

VIA Apollo P4X333 Chipset

P4X333^{DDR}

Enabling Total System Performance

High performance DDR333 chipset platform for the
Intel® Pentium® 4 processor

Introduction

The VIA Apollo P4X333 is a core logic chipset solution that makes Total System Performance a reality in Intel® Pentium® 4 processor based systems. Fusing the unequalled bandwidth of DDR333 with the Intel® Pentium® 4 processor, the VIA Apollo P4X333 with 533MHz processor bus, AGP 8X, ATA-133, USB 2.0 and Double-Speed V-Link chip interconnect, brings an unmatched suite of new memory, system and I/O technologies to a single platform. In combination these technologies enable Intel® Pentium® 4 systems and servers to achieve heights of performance never scaled before.

In the past, advances in one area of system performance have frequently been held back by I/O and connectivity bottlenecks, but with the advent of the VIA Apollo P4X333, every aspect of performance is addressed, delivering end user experiences that meet the high expectations of today's consumers. The VT8235, with USB 2.0 integrated into a chipset for the first time, enables peripheral devices to send and receive data at 480 Mbps, 40 times faster than the previous USB standard. This data can then be sent to the North Bridge through the new Double-Speed V-Link chip interconnect which offers 533MB/s of bandwidth, twice as much as Intel Hub Architecture, making sure the ultra fast processor and DDR333 memory subsystem is supplied with all the data it needs minimizing system delays and offering the smoothest system performance you will ever have experienced.

The flexibility of V-MAP architecture means the VIA Apollo P4X333 is pin to pin compatible with the previous generation VIA Apollo P4X266A, enabling it to leverage the huge choice of motherboard configurations already developed, enabling a fast time to market and lower development costs, ultimately delivering value to the end user.

The launch of the VIA Apollo P4X333 further extends the leadership role that VIA has played in enabling rapid industry wide transitions to higher bandwidth memory technologies that enable OEMs and SIs to address a performance hungry market and support today's and tomorrow's most demanding applications. It achieves total system performance through the implementation of the following key technologies:

- **DDR200/266/333 SDRAM Support:** The VIA Apollo P4X333 features the world's fastest single channel memory controller, designed for exceptionally high performance. Supporting DDR200/266/333 memory, the VIA Apollo P4X333 provides lightning fast access to system memory and can reach a peak bandwidth of 2.7GB/sec, 25% greater than the P4X266A, enabling the full performance potential of the fastest Intel® Pentium® 4 processors to be harnessed.
- **400/533MHz Processor Bus Settings:** The VIA Apollo P4X333 has the fastest ever processor bus, extending to 533MHz to keep even the highest speed grade Intel® Pentium® 4 processors supplied with as much data they can handle. The P4X333 processor bus is flexible with a 400MHz speed setting for processors locked to that level.
- **AGP 8X:** New AGP 8X technology implemented in the VIA Apollo P4X333 North Bridge conforms to the full AGP 3.0 specification and provides up to 2.1GB/s in graphics bandwidth, deriving maximum performance from current and future graphics processors and making the P4X333 the ultimate platform for

game enthusiasts and design professionals. Additionally, it does not sacrifice AGP 4X compatibility, allowing low cost graphics products to be paired with Intel® Pentium® 4 systems for everyday computing in business & educational and home environments.

- **Double-Speed V-Link:** The VIA Apollo P4X333 is equipped with new Double-Speed V-Link Chip interconnect between North and South Bridge. Double-Speed V-Link offers 533MB/s of memory bandwidth, 4 times as much as less advanced chipsets which use the 132MB/s PCI bus as a link.
- **USB 2.0:** The superior bandwidth capacity of Hi-Speed USB 2.0 is integrated into the VT8235, providing transfer speeds 40 times faster than the standard USB 1.1 specification. This high-speed transfer technology is ideal for today's bandwidth-hungry peripherals such as video cameras and next generation scanners and printers, and greatly enhances the performance of demanding applications such as interactive gaming and digital photography.
- **ATA-133 IDE Interface:** ATA-133 FastDrive™, integrated into the VT8235 South Bridge is the fastest IDE interface currently available and meets today's ever increasing data transfer requirements offering shorter access times and greater performance in a huge variety of everyday applications including audio, video & gaming.
- **V-MAP:** The VIA Modular Architecture Platform offers a balance of reliability and flexibility. Reliability comes from using proven, modular components and evolutionary design principles in enabling the VIA Apollo P4X333 to share the best characteristics of award winning previous generation products like the VIA Apollo P4X266A. Flexibility comes from the pin compatible North Bridge enabling motherboard manufacturers to save development costs and speed P4X333 solutions to the market.

This white paper describes the features of the VIA Apollo P4X333 chipset in detail as well as the elements of total system performance that enable next generation computing for high performance desktops, workstations, and servers based on the Intel® Pentium® 4 processor.

DDR333: The Power of Evolution

VIA Technologies, Inc. has been instrumental in driving new memory technologies to the market by being the first company to offer PC133 based chipsets to the marketplace, and the first company offer DDR SDRAM based chipsets for Socket 370 (Intel® Pentium® III, VIA C3™), Socket 423/478 (Intel® Pentium® 4) and Socket A (AMD Athlon™ and AMD Duron™) platforms.

DDR SDRAM was developed to keep pace with newer, more powerful PC processors like the AMD Athlon™ XP and Intel® Pentium® 4 which require faster access to the system memory to deliver to their full performance potential. Compared to PC100/133, DDR doubles the effective clock rate by transferring data on both the rising and falling edges of the clock. Also, due to its evolutionary, parallel technology, the latency of DDR is quite low compared to competing serial memory technologies like RDRAM.

All grades of DDR SDRAM operate at 2.5 volts, as opposed to 3.3V for PC100 and PC133. This lowered voltage allows DDR to penetrate power sensitive applications, such as notebooks and 1U servers. Lowered power consumption translates directly to lowered heat dissipation, again increasing the effectiveness of DDR in mobile and server applications.

These basic specifications of SDRAM technologies are summarised below.

	Clock Rate	Effective Clock Rate	Memory bandwidth	Voltage
PC100	100MHz	100MHz	0.8GB/sec	3.3
PC133	133MHz	133MHz	1.05GB/sec	3.3
DDR200	100MHz	200MHz	1.6GB/sec	2.5
DDR266	133MHz	266MHz	2.1GB/sec	2.5
DDR333	167MHz	333MHz	2.7GB/sec	2.5

DDR333 offers the greatest memory bandwidth yet, a 25% increase over DDR266, offering performance benefits in every type of application but especially in memory intensive 3D graphics and gaming. With new and more demanding software applications and faster processors being developed all the time, the extra bandwidth gives DDR333 based systems much needed performance headroom.

VIA DDR333 Validation Programme

To ensure the reliability and stability of DDR333 memory modules and devices, VIA is conducting an independent validation programme in conjunction with Advanced Validation Labs and SMART Modular Technology. The VIA DDR independent validation programme is essential in making the transition to new memory technologies smooth and ultimately successful.

The validation process will ensure DDR333 modules and devices are fully compatible with VIA DDR333 chipsets and comply with the DDR333 specification set out by JEDEC, the semiconductor industry standards body. DDR333 modules & devices produced before February 2002 do not meet this specification. For more information on the VIA DDR333 Validation Programme visit www.viatech.com and click on the DDR333 logo.

AGP 8X: A New Dawn in Graphics Performance

The new AGP 3.0 specification is a first to market implementation in the VIA Apollo P4X333 North Bridge. AGP 3.0, known as AGP 8X, doubles the speed of the Accelerated Graphics Port interface to 533MHz delivering 2.1GB/s of bandwidth, enabling the graphics engine to leverage the fast DDR333 system memory and transfer data to and from the processor, twice as fast as before. This in turn allows the graphics engine to store larger texture maps than in the frame buffer memory, helping today's faster graphics processors render more images in a shorter time frame. AGP 8X also provides headroom for future advances in graphics technology and offers more scope to hardware and software developers to push the boundaries of realism and quality. AGP 8X is backwards compatible with AGP 4X enabling P4X333 platforms to be paired with a full range of today's mainstream graphics cards.

Double-Speed V-Link

VIA has developed V-Link technology to remove the PCI bus as the bottleneck in inter-chip communication. In less advanced chipsets, the PCI bus is responsible for connecting both the North and South Bridge, as well as providing a bus for most add-in peripherals. VIA Double-Speed V-Link technology provides a dedicated 133MHz quad-pumped bus between the North and South Bridge, freeing up the PCI bus to deal strictly with peripheral devices and providing 533MB/s, four times the bandwidth of the original PCI interconnect.

USB 2.0: Empowering Peripherals Like Never Before

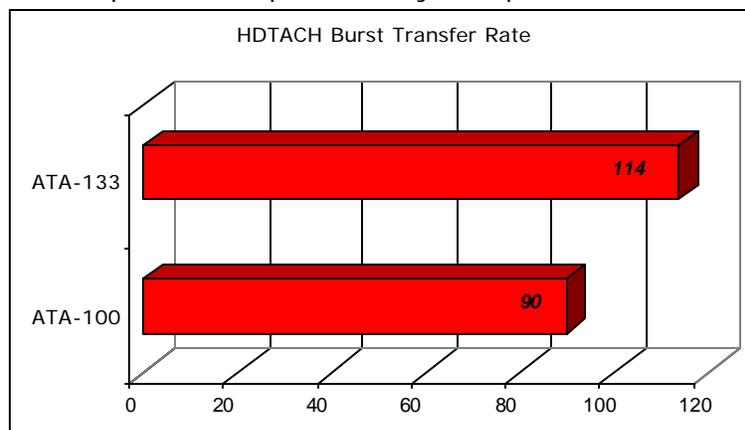
VIA has long recognized the potential of USB as a universal interconnect system, designing USB 1.1 support into our award-winning core logic chipsets some time before the proliferation of USB-enabled PC peripherals. Following the widespread success of USB 1.1, VIA now sees the drive to new industry standard USB 2.0 as a natural evolution, meeting the greater bandwidth demands of today's PC peripherals and applications, from higher resolution video to fast storage unit access.

As a member of the USB Implementers Forum, VIA is helping to facilitate an industry-wide move towards adoption of the latest USB specifications, by integrating full support for the high bandwidth technology into upcoming core logic chipsets, and by expanding our product lineup of Hi-Speed USB 2.0 discrete chips.

ATA-133

ATA-133 FastDrive™ is the fastest IDE standard currently available on the market, and allows each IDE controller to burst up to 133MB/s. This offers a significant performance improvement in data intensive professional applications and in consumer applications including gaming, audio and video. The faster interface will also save time when booting up the system and opening new applications. In the VT8235 South Bridge each controller also supports up to two devices, for a total of four ATA-133 capable drives. In multiple configurations including RAID, the performance benefits of the faster interface are particularly apparent.

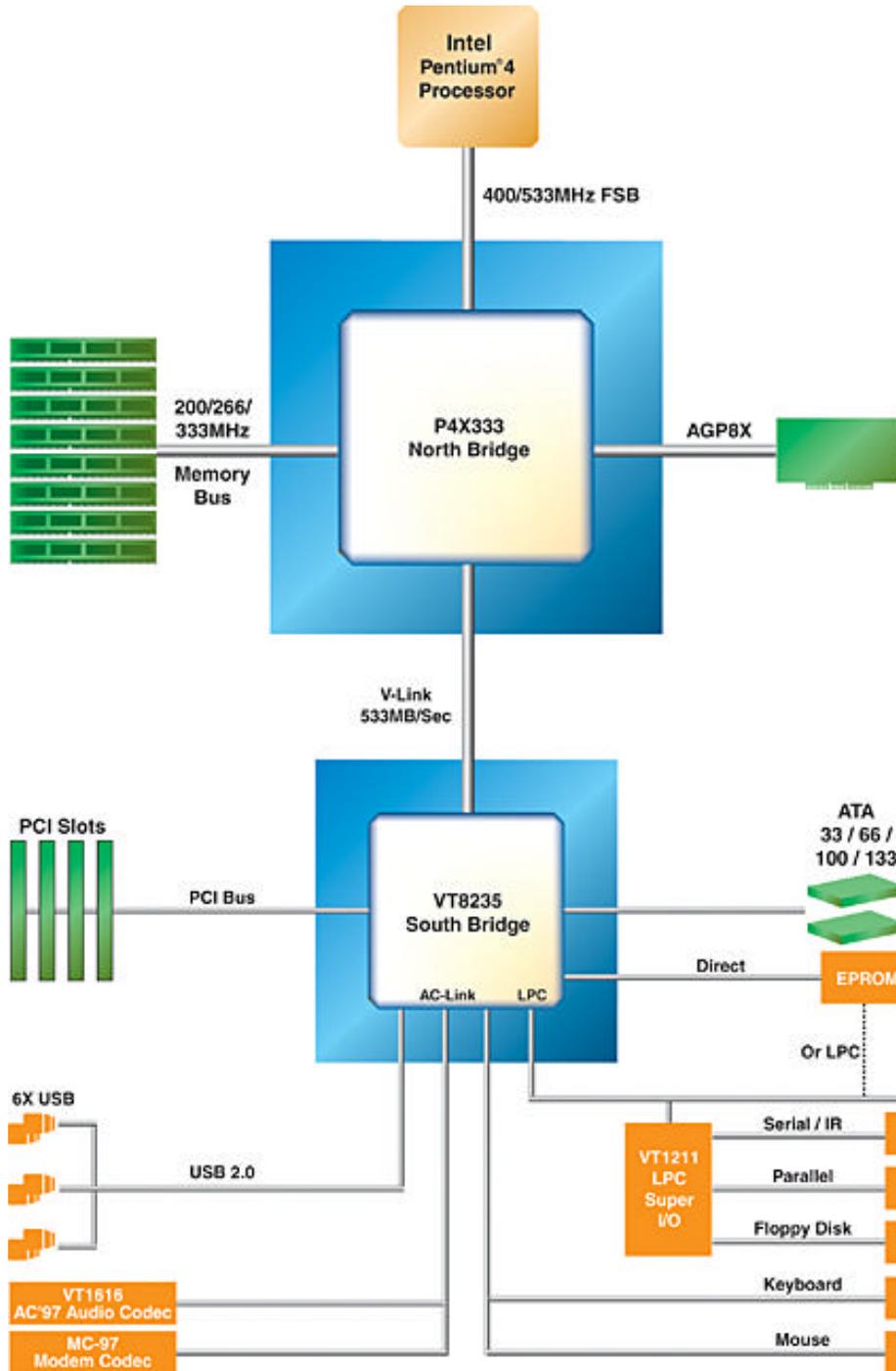
The diagram below demonstrates the difference between ATA-133 and ATA-100 using the VT8233A South Bridge and. ATA-133 bursts 27% more data, offering a tangible performance benefit, as fast access to stored data becomes a more and more important component of system performance.



AMD Duron 900MHz, Win98, VIA KT266A, VT8233A South Bridge. Data Source: Maxtor Corporation.

VIA Apollo P4X333 Product Overview

The VIA Apollo P4X333 consists of two separate chips: The 664-pin VT8367 North Bridge, and the 487-pin VT8235 V-Link South Bridges. Both use standard BGA packaging to reduce the cost of production and allow the use of standard heatsink solutions. The basic architecture of the chipset is shown in the illustration below.



VIA Apollo P4X333 North Bridge

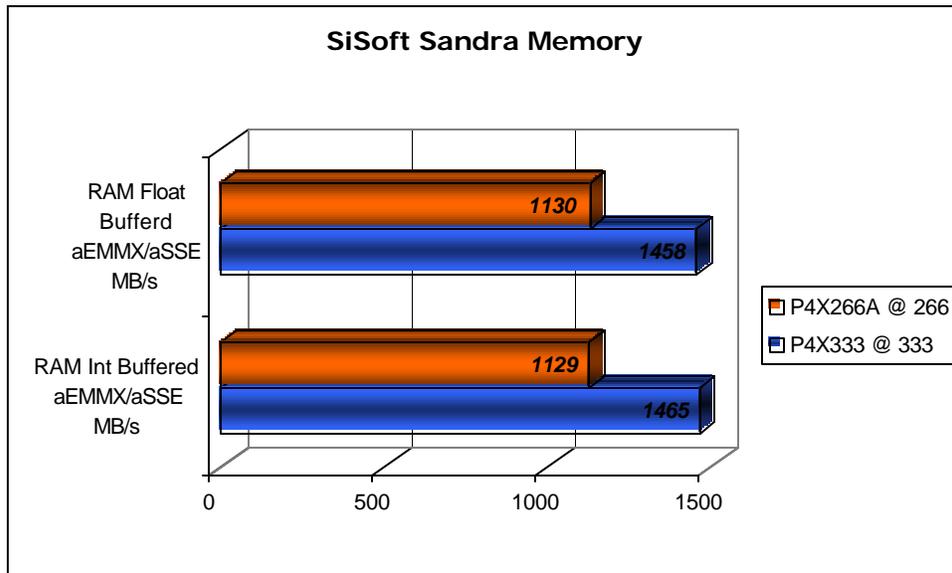
The 664-pin BGA VT8754 North Bridge provides support for flexible 400/533MHz Front Side Bus for Socket 478 compatible processors. Deep pipelining and buffering keep the high-speed system bus supplied with a constant stream of data, maximizing the performance of the processor. VIA Apollo P4X333 North Bridge also has a flexible ECC Memory Controller that supports up to 32GB of DDR200/266/333 SDRAM with concurrent CPU, AGP and Double-Speed V-Link access.

VT8235

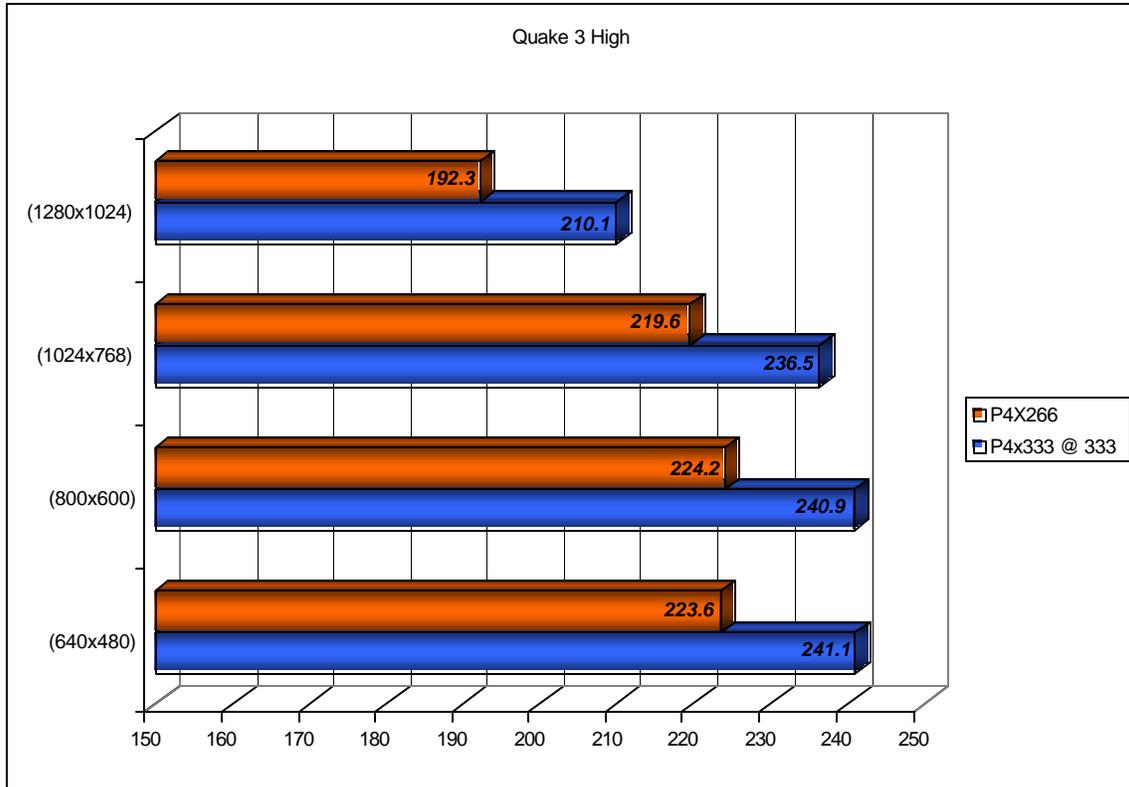
The 487-pin BGA VT8235 South Bridge supports the new Double-Speed V-Link interconnect and includes an integrated PCI controller (PCI 2.1 compliant) with support for 5 PCI slots. The VT8235 also includes an integrated VIA MAC controller for 10/100 Ethernet support as well as integrated 5.1 Surround Sound Audio and an integrated IDE controller with support for dual ATA133/100/66/33 devices. The VT8235 is the first VIA South Bridge to integrate USB 2.0 support with 3 root hubs with 6 functional ports for plug and play peripheral support.

VIA Apollo P4X333 Chipset Performance

The VIA Apollo P4X333 takes over from the VIA Apollo P4X266A as the highest performing chipset for the Intel® Pentium® 4 platform. The extra memory bandwidth from using DDR333 memory offers a new dimension in system performance for today's and tomorrow's most demanding applications. In memory benchmarks SiSoft Sandra 2001 averages a remarkable 29% performance improvement.



In 3D gaming the extra bandwidth is converted into very tangible performance benefits with the industry standard Quake III benchmark showing an 8% performance improvement. With new and more technically demanding games under development all the time, even the stellar performance of the P4X333 is sure to be tested.



Conclusion

The VIA Apollo P4X333 is the latest VIA Apollo chipset to extend the boundaries of system performance on the Intel® Pentium® 4 processor platform. DDR333 memory delivers a stunning 2.7GB/sec of memory bandwidth empowering the CPU to perform like never before and giving end users stunning results across the full range of applications. In addition the VIA Apollo P4X333 is the product of an evolutionary design process making it pin compatible with previous generation designs offering a clear flexibility and time to market advantage to customers and ensuring a reliable & stable motherboard selection. Allied to the new leading edge connectivity features in the VT8235 South Bridge, the VIA Apollo P4X333 is the ultimate chipset solution for Intel Pentium® 4 platform.

Appendix

The reference systems tested for the benchmark figures were based on the following configurations:

Chipset	VIA Apollo P4X333	VIA Apollo P4X266A
Processor	Intel® Pentium® 4 2.0GHz	Intel® Pentium® 4 2.0GHz
Memory	256MB PC2700 (Samsung)	256MB PC2100 (Samsung)
Graphics	Elsa GeForce 3	Elsa GeForce 3
HDD	IBM 40GB	IBM 40GB
Operating System	Windows® 2000	Windows® 2000

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