VIA Apollo KT333 Chipset

**High performance DDR333 chipset platform for the
AMD Athlon™ XP processor**

Introduction

The VIA Apollo KT333 is a core logic chipset solution that elevates the performance of AMD Athlon™ XP based systems to heights never scaled before. Building on the success of the award-winning VIA Apollo KT266A platform, the implementation of DDR333 memory support in the VIA Apollo KT333 adds 25% more memory bandwidth delivering breathtaking application performance, across the board. The flexibility of V-MAP architecture means the VIA Apollo KT333 is pin to pin compatible with the previous generation VIA Apollo KT266A, enabling it to leverage the huge choice of motherboard configurations already developed, ensuring stability and reliability.

In addition, the VIA Apollo KT333 features a choice of V-MAP South Bridge options, offering a market leading array of networking and communication features, including Ultra ATA-133, integrated 3Com® Ethernet MAC, and high-speed V-Link chip to chip interface.

The launch of the VIA Apollo KT333 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 the today's and tomorrow's most demanding applications. It achieves this through the implementation of the following key technologies:

- **DDR200/266/333 SDRAM Support**: The VIA Apollo KT333 features the world's fastest single channel memory controller, designed for exceptionally high performance. In addition to DDR200/266 memory, the VIA Apollo KT333 also supports new high speed DDR333 SDRAM that conforms with the JEDEC standard. DDR333 SDRAM provides lightning fast access to system memory and can reach a peak bandwidth of 2.7GB/sec, 25% greater than the KT266A, to enable the full performance potential of the fastest AMD Athlon™ XP processors to be harnessed.

- **ATA-133 IDE Interface:** ATA-133 FastDrive™, integrated into the VT8233A 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 KT333 to share the best characteristics of award winning previous generation products like the VIA Apollo KT266A. Flexibility comes from the North Bridge pin compatible with the KT266A and the industry's best choice of pin compatible VT8233 series South Bridge options enabling a variety of system configurations and price points based on the same mainboard design.

- **High-Speed V-Link Hub Architecture:** The VIA Apollo KT333A makes use of VIA's V-Link Hub Architecture, which provides a dedicated 266MB/s bus between the north and south bridge. Less advanced chipsets use the 132MB/s PCI bus as a link, which must be shared with all PCI peripherals.

- **200/266MHz Front Side Bus Settings**: The VIA Apollo KT266A supports the AMD Athlon/Duron S2K system bus, running at up to an effective 266MHz.

- **AGP4X/2X Support:** Providing up to 1GB/s in graphics bandwidth with AGP4X technology, the VIA Apollo KT333 supports the latest in video card technology. Additionally, it does not sacrifice AGP2X compatibility like less advanced chipsets, allowing low cost graphics products to be paired with AMD Duron™ systems for very keenly priced everyday computing.

This white paper describes the features of the VIA Apollo KT333 chipset as well as the combination of performance and cost efficiency that enables next generation computing for mainstream and value desktops, workstations, and servers based on the AMD Athlon™ XP 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), 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, delivering 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.

ATA-133 Overview

ATA-133 FastDrive™ is the fastest IDE standard currently available on the market, and allows each IDE controller to burst at rates of 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. 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.
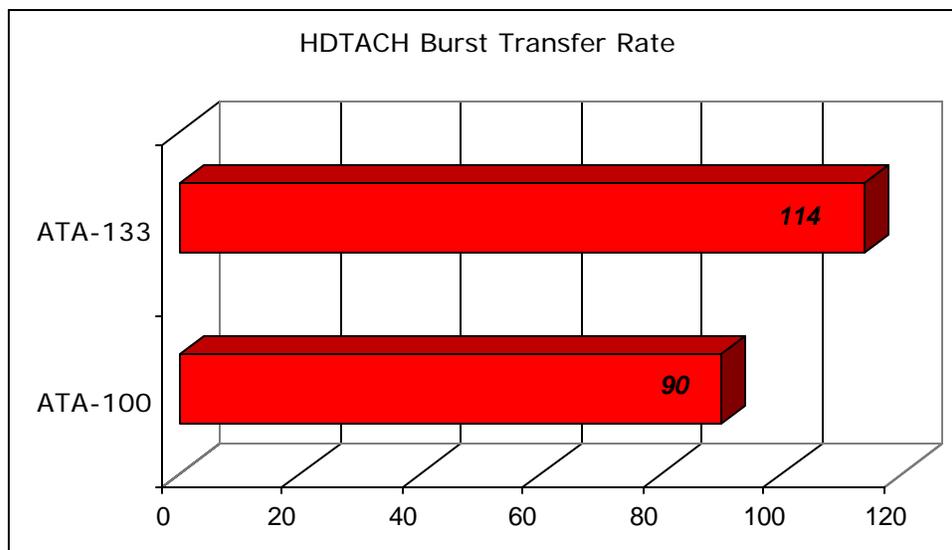
AMD Duron 900MHz system running Win98 with VIA KT266A North Bridge & VT8233A South Bridge. Data courtesy of Maxtor Corporation.

VIA Apollo KT333 Product Overview

The VIA Apollo KT333 consists of two separate chips: The 552-pin VT8367 North Bridge, and a choice of 376-pin VT8233 series V-Link South Bridges. Both use standard PGA 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.
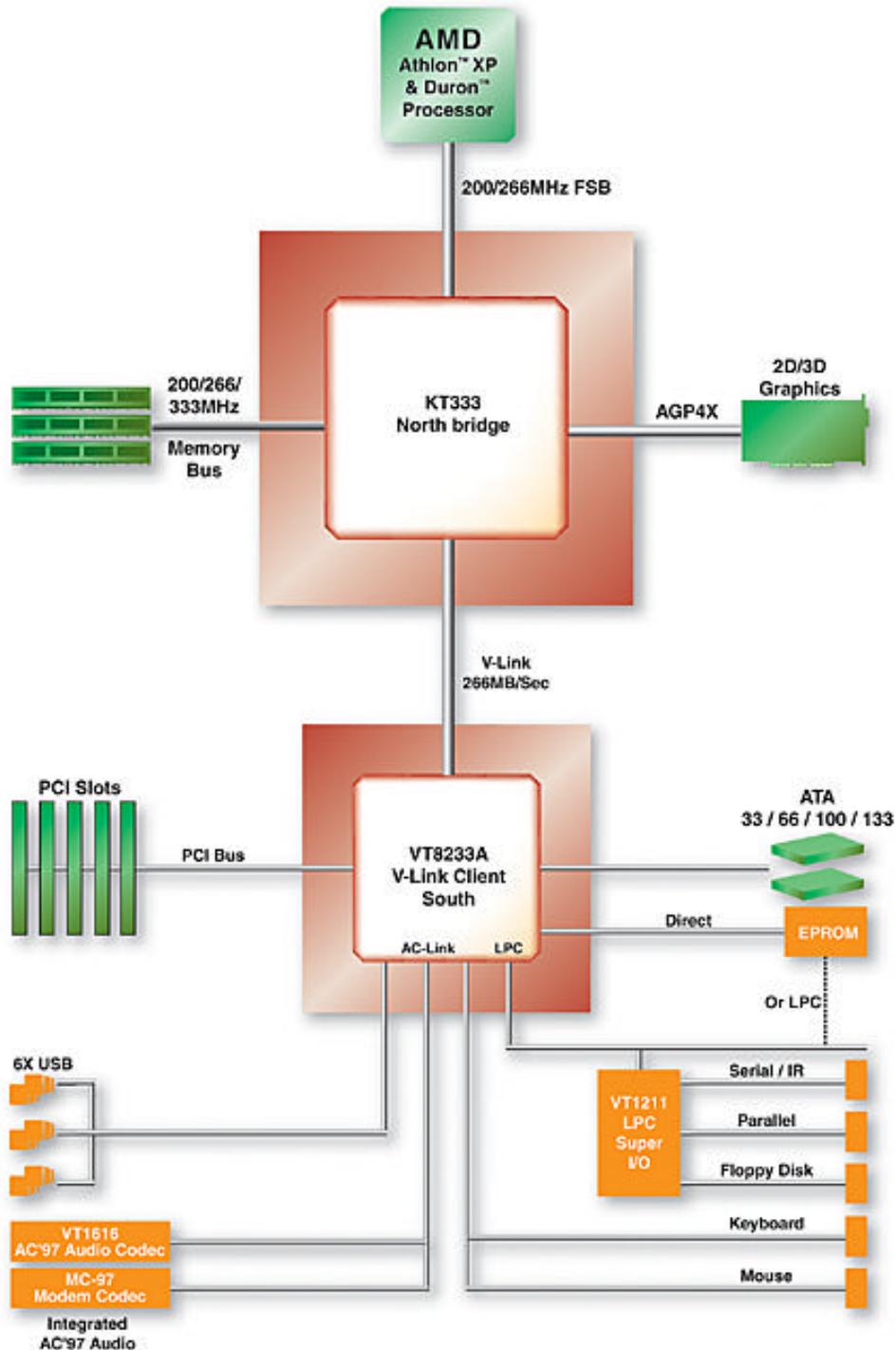
VIA Apollo KT333 North Bridge

The North Bridge of the VIA Apollo KT333 (model number VT8367) provides support for flexible 200/266MHz Front Side Bus for AMD Socket A 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.

The VT8367 North Bridge of the VIA Apollo KT333 has a flexible memory controller that supports up to 4GB of DDR200/DDR266 SDRAM. Virtual Channel Memory and Error Correcting Code (ECC) memory are also supported. With such flexible memory support, the VIA Apollo KT333 gives OEMs and SIs maximum scalability to allow the construction of a full spectrum of high-performance and low-cost systems from mainstream consumer and commercial desktops to high-end workstations.

VIA Apollo KT333 South Bridge

The VIA Apollo KT333 is capable of interfacing to any VIA V-Link South Bridge, including the VT8233, VT8233C and VT8233A, as well as future South Bridge designs. The VT8233 and VT8233C are highly integrated network-ready South Bridges that feature two high-speed ATA-100 IDE controllers (4 IDE devices total), six USB ports, 6 PCI slots, Low Pin Count (LPC) interface, and an I/O Advanced Programmable Interrupt Controller (APIC). Advanced Configuration and Power Interface (ACPI) and Advanced Power Management (APM) are also integrated into all VT8233 family products. The VT8233C adds an integrated 3Com® Ethernet MAC controller, providing high quality and ultra reliable 10/100 Mbps network support. All VIA V-Link South Bridges feature high quality, 6 channel AC/97 2.2 sound support, as well as an MC/97 software modem interface. These features, along with 10/100 Ethernet and HomePNA support, can be harnessed through the use of an ACR (advanced communication riser) slot, or can be integrated directly onto the system board.

The three USB hubs offering a combined 36 Mbps of bandwidth on the VT8233 family provide additional flexibility by allowing the user to add up to six USB devices to the system, such as keyboards, mice, drives, digital cameras, scanners, speakers, modems, joysticks, and MP3 players.

VT8233A

The VT8233A is the first South Bridge Chip to support Ultra ATA-133, the new IDE interface that offers 33% more bandwidth for data transfer between storage devices and CPU. The enhanced IDE controller supports all Ultra-DMA 33/66/100/133 devices including HDDs, CD-ROMS and DVD-ROMs as well as new generation BigDrive™ HDDs that break the existing 137GB limit on hard drive capacity and enable an exponential increase in data storage capacity for personal computing devices.

The VT8233A is a highly integrated South Bridge that features ultra-fast VIA V-Link North-South Bridge interface, four USB ports, 6 PCI slots, Low Pin Count (LPC) interface, and an I/O Advanced Programmable Interrupt Controller (APIC). Advanced Configuration and Power Interface (ACPI), Advanced Power Management (APM), high quality, 6 channel AC/97 2.2 sound support, as well as an MC/97 software modem interface are also integrated into the VT8233A.

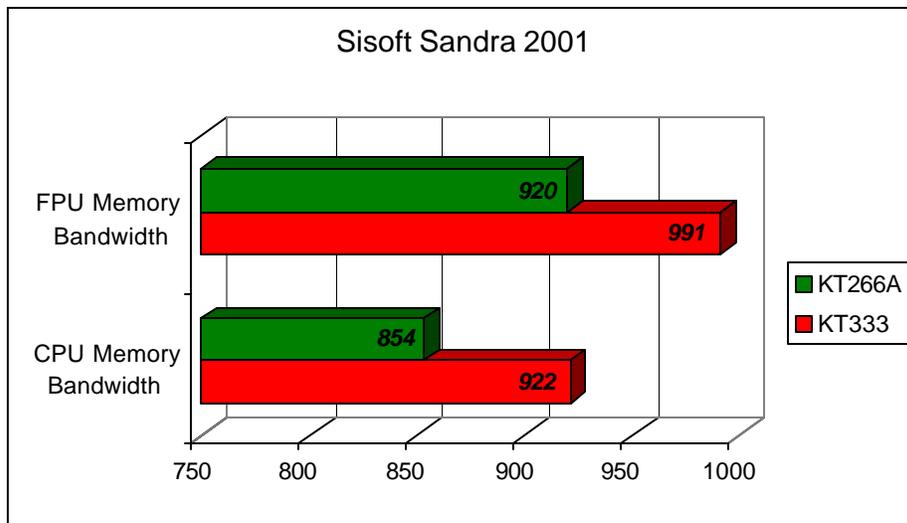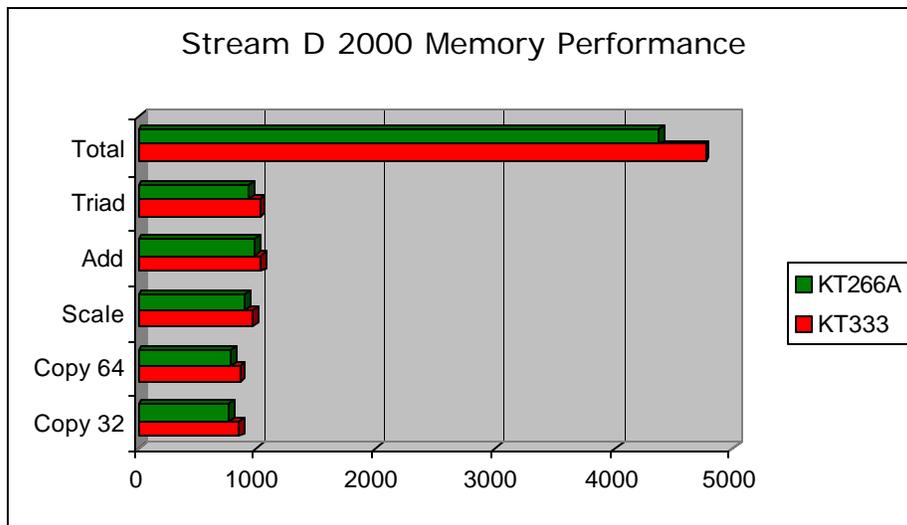**VIA V-Link Chip to Chip Interface**

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
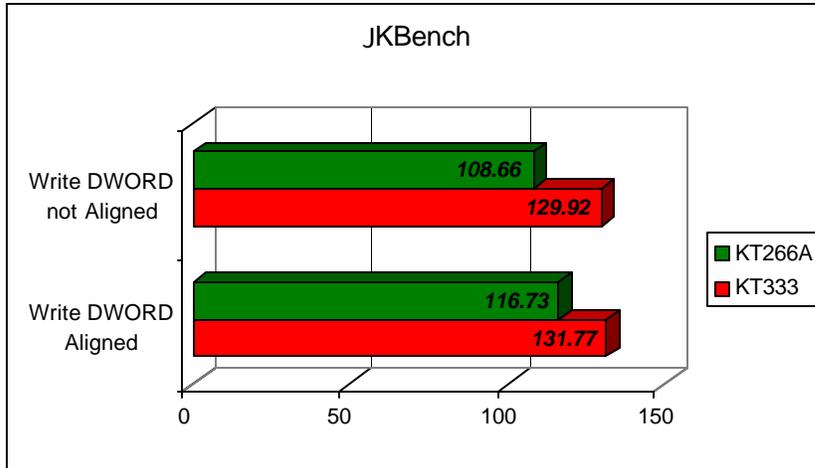
connecting both the North and South Bridge, as well as providing a bus for most add-in peripherals. VIA V-Link technology provides a dedicated 66MHz quad-pumped bus between the North and South Bridge, freeing up the PCI bus to deal strictly with peripheral devices.
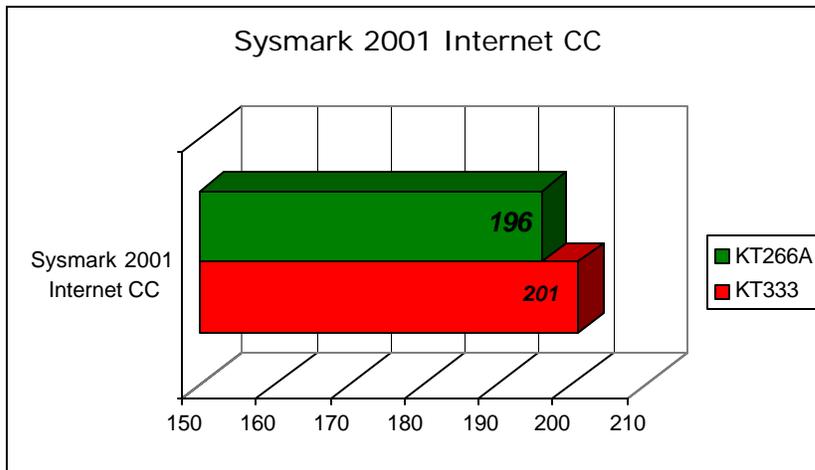
VIA Apollo KT333 Chipset Performance

The VIA Apollo KT333 takes over from the VIA Apollo KT266A as the highest performing chipset for the AMD Athlon™ XP 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 intensive benchmarks like StreamD 2000 Times, the KT333 offers performance deltas averaging 8% over the previous performance champion. Other memory intensive benchmarks show similarly impressive results with Sisoft Sandra 2001 averaging 7% better and JKbench 14% better.

Stream D 2000 Memory Performance

Sisoft Sandra 2001

JKBench

	KT266A	KT333
Write DWORD not Aligned	108.66	129.92
Write DWORD Aligned	116.73	131.77

*(horizontal axis: 0, 50, 100, 150)*

Today's applications, tested in benchmarks like Sysmark 2001 Internet Content Creation reveal the extra memory bandwidth yields tangible performance benefits.

Sysmark 2001 Internet CC

	KT266A	KT333
Sysmark 2001 Internet CC	196	201

(horizontal axis: 150, 160, 170, 180, 190, 200, 210)

For 3D gaming where every ounce of performance matters there are no faster chipset platforms than the VIA Apollo KT333. With new and more demanding games under development all the time, even the bandwidth of the KT333 is sure to be tested.

Quake III

	KT266A	KT333
Quake III	240.9	247.6

(horizontal axis: 220, 225, 230, 235, 240, 245, 250)
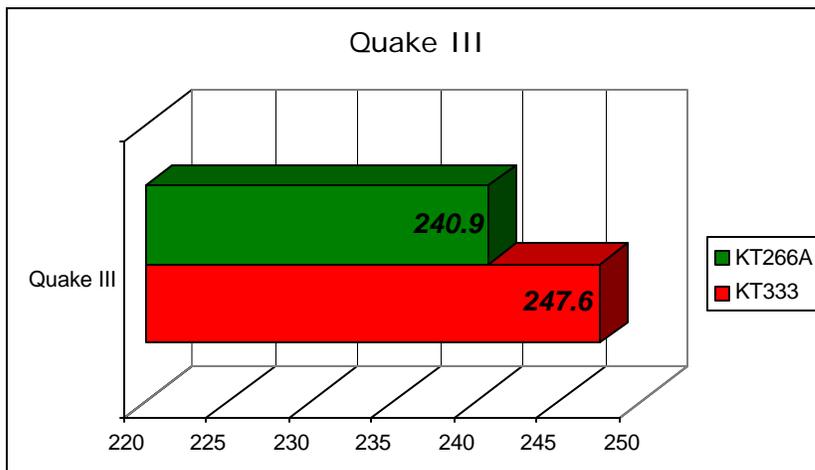
Conclusion

The VIA Apollo KT333 is the latest in a long line of VIA Apollo chipsets to extend the boundaries of system performance on the AMD processor platform. DDR333 memory delivers a stunning 2.7GB/sec of memory bandwidth to AMD Athlon™ XP processor based systems empowering the CPU to perform like never before and giving end users an unmatched computing experience. In addition the VIA Apollo KT333 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 market leading VT8233 series South Bridge range, the VIA Apollo KT333 is the ultimate chipset solution for AMD platform.

Appendix

The reference systems were based on the following configurations:

Chipset	VIA Apollo KT333	VIA Apollo KT266A
Processor	AMD Athlon™ XP 2000	AMD Athlon™ XP 2000
Memory	256MB PC2700 (Samsung)	256MB PC2100 (Micron)
Graphics	Elsa GeForce 3	Elsa GeForce 3
HDD	IBM 40GB	IBM 40GB
Operating System	Windows® XP Pro	Windows® XP Pro

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