zuma Toolset makes DSP development and complex peripheral integration fast and simple with easy-to-use, single command functions. A 300+ target-specific DSP and peripheral function library is provided in source form and is fully documented in an on-line Windows help file.

The Zuma Toolset includes everything from convenient utility applets allowing download, execution and high level debugging of DSP applications to a complete set of source code examples demonstrating full operation of all hardware resources.

## Features

Four 200 MHz TMS320C6201 DSP (fixed-point) or
Four 160 MHz TMS320C6701 DSP (floating-point)
Multi-Board Synchronization (SyncLink, ClkLink)
FIFO Link Interconnects Between Processors
Three FIFOPort interfaces

## Applications

Numeric Coprocessing
Video Coprocessing
Large-Scale Data Reduction
RADAR/SONAR

## Hardware Options

512 KBytes SBSRAM per DSP	
FIFOCable	pg 130

## Software Development Tools

Zuma Toolset	pg 94
TI Code Composer Studio	pg 91
Code Hammer / Debugger	pg 102

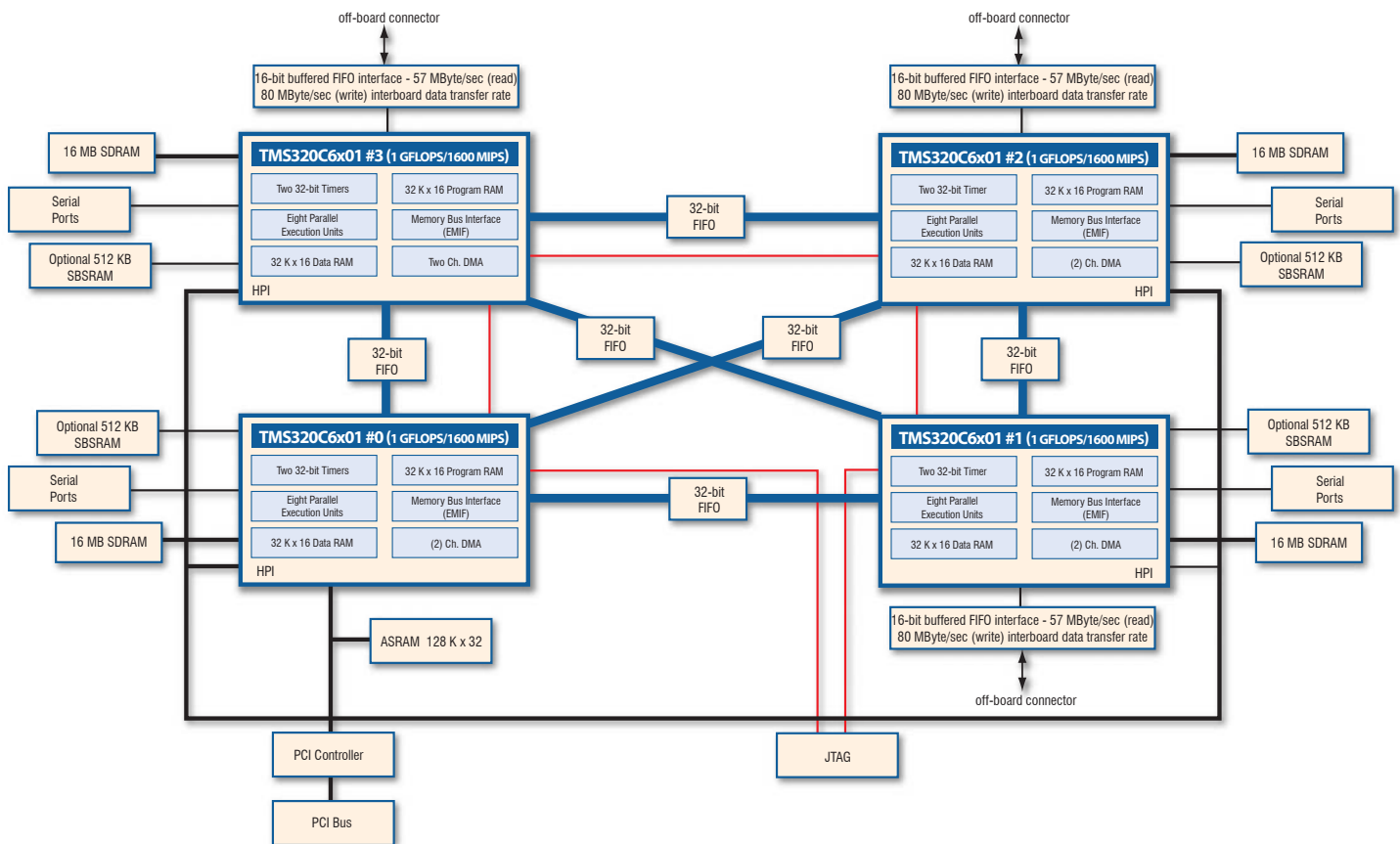
## Ordering Information

Quatro62	80013-1
Quatro62 DevPack	90013-0
Quatro67	80032-1
Quatro67 DevPack	90032-0



**DevPack Available**

See page 91 for details



The Zuma Toolset is fully supported from within Texas Instruments' Code Composer Studio. This state-of-the-art integrated development environment not only provides editing, compiling, linking, downloading and low level debugging, but also gives access to specific DSP registers and functions when used in conjunction with Innovative Integration's Code Hammer JTAG emulator.

Zuma support extends beyond target DSP development to include host PC code development as well. The toolset includes a real-time, Ring-0 (kernel mode) device driver and a fifty-function DLL which supports optimal-performance communications with the embedded DSP board. The DLL/Driver provides all of the support functions needed to download code to the embedded DSP, control the card operation and implement bidirectional data communications at full PCI bus bandwidth - up to 132 MBytes/sec!

A number of examples illustrating use of the DLL/Driver are supplied in Zuma. The example programs highlight everything ranging from host-to-target/target-to-host interrupts to common data passing techniques. The supplied DLL may be readily accessed from within popular PC programming environments like Visual C/C++, Visual Basic, Borland C++ Builder and Delphi to name just a few.

## OEM Configurations

The Quatro6x can be configured to fit your specific requirements and provide an optimal mix of performance, cost and features. Contact Innovative Integration with your specific OEM requirements.

## Digital Signal Processor

Texas Instruments TMS320C6201 or TMS320C6701 DSP.  
 64 KB program / 64 KB data memory  
 (2) multichannel buffered serial ports  
 (2) 32-bit timers  
 (4) DMA channels  
 32-bit external memory interface  
 DSP speed up to 200 MHz, depending on configuration

## Memory

16 MByte synchronous DRAM/DSP (one wait-state)  
 512 KBytes synchronous burst SRAM/DSP (one wait-state, optional)  
 512 KBytes asynchronous SRAM (DSP0)

## Debug Port

JTAG 1149.1 compliant emulation port  
 Compatible with Innovative Code Hammer, TI XDS-510, or equivalent debugger using TI Code Composer Studio

## FIFO Links

Dedicated link between each processor core  
 All processors connect to each other via 32-bit bidirectional FIFO links  
 160 MBytes/sec max transfer rate  
 2 KBytes FIFO size

## PCI Bus

32-bit PCI bus Advanced 2<sup>nd</sup> generation PCI bus controller.  
 Master or slave interface  
 Bus Mastering interface, capable of 132 MBytes/sec burst transfers  
 Typical performance 60 MBytes/sec sustained under Windows 9x/NT/2000  
 Plug-n-Play under Windows 9x/NT/2000

## FIFOPort

Memory mapped FIFOPort  
 16-bit input and output  
 Input data stream has 512 x 16 FIFO  
 Writes 80 MB/sec, reads 64 MB/sec

## Timers/Counters

Eight total, two on-chip per DSP 32-bit timers clocked at DSP speed /4

## Connectors

14-pin polarized male pin header for emulation  
 Three 54-pin male pin headers for FIFOPort  
 Eight 10-pin male pin headers for serial ports

## Physical Description

Full length PCI card  
 conforms to PCI specification  
 Max component height 0.70 inches

## Power Requirements

+5 V @ 2-5 A depending on software executed and processor revision level

## Operating Conditions

10-55 degrees C

## Development Languages

**DSP**  
 C or Assembler for DSP  
 Code Composer Studio  
 Zuma Toolset.  
**PC**  
 Microsoft Visual C++  
 Borland C++ Builder Visual Environment

## C/Assy Source Debugger

Code Hammer with Code Composer Studio Debugger

## Operating System

Virtuoso OS from Wind River  
 DSP/BIOS II

## TMS320C6701 Benchmarks @160 MHz

Benchmark Algorithm	Speed
1024 Point Complex FFT (Radix 4, with reversal)	108µsec
FIR Filter (per tap)	12.5nsec
IIR Filter (per biquad)	25nsec
Matrix Multiply [3x3] * [3x1]	437nsec
[4x4] * [4x1]	750nsec
Divide (y/x)	175nsec
Inverse Square Root	212.5nsec

## Software Selection Guide for Quatro6x

Software Package	Description	Usage/Requirements	Page	Recommendations
<b>Zuma Toolset</b>	Peripheral libraries needed for developing code on this card. Includes host applications and target examples in source form demonstrating use of peripherals on the card.	Requires CCStudio*. Windows2000/XP compatible.	94	Required for all first time users. Includes 1 year of technical support.
<b>Quatro6x DLL</b>	Dynamic link library (DLL) for the Quatro6x.	Requires ANSI-compliant C/C++ compiler. For example, Microsoft Visual C/C++. Windows2000/XP compatible.	58	Required for interfacing Host side code to DSP.
<b>CCStudio 'C6000</b>	Integrated development environment (IDE) for Target side development/debugging from Texas Instruments.	Requires XDS-510 compatible JTAG emulator for debugging capabilities.	91	Required for all first time users. Recommend use with Innovative Integration plug-n-play PCI JTAG emulator.
<b>Code Hammer</b>	Plug-n-play PCI JTAG emulator.	Code Composer Studio.	102	Recommended for all developers of code on the Quatro6x.

The Quatro6x Development Package contains all software packages listed above.

\*Contact Innovative Integration for latest version information.