



## **VIA PT880**

**Intuitive Technologies Powering the  
Intel® Pentium® 4 Platform**

**Technology Brief**

**VIA Technologies, Inc.  
November 2003**

## VIA PT880 Chipset: Intuitive Technologies Powering the Intel® Pentium® 4 Platform

The PT880 represents a revolutionary new North Bridge architecture design from VIA and includes a host of new intuitive memory technologies, providing exceptional system performance and a rich digital media experience. Featuring the revolutionary DualStream64™ memory controller, a new approach to dual channel memory technologies with support for up to 8GB of DDR400 SDRAM, the VIA PT880 integrates support for 800MHz FSB, Hyper-Threading, AGP 8X and utilizes an asynchronous bus design to maximize system optimizations and flexibility. Ultra V-Link provides a high throughput 1066MB/s interconnect between the North and South Bridge.

In combination with the acclaimed VIA VT8237 South Bridge, the VIA PT880 offers the most complete range of storage, multimedia and connectivity features for the Intel Pentium 4 processor. In addition to enabling native support for two Serial ATA Hard Drives and up to four IDE devices, it provides optimal data transfer rates and data integrity through V-RAID, a revolutionary integrated RAID controller with support for multiple RAID configurations. The VT8237 also features the VIA Vinyl Multichannel Audio Suite for superlative 6-channel and 8-channel immersion audio support, while VIA's Advanced Connectivity Suite offers a host of high-bandwidth connectivity options, including support for the VIA Velocity Gigabit Ethernet companion controller, integrated 10/100Mbps Fast Ethernet and up to eight high-speed USB 2.0 ports.

The VIA PT880 is part of VIA's unique Modular Architecture Platform (V-MAP) that reduces design times and shortens time-to-market for motherboard partners through pin-compatibility across VIA core logic solutions, and allows motherboard partners to cover multiple market segments with a single design.



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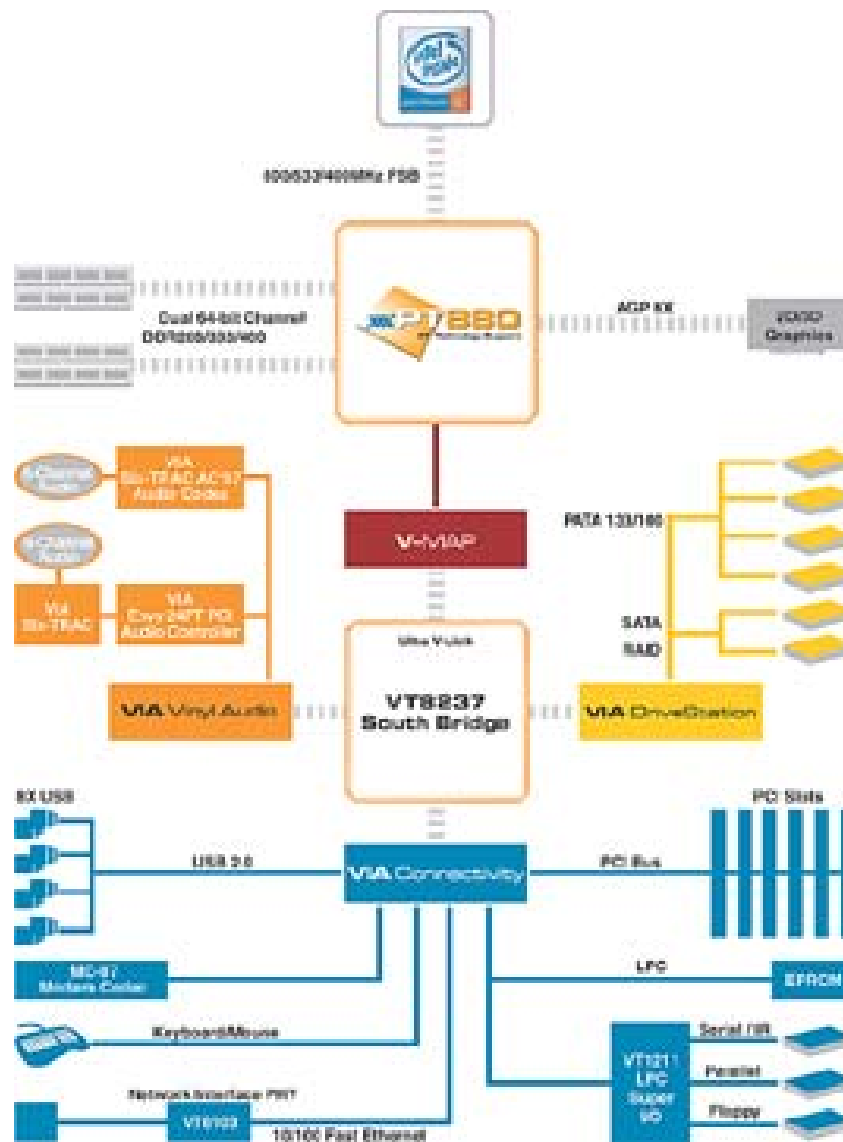
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## VIA PT880 North Bridge

Optimized for the Intel® Pentium® 4 processor, the VIA PT880 chipset features support for 800MHz FSB, Hyper-Threading, AGP8X and introduces the revolutionary DualStream64 memory controller, providing lightning fast access to system memory to enable unparalleled performance in power-hungry 3D graphics and multimedia applications, so providing the optimum platform for today's most demanding PC enthusiasts and professionals.

Figure 1: VIA PT880 Block Diagram



## DualStream64 Memory Controller

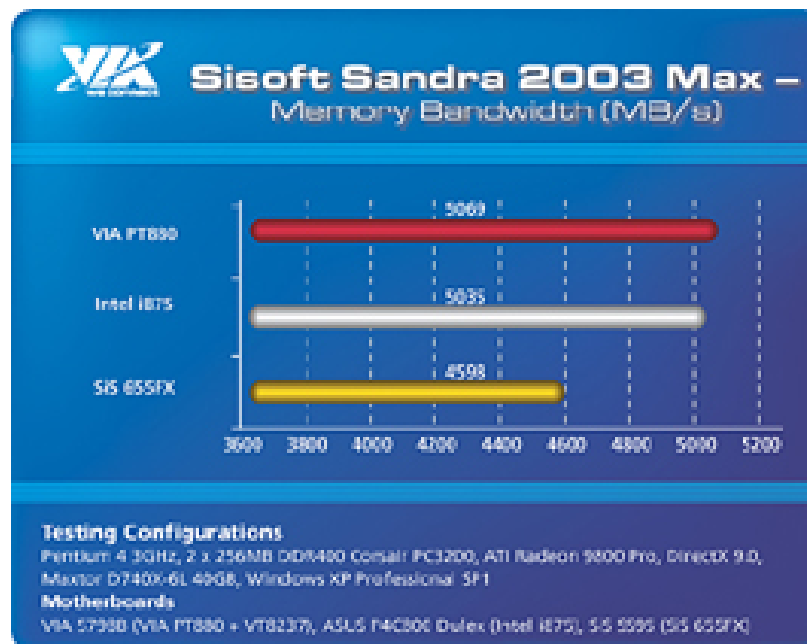
Harnessing revolutionary new intuitive technologies, the VIA DualStream64 memory controller enables lightning fast access to system memory and optimum system performance through an enhanced data prefetch protocol.



Further performance enhancements include improved memory branch prediction, utilizing a larger on-chip branch table, and tighter read/write turnaround for significantly improved clock timings. With an asynchronous bus design, the PT880 allows maximum system flexibility and optimization options, as demanded by today's power users.

Figure 2 below shows the SiSoft Sandra benchmark for testing the memory bandwidth performance of competing platforms; the VIA PT880 clearly enjoys a significant memory bandwidth boost from DualStream64's intuitive technologies, through the expanded array of prefetch buffers, superior data prediction technology and lower latency clock cycles.

**Figure 2: Memory Bandwidth Performance: SiSoft Sandra Benchmark**





## Asynchronous Bus Architecture

The PT880 employs an asynchronous bus architecture, enabling power users to fully optimize system performance and flexibility through the ability to manipulate the FSB, AGP, and memory bus speeds independently.

### 800MHZ Front Side Bus

800MHz Front Side Bus and HyperThreading enabled, the PT880 is optimized for today's latest generation high performance Intel Pentium 4 processors.

### AGP 8X

The PT880 high bandwidth AGP 8X port allows users access to the latest in graphics card technology, providing a full 2.1 gigabytes per second (GB/s) data bandwidth for realistic 3D graphics environments and a new realm of PC gaming.

## Ultra V-Link Interconnect

The PT880 features the new Ultra V-Link North/South Bridge interconnect, delivering aggregate data throughput speeds of up to 1066MB/s. The Ultra V-Link bus delivers the necessary bandwidth and low latency required by today's increasingly demanding multimedia applications, and also provides headroom for I/O traffic generated from ever increasing processor and memory bus speeds.

Not only does Ultra V-Link speed up data transfer rates, it also addresses potential bottlenecks on the South Bridge that may be created by the growing use of high-speed USB2.0 and 1394 peripherals.



## VIA VT8237 South Bridge

Featuring the VIA DriveStation™ Controller Suite, the VIA VT8237 South Bridge provides the most comprehensive high-performance integrated storage interface technologies available on the market today. In addition to enabling high-speed 150MB/s dual channel connections to Serial ATA Hard Drives while retaining support for up to four Parallel ATA-133 devices, it combines exceptionally fast disk data transfer rates and optimal data integrity with easy installation and manageability through V-RAID, the first native RAID controller integrated into a South Bridge supporting multiple RAID Level 0, RAID Level 1, RAID 0+1, and JBOD configurations.

The VT8237 also features the VIA Vinyl Multichannel Audio Suite for superlative 6-channel and 8-channel immersion audio support, while the VIA Advanced Connectivity Suite provides a host of high-bandwidth connectivity options, including support for the VIA Velocity Gigabit Ethernet companion controller, integrated 10/100Mbps Fast Ethernet and up to eight high-speed USB 2.0 ports.

The VT8237 South Bridge has been designed to meet the increasing demands of today's software programs while providing all the necessary headroom for the data-intensive applications of tomorrow. It consists of four key components, as shown in Figure 3 and listed below.

**Figure 3: VIA VT8237 South Bridge Architecture**



### VIA Vinyl Multichannel Audio Suite

The VT8237 South Bridge integrates the high-performance VIA Vinyl Audio AC'97 controller to enable six-channel audio support and the transfer of the highest resolution audio possible over the AC'97 standard.

For the best audio performance, the VT8237 should be combined with VIA Eight-TRAC (VIA VT1617) codec to enable premium quality AC'97 surround sound. Supporting up to 20-bit resolutions, the VIA Eight-TRAC delivers full 6-channel surround sound to enable theatre-quality home audio and realistic 3D gaming sound effects on mainstream PC systems.

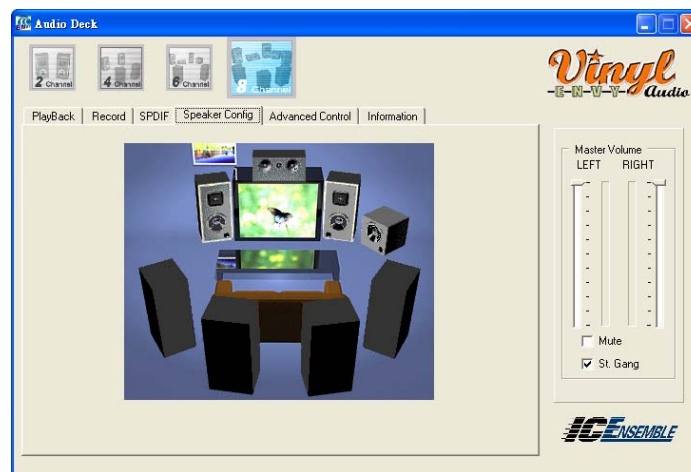


### Enabling VIA Vinyl Audio

To make set-up as easy as possible, the VIA Eight-TRAC provides innovative Sixth-Sense™ jack detection, while the advanced MixMaster™ technology enables maximum flexibility in configuring customized audio set-ups. The VIA Vinyl Eight-TRAC also supports DualMax™ hardware down-mixing or headphones, allowing end users to enjoy 6-channel audio with 2-channel or 4-channel speakers. To maximize recording quality for home studio applications, the VIA Eight-TRAC integrates 20-bit, Sigma-Delta ADCs for stereo recording and white noise removal. The analog mixer circuitry integrates a stereo enhancement to provide a pleasing 3D surround sound effect for stereo media. A high-quality headphone amplifier is integrated into the Eight-TRAC, reducing BOM cost and design time.

The VIA Stylus audio driver rounds out the solution, an easy to use software driver that enables full access to VIA Eight-TRAC features. The VIA Stylus driver also includes full 3D Immerzio™ gaming support and sound positioning through Sensaura technology, to enable a new level of gaming experience in an AC'97 solution.

**Figure 4: VIA Stylus Audio Driver Interface**





### VIA Vinyl Gold Audio

To meet the growing demand for the highest fidelity multi-channel surround sound, the VT8237 South Bridge can also be coupled with the PCI-based VIA Envy24PT onboard audio controller.



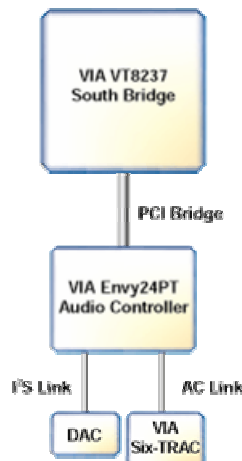
Enabling 24-bit resolution and 96KHz sampling rates for digital connections, the VIA Envy24PT is the only PC onboard audio solution that supports up to eight-channel outputs for improved flyover effects with the latest Dolby® Digital EX and DTS ES DVD-Video soundtracks.

To connect with other devices, the VIA Envy24PT comes equipped with an integrated S/PDIF transmitter and IEC958 line driver that allows the easy and accurate transfer of PCM, DTS, and AC3 audio data in pure digital formats to items like stereos and portable audio devices.

For high-resolution eight-channel surround sound, the VIA Envy24PT can be paired with the VIA Six-TRAC codec plus an additional DAC though an I<sup>2</sup>S-link. Further provisions will enable the VIA Envy24PT to be connected to the VIA Vinyl Eight-TRAC codec for even higher levels of audio fidelity.



**Figure 5: VIA Vinyl Gold Audio 8-Channel Configuration**



## VIA DriveStation Controller Suite

The VIA DriveStation Controller Suite in the VIA VT8237 provides the most comprehensive set of high-performance integrated storage interface technologies available on the market today. It not only enables high-speed 150MB/s dual channel connections to new generation Serial ATA Hard Drives while retaining support for today's Parallel ATA-133 devices, but also combines exceptionally fast disk data transfer rates and optimal data integrity with easy installation and manageability through V-RAID, the first native RAID controller integrated into a South Bridge supporting multiple RAID configurations.



## VIA DriveStation Serial ATA Controller

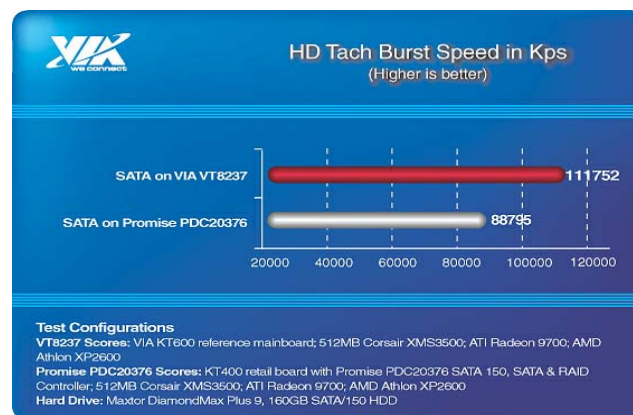
With the integrated VIA DriveStation Dual Channel Serial ATA controller, the VT8237 South Bridge delivers a number of significant benefits to mainstream PC users:

- Superior Hard Disk Drive Performance
- Quick and Easy Set-Up
- Hot Plug Capabilities
- SATALite Interface

## VIA DriveStation Serial ATA Controller Performance

By integrating the Serial ATA controller in the South Bridge, the VT8237 not only delivers superior data transfer rates of up to 150 MB/s per SATA device compared to a maximum of 133MB/s for Parallel ATA devices, but also eliminates the 132MB/s bottleneck on the PCI bus that can significantly inhibit the performance of discrete Serial ATA controllers. Figure 6 shows the integrated VIA DriveStation Serial ATA Controller delivering an increase of over 25% in data transfer speeds compared to a discrete Promise PDC20376 Serial ATA controller, using the popular HD Tach Burst Speed benchmark over a single Serial ATA drive. This benchmark measures the speed in which data from the HDD's cache is transferred to the system, and represents the theoretical peak of the system's data transfer.

**Figure 6: Serial ATA Performance: HD Tach Burst Speed Benchmark**



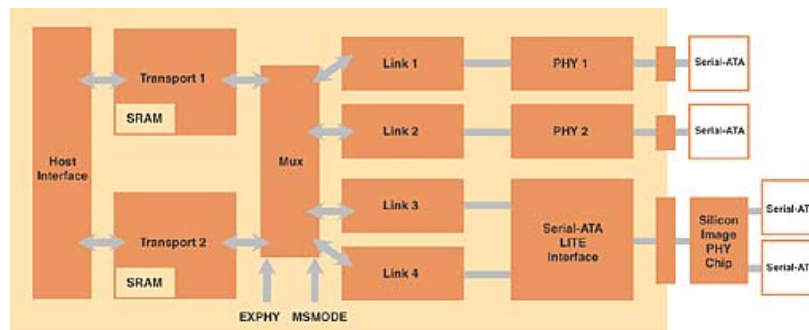
### Quick and Easy Set Up, & Hot Plug Capabilities

Setting up a Serial ATA Drive using the VIA DriveStation Serial ATA Controller is intuitive and straightforward. In addition, no configuration at all is necessary when installing an additional Serial ATA drive because there is no need for jumpers to determine master/slave settings. The VIA DriveStation™ Serial ATA Controller also supports hot-plug capabilities when the appropriate BIOS and OS support is enabled.

### VIA DriveStation SATA Lite Interface

In its default configuration, the VIA DriveStation Serial ATA Controller supports up to two Serial ATA devices and four Parallel ATA 133 devices directly. Two extra Serial ATA ports can be supported through the implementation of the SATA Lite interface with a single external PHY on the secondary Parallel-ATA interface, replacing one Parallel ATA channel, as shown in Figure 7. Unlike IDE-to-SATA bridge solutions that are limited by the 133MB/s and half-duplex speed of the IDE bus, the SATA Lite interface enables the two additional Serial ATA ports to be operated simultaneously at full-duplex at up to 150MB/s speed.

**Figure 7: The SATA Lite Interface**



### VIA DriveStation Parallel ATA-133 Controller

The VIA DriveStation Controller Suite also includes an enhanced IDE controller with a dual channel DMA engine and interlaced dual channel commands, allowing for full backwards compatibility with up to four Parallel ATA 133/100/66 devices delivering data transfer rates of up to 133 MB/s.

### VIA DriveStation V-RAID Controller

The advanced VIA DriveStation V-RAID Controller implemented in the VIA VT8237 South Bridge is the first full-featured native Serial RAID solution to be integrated into PC chipset architecture. It enables users to benefit from all the enhanced performance and rock solid data security benefits of a high-end RAID system, but without the complicated setup procedures that are normally found in server and workstation products and at a much more affordable price.

With digital media applications such as digital video creation and editing, and digital audio storage and playback becoming increasingly popular, the demands on hard disk drive throughput are growing at a dramatic rate. But although memory, processor, and Front Side Bus technologies have improved in recent years, significantly enhancing the performance of desktop systems, storage performance has not scaled at the same rate. V-RAID overcomes this bottleneck by delivering a significant boost in desktop storage performance.

V-RAID is the first native RAID controller to support a complete range of RAID Level 0, RAID Level 1, RAID Level 0+1<sup>1</sup>, and JBOD configurations (shown in Table 1), giving the user maximum flexibility in tuning their disk array to achieve the optimum balance of performance and data integrity depending on their requirements.

**Table 1: RAID Configurations Supported by V-RAID**

RAID Level	Effect	Capacity	Performance	Fault Tolerance
0	Striping	100 %	High	Low
1	Mirroring	50 %	Medium/High	High
0+1 <sup>1</sup>	Mirroring & Striping	50 %	High	High
JBOD	None	100 %	Normal	Low

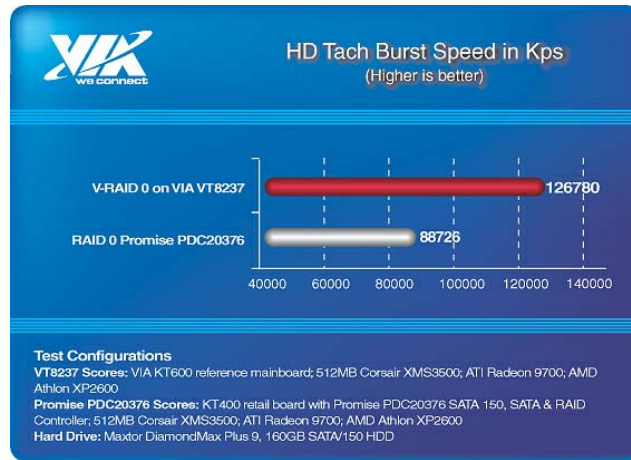
Based on VIA's ground breaking DriveThru™ technology, V-RAID also enables “on-the-fly” upgrades to RAID configurations, and an exceptionally user friendly software interface for V-RAID installation and management. Its key benefits are described in more detail below.

**V-RAID Performance**

V-RAID optimizes hard disk data transfer rates by utilizing the integrated VIA DriveStation Dual Channel Serial ATA Controller to deliver a maximum theoretical transfer rate of 300MB/s under a RAID Level 0 configuration. Since V-RAID is integrated into the VT8237 South Bridge, as opposed to implementing a discrete RAID controller on the PCI bus that has a shared 132MB/s peak bandwidth limitation, V-RAID is the only solution available that can deliver the full benefit of Serial ATA RAID without having to adopt expensive server/workstation platforms such as PCI-X or PCI Express.

The inherent performance advantages that the native V-RAID implementation offers over using a third party onboard RAID controller or PCI card RAID controller by comparing HD Tach Burst speeds, are clearly shown in Figure 8 overleaf, where V-RAID performs over 50% faster than the Promise PDC20376 discrete controller. HD Tach Burst represents the theoretical peak of the system's data transfer speed.

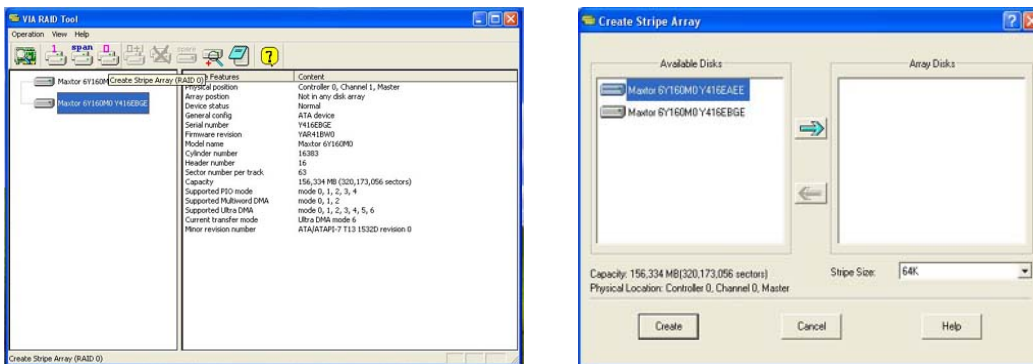
**Figure 8: V-RAID Performance: HD Tach Burst Speed Benchmark**



### V-RAID Software Interface

With its unique user-friendly software interface, V-RAID makes it easier and faster than ever before to install and manage RAID configurations. Users who are not confident in using the RAID BIOS to configure RAID arrays can do so from within their Microsoft® Windows® or Linux operating system in a few easy steps, VIA’s DriveThru technology also enables users to easily migrate from a standard Parallel ATA or Serial ATA drive configuration to a higher performance RAID configuration “on-the-fly”, without having to endure lengthy installation procedures involving complicated BIOS set-ups and operating system re-installations. Figure 9 shows screenshots during the V-RAID set up.

Figure 9: Screenshots Using the V-RAID Software Interface



## VIA Advanced Connectivity Suite

The VIA Advanced Connectivity Suite in the VIA VT8237 offers a host of high-bandwidth network and peripheral connectivity options, including high-throughput Velocity Gigabit and 10/100Mb/s Fast Ethernet support, eight high-speed USB 2.0 ports, as well as TV-Out and IEEE 1394 companion controllers and a host of ultra high-bandwidth PCI-X expansion controllers for the server/workstation platforms.

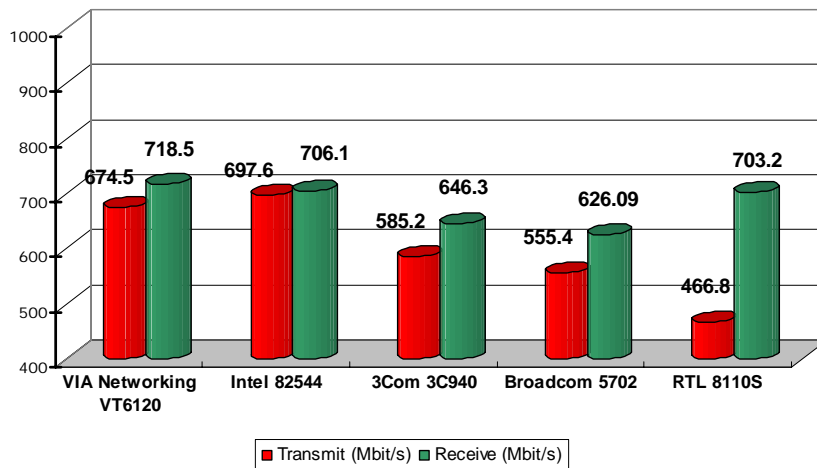
## VIA Velocity™ Gigabit Ethernet Controllers

VIA offers the highest performing single chip Gigabit Ethernet solution for the Intel Pentium 4 platform available today with the VIA Velocity™ Series of Gigabit Ethernet Controllers. This leading edge Gigabit technology enables easier integration in a highly integrated package making them ideal for a diverse range of PC client or server LAN on Motherboard (LOM), and Network Interface Card (NIC) applications.



Supporting 10/100/1000 Mbps triple-speed and full/half-duplex capability at all speeds, the integrated Cicada PHY is fully compliant with IEEE 802.3 (10BASE-T), 802.3u (100BASE-TX), and 802.3ab (1000BASE-T) standards. With Cicada's proven SimpliPHY™ design, VIA Velocity controllers feature leading narrow band noise tolerance that delivers superior performance for real world PCBs and cables.

Figure 10: Gigabit Ethernet Throughput Output



To minimize host-side CPU utilization, VIA Velocity Gigabit Ethernet Controllers adopt an adaptive interrupt scheme to reduce interrupts made to the processor, and maximize the use of packet bursts for efficient PCI bandwidth usage. Velocity controllers can further offload tasks from the host CPU to improve the overall system performance with TCP/UDP/IP checksum, and TCP segmentation offloading.

To maximize network management features for the user, the VIA Networking Velocity Controllers also include a sophisticated GigaCheck™ link management software suite that makes available comprehensive cable diagnostics, operating analysis, and status information, greatly simplifying network management and troubleshooting.

## USB 2.0

The VIA VT8237 enhances connectivity options with its support for eight high-speed USB2.0 ports, delivering forty times the bandwidth of USB 1.1. The VT8237 includes eight function ports featuring integrated physical layer transceivers, all supporting a full range of USB 2.0 and USB1.1 devices, and achieving data transfer rates of up to 480Mb/s. USB enables plug'n'play, and supports isochronous data transfers. Peripherals can be inserted into the system with driver support for many user classes such as external storage. The controller also implements legacy keyboard and mouse support so that legacy software can run transparently in a non-USB-aware OS environment.

## PCI Interface & LPC Bus

Featuring a PCI 2.2 compliant PCI controller, the VT8237 offers support for up to six PCI masters. It also has built-in controllers a keyboard and PS2 mouse, and supports a full range of legacy devices through the LPC bus, including Super I/O, boot Rom and embedded microcontrollers.

## Advanced Connectivity Options

Motherboard makers and OEMs can deliver flexible levels of multimedia connectivity via companion chips such as the VIA VT6307 1394 controller and the VIA VT1622 Digital TV-Out chip.



## VIA VPX2 for Servers and Workstations

The new VIA VPX2 companion chip with high throughput HDIT® Interface provides support for ultra high-bandwidth expansion, via two 133MHz PCI-X slots, or maximized connectivity via 12 standard PCI connections. The dual channel VPX2 solution also allows simultaneous support for AGP8X and PCI-X, effectively enabling PCI-X expansion capabilities for the high-end workstation segment. Supported configurations are:

- 2 slots x 133MHz
- 4 slots x 100MHz
- 8 slots x 66MHz
- 12 slots x 33MHz



By implementing the VIA VPX2 companion chip, system designers can also provide support for ultra high-bandwidth expansion using two 133MHz PCI-X slots, or maximized connectivity with up to twelve standard PCI connections, without sacrificing full AGP 8X support.

**Table 2: VIA PT880 Chipset Feature Comparison Table**

Feature	PT880	PT800
Processor	Intel® Pentium® 4	Intel® Pentium® 4
Hyper-Threading Support	Yes	Yes
Front Side Bus	800/533/400MHz	800/533/400MHz
Memory Support	Dual Channel DDR400/333/266	Single Channel DDR400/333/266
Max. Memory	8.0GB	8.0GB
AGP Support	AGP 8X/4X	AGP 8X/4X
Bus Architecture	Asynchronous	Synchronous
South Bridge	VT8237	VT8237
North/South Bridge Link	Ultra V-Link (1066MB/sec)	8X V-Link (533MB/sec)
Audio	VIA Vinyl™ 6-channel Audio (AC'97)  VIA Vinyl™ Gold 8-channel Audio (PCI)	VIA Vinyl™ 6-channel Audio (AC'97)  VIA Vinyl™ Gold 8-channel Audio (PCI)
Network	VIA Velocity Gigabit Ethernet companion controller  VIA integrated 10/100 Fast Ethernet	VIA Velocity Gigabit Ethernet companion controller  VIA integrated 10/100 Fast Ethernet
Integrated Modem	MC'97	MC'97
PCI Devices/Slots	6 slots  Dual PCI-X bus support through VIA VPX2 I/O expansion bridge	6 slots
SATA	Dual Channel Serial ATA supports 2 SATA devices  SATALite™ interface for two additional SATA devices (4 total)	Dual Channel Serial ATA supports 2 SATA devices  SATALite™ interface for two additional SATA devices (4 total)
V-RAID	RAID 0, RAID 1, and RAID 0+1* & JBOD (SATA)	RAID 0, RAID 1, and RAID 0+1* & JBOD (SATA)
PATA	Dual Channel Parallel ATA133 (up to 4 devices)	Dual Channel Parallel ATA133 (up to 4 devices)
USB	8 ports	8 ports
I/O Protocols	I/O APIC / LPC Super I/O	I/O APIC / LPC Super I/O
Power Management	ACPI/APM/PCI/PM	ACPI/APM/PCI/PM

\*RAID Level 0+1 requires four Serial ATA drives; support for the two additional drives can only be implemented with two external Serial ATA ports enabled through implementing the SATALite interface.